

## *Chapter 7*

# **Indicators of the Internationalisation of Science and Technology**

## 7.1. Introduction

Inventive activities are increasingly organised at the international level (OECD, 2007). Inventions made by researchers residing in one country can be funded and owned by foreign companies, companies from different countries can join their resources to sponsor research, and researchers from different countries can co-operate on inventions, etc. Alliances across different geographical locations are formed to obtain research synergies and complementarities and to acquire new technological competences. The advent of global value chains, differences in research and development (R&D) costs, increased flexibility in handling cross-border R&D projects (owing to information and communication technology – ICT), and major policy changes (such as stronger intellectual property rights or the tax treatment of R&D) have all favoured this trend. Given the importance of these changes and their implications for the technological capacity of countries, it is important to quantify the intensity and geographical patterns of these activities.

Different indicators are available to measure the internationalisation of science and technology (S&T). They are based notably on R&D and international trade statistics, such as the share of R&D financed by sources abroad, exports and imports of high-technology products, and receipts and payments related to technology services (OECD, 2005). As regards the internationalisation of R&D activities, the analysis relies on survey data on the activities of multinational firms and case studies. Information from business surveys provides important insight into the activities of foreign affiliates (*i.e. OECD-AFA Database*) but their coverage remains limited to few countries.

Internationalisation of technological activities can also be examined in patents resulting from the output of inventive activities. Patent documents show the inventor(s) and the applicant(s) – the owner of the patent at the time of application – along with their addresses and thus their country or countries of residence. The exploitation of this information, separately or jointly, can tell much about the geographical organisation of inventions. This is reflected in the indicators presented in this chapter. Citations can also be used: patents citing other patents corresponding to inventions made in another country reflect international knowledge flows. Citation-based indicators are discussed in Chapter 6 and are not addressed in this chapter.

## 7.2. Indicators

### 7.2.1. Cross-border ownership of inventions

When the applicant's and inventors' country of residence differ, this indicates cross-border ownership. Using the information contained directly or indirectly in patent documents, two indicators of cross-border ownership can be computed at the country or regional level (Guellec and van Pottelsberghe, 2001):

- *Foreign ownership of domestic inventions.* This refers to the number of patents which are granted to applicants residing abroad (for reference country  $i$ , foreign country  $j = 1, \dots, N, j \neq i$ ) and which have at least one domestic inventor ( $P_{i,j}$ ), divided by the total number of patents invented domestically ( $P_i$ ). The foreign ownership in the total of domestic invention for country  $i$  is then:

$$\frac{\sum_{j=1}^N P_{i,j}}{P_i}$$

- *Domestic ownership of inventions made abroad.* This refers to the number of patents which are granted to a country whose inventions have been made abroad with at least one foreign inventor ( $P_{i,j}$ ), divided by the total number of patents owned by the country ( $P_i$ ). The domestic ownership in the total of

owned patents, for country  $i$ , is then:  $\frac{\sum_{j=1}^N P_{i,j}}{P_i}$ .

In most cases, patents with inventors from abroad correspond to inventions made at the research laboratories of multinational companies and applied for at company headquarters (although in some cases national subsidiaries also may own or co-own the patents). Hence, the first indicator expresses the extent to which foreign firms control domestic inventions. Similarly, the second reflects the extent to which domestic firms control inventions made by residents of other countries.<sup>1</sup> These indicators therefore reflect the role of foreign affiliates of multinational companies in inventive activities. They complement data on the R&D of foreign affiliates of multinational firms. Foreign control means that the economic benefits arising from the inventions are shared among countries: the country of invention, the country of ownership, but also partly other countries, as multinational companies may implement part of their technology worldwide (in terms of manufacturing or sales).

### 7.2.2. International co-operation in research

Another measure of the internationalisation of technology is international co-operation on research as measured by patents involving inventors from a different country of residence. It refers to the number of patents invented by a

country (reference country  $i$ , foreign country  $j=1, \dots, N, j \neq i$ ) with at least one inventor located in a foreign country ( $P^{i,j}$ ) in the total number of patents invented domestically ( $P^i$ ). The share of international co-inventions in the

total of domestic inventions for country  $i$  is then: 
$$\frac{\sum_{j=1}^N P_{i,j}}{P_i}.$$

As countries differ in their specialisation and knowledge assets, complementary external knowledge can be found abroad. International collaboration by researchers can take place either within a multinational corporation (with research facilities in several countries) or through co-operative research among several firms or institutions (collaboration between inventors belonging to different universities or public research organisations). In that sense, co-invention indicators also reflect international flows of knowledge.

Indicators of cross-border ownership and of co-invention are not independent. By definition international co-invention involved cross-border ownership. In fact, cross-border ownership can be broken down by inventions which do or do not involve co-invention (the applicant country also being an inventor). Naturally, what is accounted for as foreign ownership in one inventor country implies a domestic-owned invention abroad by domestic firms in another country. Not surprisingly, worldwide totals are much lower than the figures reported by some countries, as counts are consolidated.

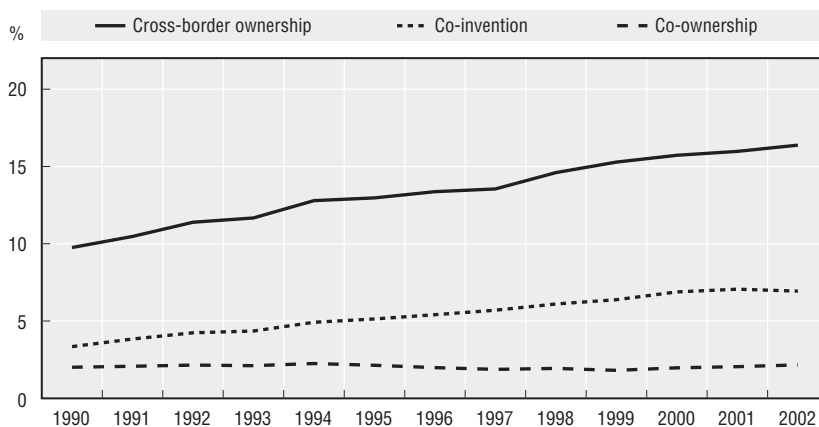
Figure 7.1 reports the evolution of worldwide cross-border ownership and co-invention in patent applications at the European Patent Office (EPO) from 1990 to 2002. The former is the percentage of patents with at least one inventor residing in a different country from the owner of the patent (in total worldwide inventions), whereas the latter is the share of patents with at least two inventors residing in different countries in total worldwide. Over this period, international co-invention more than doubled from around 3% in 1990 to over 7% in 2002. The share of cross-border ownership has grown steadily worldwide; it increased by 50% between the early 1990s and the early 2000s. That is, in 2002, more than 1.5 out of 10 patents applied for at the EPO were subject to cross-border ownership. Figures 7.2 and 7.3 report the indicators on foreign ownership and domestic ownership of inventions made abroad for a group of countries.

### **7.2.3. Advantages of patents for measuring internationalisation of S&T and relevant caveats**

The advantages of using patent indicators for tracking the internationalisation of technology are numerous. Patents provides a reasonably complete description of the invention, the technology field concerned, the inventor (name, geographical location, etc.), the applicant, references or citations to previous patents and

Figure 7.1. **Globalisation of S&T based on patent indicators**

PCT applications, 1990-2002

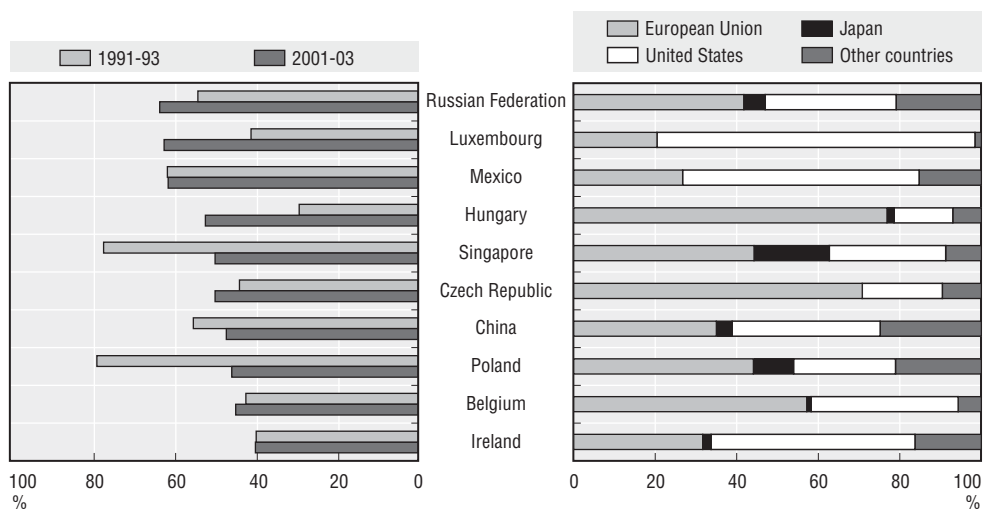


Note: Patent counts are based on the inventor's country of residence, the priority date and fractional counts. Patent applications filed under the Patent Cooperation Treaty and designating the European Patent Office. Cross-border ownership: share of patents in total inventions having an applicant located in a country different from the inventor country. Co-invention: share of patents in total inventions worldwide having at least two inventors located in different countries. Co-ownership: share of patents for which at least two co-applicants are located in different countries (in total inventions worldwide).

Source: OECD, Patent Database.

Figure 7.2. **Foreign ownership of domestic inventions**

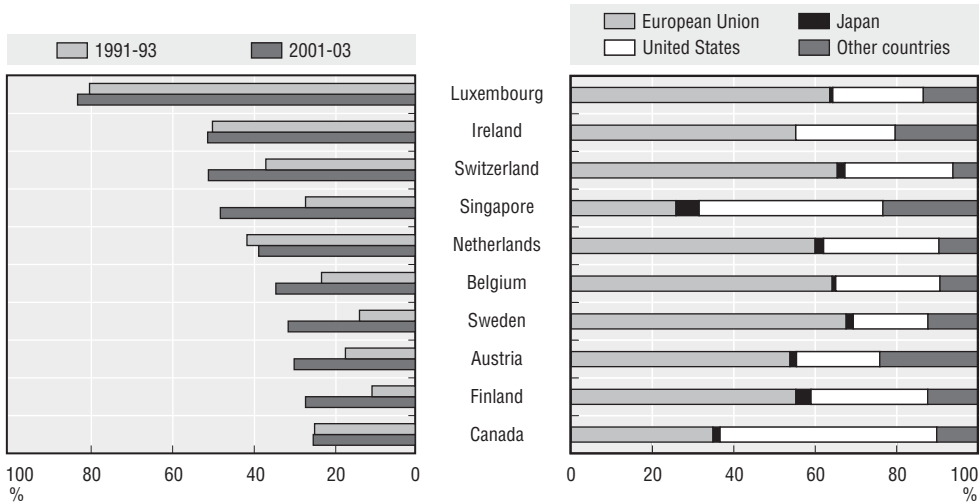
PCT applications, 1991-2003



Note: Patent counts are based on the priority date and the inventor's country of residence, using simple counts. Share of patent applications to the European Patent Office (EPO) owned by foreign residents in total patents invented domestically.

Source: OECD, Patent Database.

Figure 7.3. **Domestic ownership of inventions made abroad**  
PCT applications, 1991-2003



Note: Patent counts are based on the priority date and the applicant's country of residence, using simple counts. Share of patent applications to the European Patent Office invented abroad in total patents owned by country residents.

Source: OECD, Patent Database.

scientific articles to which the invention relates, among other things. The internationalisation of technology can be tracked by technology field, type of firm (when company data are available, *e.g.* size), university-industry linkages, etc.

The most important difficulties in measuring the internationalisation of technology with patent information come from the complexity of and lack of information on companies' ownership structure and strategy, which sometimes makes it difficult to attribute a particular country to the owner company declared in the patent file. Many of these difficulties, however, simply have to do with the issue of attributing a country to a company, a problem for all indicators of internationalisation (OECD, 2005). Examples of misleading cases are:

- The owner's country as declared in the patent file may be the affiliate of a multinational group which is in charge of managing its international intellectual property and not the multinational company itself. As this affiliate may be located in a different country from the group headquarters (for strategic or tax-related reasons), this will give a distorted picture of cross-country linkages.
- A patented invention can be controlled by a foreign entity *ex post*, after its initial owner was acquired by or merged with this foreign entity or the patent right was transferred to the foreign entity. Conversely, a foreign-owned company may become national for similar reasons. The new owner

may or may not take direct control of the patent. Standard patent databases do not register such changes in the ownership of patents when they occur after the grant and thus provide an imprecise picture of the actual control of inventions.

- The patent can be owned (or applied for) directly by the domestic subsidiary of a multinational group, which therefore is not mentioned as such in the patent file (see Chapter 5). In that case, foreign ownership is underestimated (*e.g.* the case of Belgium in Cincera *et al.*, 2006), and, symmetrically, domestic ownership of foreign inventions is underestimated for the owner's country.

Some care must be taken when using patents to interpret international co-invention activity. Inventors located in different countries frequently belong to the same multinational firm and company management practices may influence who is mentioned as an inventor (or first inventor, see Bergek and Bruzelius, 2005). Conversely, inventors located abroad can be involved in research that is contracted out.

The submission of company information (companies' country of origin and international ownership of companies) is not required in patent applications. When compiled solely with the information available in patent files, the indicators proposed here may underestimate the importance of internationalisation. It is recommended to complement the information on the owner provided in the patent databases with other information regarding company ownership to get more accurate indicators of the internationalisation of technology.

### Box 7.1. Regional dispersion of patenting

Indicators presented in this chapter can be compiled at the level of regions as well as countries: indicators of cross-regional ownership and cross-regional co-operation. Although the formulae are similar, the economic interpretation may differ somewhat as cross-regional differences and barriers are usually much lower than cross-country ones (*e.g.* language, regulation, tax system, distance). Adaptation of existing technology to local tastes, an important motive for locating R&D closer to final demand, applies more to cross-country investment than to cross-regional investment.

The OECD uses the TL ("territorial levels") classification, which has different levels of aggregation (level 2 consists of about 300 macro-regions; level 3 consists of 2 300 regions, *e.g.* the US BEA economic areas, Japanese prefectures, French "départements", etc.). In EU countries, regions are defined by "NUTS" (Nomenclature des Unités Territoriales Statistiques), an official classification of the European Commission (which is equivalent to the OECD classification for Europe).

### 7.3. Ownership and research strategies

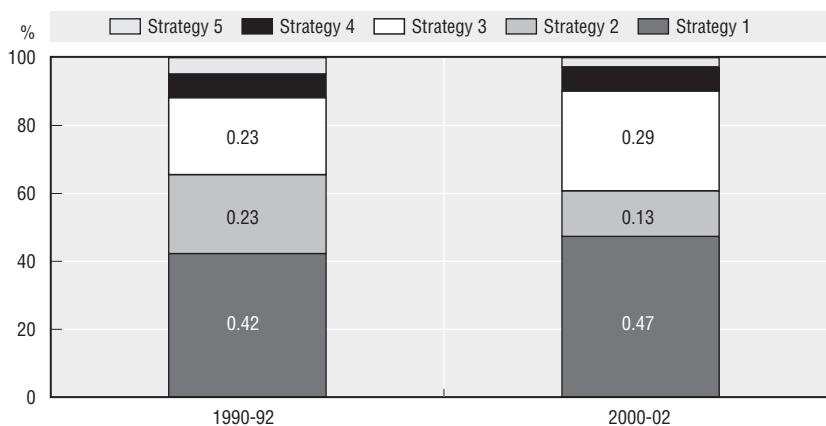
Globalisation of technological activities as illustrated in patents reflects a mix of research and ownership strategies. Patent data provide further insight into these matters when one looks at the combinations of types of ownership (or co-ownership) and types of invention (invention made only abroad or through co-invention). Five patterns of internationalisation can be identified in patent data:

1. *Purely domestic ownership of foreign inventions* (country A owner and country B inventor). This type of strategy concerns patents for which the research has been entirely conducted in the foreign laboratory (subsidiary of a multinational corporation).
2. *Domestic ownership implying co-ownership with a single inventor* (countries A and B owners but only country B inventor). This pattern may reflect co-ownership by the multinational and an affiliate abroad or a research joint venture between companies of two different countries.
3. *Domestic ownership with co-invention* (countries A and B inventors but only country A owner). This pattern concerns patents by multinational firms engaged in twofold internationalisation strategies: exploiting their own knowledge assets and accessing foreign knowledge.
4. *Co-ownership jointly with co-invention* (countries A and B inventors and owners). This strategy is a combination of the last two types. It may reflect the joint involvement of the headquarters and a foreign affiliate of a multinational firm, or research co-operation between companies in two different countries.
5. *Cross-border ownership or inventorship with distinct inventor and owner countries* (A and B owners and C inventor). This complex and uncommon pattern requires case-by-case analysis. It may for instance reflect an international network of companies having assigned a third company the management of their patents (e.g. technology pools).

Figure 7.4 displays the breakdown of patents subject to cross-border ownership. It appears that the predominant strategy in cross-border inventions is a single country owning one invention located in a single inventor country: 47% of patents subject to cross-border ownership are in this category, followed by *single owner country patents with co-invention* (with the owner country also an inventor). The latter increased from 23% during 1990-92 to 29% in 2000-02, and is evidence of the growing deployment of mixed strategies (e.g. strategic partnerships aimed at achieving technological synergies for innovation).

The three remaining combinations (*ownership and co-invention, co-ownership and co-invention, and co-ownership with a third country as the inventor*) are less important and their share has actually decreased: patents implying co-ownership in two different countries (multinationals jointly with subsidiaries, or



Figure 7.4. **Composition of cross-border ownership in PCT applications**

Note: Fractional counts of patent applications filed under the Patent Cooperation Treaty and designating the European Patent Office, by strategy and priority year.

Source: OECD, Patent Database.

two non-affiliated firms located in different countries with only one country inventor or implying co-invention) represented less than 11% of cross-border patents. Lastly, patents under co-ownership shared between different countries, none of which is inventor, account for less than 2%.

### Note

1. Some fraction of these patents subject to cross-border ownership may also represent co-ownership between two companies located in different countries; again, this more likely concerns cases of co-ownership between headquarters and foreign subsidiaries. However, this represents a very small share of total patents with cross-border ownership.

### References

- Bergek, A. and M. Bruzelius (2005), "Patents with Inventors from Different Countries: Exploring Some Methodological Issues through a Case Study", presented at the DRUID conference, Copenhagen, 27-29 June.
- Guellec, D. and B. van Pottelsberghe (2001), "The Internationalisation of Technology Analysed with Patent Data", *Research Policy*, 30 (8), pp. 1256-1266.
- OECD (2005), *Compendium of Patent Statistics 2005*, OECD, Paris.
- OECD (2007), *Compendium of Patent Statistics 2007*, OECD, Paris.

## Acronyms

<b>AFA</b>	Activity of Foreign Affiliates Database
<b>ARIPO</b>	African Regional Intellectual Property Organization
<b>BEA</b>	Bureau of Economic Analysis (United States)
<b>CAFC</b>	Court of Appeals of the Federal Circuit (United States)
<b>CIP</b>	Continuation-in-Part
<b>CIPO</b>	Canadian Intellectual Property Office
<b>DPMA</b>	Deutsches Patent- und Markenamt (Germany)
<b>ECLA</b>	European Classification System
<b>EPC</b>	European Patent Convention
<b>EPLA</b>	European Patent Litigation Agreement
<b>EPO</b>	European Patent Office
<b>EU</b>	European Union
<b>FhG-ISI</b>	Fraunhofer Institute for Systems and Innovation Research
<b>GATT</b>	General Agreement on Trade and Tariffs
<b>ICT</b>	Information and communication technologies
<b>IIP</b>	Institute of Intellectual Property (Japan)
<b>INID</b>	Internationally agreed numbers for the identification of bibliographic data
<b>INPI</b>	Institut National de la Propriété Intellectuelle (France)
<b>IPC</b>	International Patent Classification
<b>IPRP</b>	International preliminary report on patentability
<b>ISA</b>	International search authorities
<b>ISIC</b>	International Standard Industrial Classification
<b>ISR</b>	International search report
<b>NACE</b>	Classification of Economic Activities in the European Community
<b>NAICS</b>	North American Industry Classification System
<b>NBER</b>	National Bureau of Economic Research (United States)
<b>NISTEP</b>	National Institute of Science and Technology Policy (Japan)
<b>NSF</b>	National Science Foundation (United States)
<b>NUTS</b>	Nomenclature of territorial units for statistics ( <i>Nomenclature des unités territoriales statistiques</i> )
<b>OECD</b>	Organisation for Economic Co-operation and Development
<b>OST</b>	Observatoire des Sciences et des Techniques (France)

<b>PATSTAT</b>	Worldwide Statistical Patent Database (EPO)
<b>PCT</b>	Patent Co-operation Treaty
<b>SIC</b>	Standard Industrial Classification
<b>SIPO</b>	State Intellectual Property Office of the People's Republic of China
<b>SMEs</b>	Small and medium-sized enterprises
<b>STAN</b>	Structural Analysis Database
<b>TL</b>	Territorial level
<b>TRIPS</b>	Trade-related intellectual property rights
<b>USPC</b>	United States Patent Classification System
<b>USPTO</b>	United States Patent and Trademark Office
<b>WIPO</b>	World Intellectual Property Organization
<b>WOISA</b>	Written opinion of the international search authorities
<b>WTO</b>	World Trade Organization

## Glossary

**Appeal:** A procedure by which the applicant or patent holder can request reversal of a decision taken by the patent office.

- **USPTO:** An applicant for a patent dissatisfied with the primary examiner's decision in the second rejection of his or her claims may appeal to the Board of Patent Appeals and Interferences (BPAI) for review of the examiner's rejection. The Board is a body of the USPTO which reviews adverse decisions of examiners in patent applications and determines priority and patentability of invention in interferences. Decisions of the Board can be further appealed to the *Court of Appeals for the Federal Circuit (CAFC)* or to a district court.
- **EPO:** Decisions of the first instances of the EPO can be *appealed* before the Boards of Appeal of the EPO, in a *judicial* procedure (proper to an administrative court), as opposed to an *administrative* procedure. These boards act as the final instances in the *granting* and *opposition* procedures before the EPO. In addition to the Boards of Appeal, the European Patent Office has an Enlarged Board of Appeal. This instance takes decisions only when the *case law* of the Boards of Appeal becomes inconsistent or when an important point of law arises.
- **JPO:** An applicant who receives a rejection can appeal. The panels consist of three or five trial examiners in the Appeals Department of the JPO. Decisions of the panels can be further appealed to the Intellectual Property High Court, a special branch within the Tokyo High Court.

**Applicant:** The holder of the legal rights and obligations on a patent application. It is most often a company, a university or an individual.

**Application date:** The date on which the patent office received the completed patent application. A unique number is assigned to a patent application when it is filed.

**Assignee:** In the United States, the person(s) or corporate body to whom all or limited rights under a patent are legally transferred by the inventor (equivalent to "applicant" in this context).

**Citations:** References to the prior art in patent documents. Citations may be made by the examiner or the applicant. They comprise a list of references which are believed to be relevant prior art and which may have contributed to defining the scope of the claims of the application. References can be made to

other patents, to technical journals, textbooks, handbooks and other sources. **USPTO:** Applicants before the USPTO are required to disclose prior art known to them that is material to patentability; **EPO:** No such obligation for the applicant; **JPO:** The requirement for disclosure of information on prior art documents was introduced as of 1 September 2002 and entered into full force on 1 May 2006.

**Claim(s):** Definition of the scope of the invention and the aspects of the invention for which legal protection is sought.

**Continuation(s) (USPTO):** Second or subsequent applications for the same invention claimed in a prior non-provisional application and filed before the first application is abandoned or patented. Continuations must claim the same invention as the original application to gain the benefit of the parent filing date. At the time of filing the claims are often the same but the claims may change during prosecution so that they are not exactly the same but not patentably distinct. There are three types of continuing applications: division, continuation and continuation-in-part.

**Designated countries:** In international and regional patent systems, countries in which patent applicants wish to protect their invention if/when the patent is granted. International application filing automatically includes the designation for all PCT contracting countries that are bound by the PCT on the international filing date (since 2004). A similar rule will apply to the EPO from April 2009, as European patent applications designate all contracting states as in the PCT procedure.

**Direct European route (application):** A patent application filed under Article 75 EPC (also known as an “Euro-Direct application”). With the direct European route, the entire European patent grant procedure is governed by the EPC alone while with the Euro-PCT route, the first phase of the grant procedure (the international phase), is subject to the PCT.

**Division:** If the patent office decides that an application covers too broad an area to be considered as a single patent, the application is split into one or more divisional applications, which may or may not be pursued by the applicant. A division can also be requested at the initiative of the applicant.

**Equivalent:** A patent that protects the same invention and shares the same priority application as a patent from a different issuing authority.

**Euro-PCT route:** A way to obtain a European patent by designating the EPO in a PCT application (Article 11 PCT). The first phase of the grant procedure (the international phase) is subject to the PCT, while the regional phase before the EPO as designated or elected office is governed primarily by the EPC.

- **Euro-PCT application** – international phase (or Euro-PCT application or PCT international): A PCT application designating the EPO [Article 150(3) EPC]. With

the Euro-PCT route, the first phase of the grant procedure (international phase) is subject to the PCT, while the regional phase before the EPO as designated or elected office is governed primarily by the EPC.

- **Euro-PCT application – regional phase (or PCT regional):** PCT application entering the European (or regional) phase once the applicant has fulfilled the conditions under Article 22 or 39 PCT, Article 158 and Rule 107 EPC.

**Euro-PCT search (or PCT Chapter I):** Search carried out by the EPO acting as International Searching Authority for a Euro-PCT application in the international phase (Article 16 PCT).

**European patent:** A European patent can be obtained for all EPC countries by filing a single application at the EPO in one of the three official languages (English, French or German). European patents granted by the EPO have the same legal rights and are subject to the same conditions as national patents (granted by the national patent office). It is important to note that a granted European patent is a “bundle” of national patents, which must be validated at the national patent office in order to be effective in member countries. The validation process may include submission of a translation of the specification, payment of fees and other formalities of the national patent office (once a European patent is granted, competence is transferred to the national patent offices).

**European Patent Convention (EPC):** The Convention on the Grant of European Patents was signed in Munich in 1973 and entered into force in 1977. It is a multilateral treaty instituting the European Patent Organisation and providing an autonomous legal system according to which European patents are granted. The EPC provides a legal framework for the granting of European patents, via a single, harmonised procedure before the European Patent Office. It enables the patent applicant, by means of a single procedure, to obtain a patent in some or all of the contracting states. As of January 2008 there are 34 EPC member countries. In addition, extension agreements exist with five countries, offering the possibility to extend European patents to those countries upon request. EPC member countries are Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, the Netherlands, Norway, Poland, Portugal, Romania, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom. EPC extension countries are Albania, Bosnia and Herzegovina, Croatia, Former Yugoslav Republic of Macedonia, and Serbia.

**European Patent Office (EPO):** The European Patent Office (a regional patent office) was created by the EPC to grant European patents, based on a centralised examination procedure. By filing a single European patent application in one of the three official languages (English, French or German), it is possible to

obtain patent rights in all EPC member and extension countries. The EPO is not an institution of the European Union.

**Family:** a set of patents (or applications) filed in several countries to protect the same invention. They are related to each other by one or several common priority numbers. There are different definitions of patent families (*e.g.* triadic patent families, extended families including continuations, etc.). Depending on the use sought, a different family concept can be chosen, *e.g.* equivalents, triadic family or trilateral family.

**First to file:** A patent system in which the first inventor to file a patent application for a specific invention is entitled to the patent. This law is increasingly becoming the standard for countries adhering to the Trade-related Aspects of Intellectual Property (TRIPs) guidelines. In the EPO and the JPO, patents are awarded on a first-to-file basis, whereas in the USPTO the patent is awarded on the first to invent basis.

**First to invent (USPTO):** A system in which a patent is awarded to the first person who made the invention, even if another person filed for a patent before the person who invented first.

**Grant:** A patent application does not automatically give the applicant a temporary right against infringement. A patent has to be granted for it to be effective and enforceable against infringement.

**Grant date:** The date when the patent office issues a patent to the applicant.

**Infringement:** Unauthorised making, using, offering for sale or selling any patented invention in the country in which the patent is enforceable or importing that invention into said country during the term of the patent.

**Intellectual property rights (IPR):** The exclusive legal rights associated with creative work, commercial symbols or inventions. There are four main types of intellectual property: patents, trademarks, design and copyrights.

**International patent application:** See “PCT application”. A patent application filed under the Patent Cooperation Treaty (PCT) is commonly referred to as an “international patent application”. However, international patent (PCT) applications do not result in the issuance of “international patents” (*i.e.* at present, there is no global patent system that issues and enforces international patents). The decision of whether to grant or reject a patent filed under PCT rests with the national or regional (*e.g.* EPO) patent offices.

**International Patent Classification (IPC):** The IPC is based on an international multilateral treaty administered by WIPO. The IPC is an internationally recognised patent classification system, which provides a common classification for patents according to technology groups. The IPC is a hierarchical system in which the whole area of technology is divided into eight sections broken down into classes, subclasses and groups. IPC is periodically revised in order to

improve the system and to take account of technical development. The eighth edition of the IPC entered into force on 1 January 2006.

**International Searching Authority (ISA):** An office with competence to carry out the international search for a PCT application. It may be either a national office (Australia, Austria, Canada, China, Finland, Japan, Korea, the Russian Federation, Spain, Sweden, the United States) or an intergovernmental organisation (EPO), (Article 16 PCT, Article 154 EPC).

**Inventive step:** At the EPO and JPO, an invention is considered to include an inventive step if it is not obvious to a person skilled in the art. Inventive step is one of the criteria (along notably with novelty and industrial applicability) that need to be fulfilled in order to obtain a patent. See also “non-obviousness”(USPTO).

**Inventor country:** Country of residence of the inventor.

**Japan Patent Office (JPO):** The JPO administers the examination and granting of patent rights in Japan. The JPO is an agency of the Ministry of Economy, Trade and Industry (METI).

**Lapse:** The date when a patent is no longer valid in a country or system owing to failure to pay renewal (maintenance) fees. Often the patent can be reinstated within a limited period.

**Licence:** The means by which the owner of a patent gives permission to another party to carry out an action which, without such permission, would infringe the patent. A licence can thus allow another party to legitimately manufacture, use or sell an invention protected by a patent. In return, the patent owner will usually receive royalty payments. A licence, which can be exclusive or non-exclusive, does not transfer the ownership of the invention to the licensee.

**National application:** A patent application that is filed at a national patent office according to a national procedure.

**Novelty:** An invention cannot be patented if certain disclosures of the invention have been made.

**Non-obviousness (USPTO):** Something is obvious if the differences between the subject matter to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person with ordinary skills in the art to which said subject matter pertains. See also “inventive step”(EPO, JPO).

**Opposition:** This is a procedure usually before the issuing patent office, initiated by third parties to invalidate a patent:

- EPO: Opposition to the grant of a European patent can be filed within nine months of the mention of the grant in the European Patent Bulletin.



- **JPO:** Opposition to a grant could be filed within six months of the issue of the grant before the reform of appeals for invalidation was introduced in January 2004.

**Paris Convention:** The Paris Convention for the Protection of Industrial Property was established in 1883 and is generally referred to the Paris Convention. It established the system of priority rights, under which applicants have up to 12 months from first filing their patent application (usually in their own country) in which to make further subsequent applications in each signatory country and claim the original priority date. There are 172 countries party to the treaty (March 2008).

**Patent:** A patent is an intellectual property right issued by authorised bodies which gives its owner the legal right to prevent others from using, manufacturing, selling, importing, etc., in the country or countries concerned, for 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. A patent is known as a utility patent in the United States.

**Patent Cooperation Treaty (PCT):** As of March 2008, there were 138 countries party to the treaty, which was signed in 1970 and entered into force in 1978, enabling a patent applicant, by means of a single procedure, to obtain a patent in some or all of the contracting states. The PCT provides the possibility to seek patent rights in a large number of countries by filing a single international application (PCT application) with a single patent office (receiving office). PCT applications do not result in the issuance of “international patents”. The decision on whether to grant or reject patent rights rests with national or regional patent offices. The PCT procedure consists of two main phases: i) an “international phase”; and ii) a PCT “national/regional phase”. PCT applications are administered by the World Intellectual Property Organization (WIPO).

**PCT international search:** A search carried out by a designated office (international searching authority) for PCT applications.

**Pending application:** An application has been made at the patent office, but no decision has been taken on whether to grant or reject the patent application

**Prior art:** Previously used or published technology that may be referred to in a patent application or examination report. In a broad sense, this is technology that is relevant to an invention and was publicly available (*e.g.* described in a publication or offered for sale) at the time an invention was made. In a narrow sense, it is any technology that would invalidate a patent or limit its scope. The process of prosecuting a patent or interpreting its claims largely consists of identifying relevant prior art and distinguishing the claimed invention from that prior art. The objective of the search process is to identify patent and non-

patent documents constituting the relevant prior art in order to determine whether the invention is novel and includes an inventive step.

**Priority country:** Country where the patent is first filed worldwide before being extended to other countries. See “Paris Convention”.

**Priority date:** The priority date is the first date of filing of a patent application, anywhere in the world (usually in the applicant’s domestic patent office), to protect an invention. The priority date is used to determine the novelty of the invention, which implies that it is an important concept in patent procedures. Among procedural data, priority date can be considered as the closest date to the date of invention. In the United States the date of conception comes into play during interferences.

**Priority rights:** see “Paris Convention”.

**Processing time:** Duration of a process in the patent procedure (*e.g.* search, examination, grant, and possible opposition and appeal).

**Publication:** In most countries, a patent application is published 18 months after the priority date:

- **EPO:** All patent applications are published in this manner, whether the patents have been granted or not.
- **JPO:** Patent applications that are no longer pending in the JPO, *e.g.* granted, withdrawn, waived or rejected, are not published. While official patent gazettes are only published in Japanese, the abstracts and bibliographic data of most of the unexamined patent applications are translated into English, and are published as the Patent Abstracts of Japan (PAJ).
- **USPTO:** Prior to a change in rules under the American Inventors Protection Act of 1999, USPTO patent applications were held in confidence until a patent was granted. Patent applications filed at the USPTO on or after 29 November 2000 are required to be published 18 months after the priority date. However, there are certain exceptions for the publication of pending patents. For example, an applicant can ask (upon filing) for the patent not to be published by certifying that the invention disclosed in the application has not and will not be the subject of an application filed in another country. Also, if the patent is no longer pending or subject to a secrecy order, then the application will not be published.

**Renewal fees:** Once a patent is granted, annual renewal fees are payable to patent offices to keep the patent in force. In the USPTO they are referred to as “maintenance fees”. In most offices, renewal fees are due every year. USPTO-granted (utility) patents are subjected to maintenance fees which are due three-and-a-half years, seven-and-a-half years, and eleven-and-a-half years from the date of the original patent grant.

**Request for examination:** Patent applications filed at the EPO and JPO do not automatically enter the examination process. The applicant has to submit a request for examination within six months of the transmission of the search report at the EPO, and within three years of filing at the JPO. Patent applications filed at the USPTO are automatically examined by a patent examiner without the need for a separate request by the applicant.

**Revocation:** A patent is revoked if after it has been granted by the patent office, it is deemed invalid by a higher authority (appeal body within the patent office or a court).

**Search report:** The search report is a list of citations of all published prior art documents which are relevant to the patent application. The search process, conducted by a patent examiner, seeks to identify patent and non-patent documents constituting the relevant prior art to be taken into account in determining whether the invention is novel and includes an inventive step.

**Triadic patent families:** The triadic patent families are defined at the OECD as a set of patents taken at the European Patent Office (EPO) and the Japan Patent Office (JPO) and granted by the US Patent and Trademark Office (USPTO) which share one or more priorities. Triadic patent families are consolidated to eliminate double counting of patents filed at different offices (i.e. regrouping all the interrelated priorities in EPO, JPO and USPTO patent documents).

**Trilateral patent families:** A trilateral patent family is part of a filtered subset of patent families for which there is evidence of patenting activity in all trilateral blocs. It is then similar to a triadic family, except that it would also include applications filed in any EPC state that do not go to the EPO (in addition to going to the JPO and USPTO). Trilateral patent families are usually counted in terms of individual priorities, without consolidation.

**United States Patent and Trademark Office (USPTO):** The USPTO administers the examination and granting of patent rights in the United States. It falls under the jurisdiction of the US Department of Commerce.

**Utility model:** This type of patent, also known as a “petty patent”, is available in some countries. It usually involves less stringent patentability requirements than a traditional patent, it is cheaper to obtain and it is valid for a shorter time period.

**Withdrawal:** Under the European Patent Convention, the applicant can withdraw an application at any stage of the procedure either by informing the office or by abstaining from one or more of the following: pay fees in due time, file a request for examination within the given time period, or reply in due time to any communication within the examination procedure.

**World Intellectual Property Organization (WIPO):** An intergovernmental organisation responsible for the administration of various multilateral treaties dealing with the legal and administrative aspects of intellectual property. In the patent area, the WIPO is notably in charge of administering the Paris Convention, the Patent Cooperation Treaty (PCT) and the International Patent Classification system (IPC).

## Table of Contents

<b>Foreword</b> .....	3
<b>Acronyms</b> .....	9
<b>Chapter 1. Objectives and Scope of the Manual.</b> .....	11
Reference .....	16
<b>Chapter 2. Patents as Statistical Indicators of Science and Technology</b> ..	17
2.1. Introduction .....	18
2.2. Legal foundations of patents .....	18
2.3. Administrative routes for protection .....	19
2.4. Economic foundations of patents .....	21
2.5. The information content of patent documents .....	24
2.6. Patents as statistical indicators of inventive activity .....	26
2.7. Patent databases .....	29
2.8. Topics of investigation .....	30
Notes .....	32
References .....	34
Annex 2.A1. ....	35
<b>Chapter 3. Patent Systems and Procedures</b> .....	39
3.1. Introduction .....	40
3.2. The core patenting procedure .....	41
3.3. National and regional procedures .....	47
3.4. International patent applications .....	53
Notes .....	55
References .....	57
<b>Chapter 4. Basic Criteria for Compiling Patent-Based Indicators</b> .....	59
4.1. Introduction .....	60
4.2. Reference date .....	61
4.3. Reference country .....	63
4.4. PCT applications .....	64
4.5. Patent families .....	71
4.6. Normalised country-level patent indicators .....	74
Notes .....	75

References .....	75
Annex 4.A1. ....	77
<b>Chapter 5. Classifying Patents by Different Criteria</b> .....	83
5.1. Introduction .....	84
5.2. Technology fields .....	84
5.3. Industry classification .....	90
5.4. Regional classification .....	93
5.5. Institutional sectors .....	94
5.6. Patents by companies .....	97
5.7. Patents by inventors .....	99
Notes .....	100
References .....	101
<b>Chapter 6. The Use and Analysis of Citations in Patents</b> .....	105
6.1. Introduction .....	106
6.2. What are citations? .....	106
6.3. Uses and applications of citations indicators .....	107
6.4. Citation practices in patent offices .....	108
6.5. Citation-based indicators .....	111
6.6. Non-patent literature. ....	116
6.7. Other indicators based on the categories of citations (EPO and PCT search reports) .....	120
Notes .....	121
References .....	122
<b>Chapter 7. Indicators of the Internationalisation of Science and Technology</b> .....	125
7.1. Introduction .....	126
7.2. Indicators .....	127
7.3. Ownership and research strategies .....	132
Notes .....	133
References .....	133
<b>Chapter 8. Indicators of Patent Value</b> .....	135
8.1. Introduction .....	136
8.2. Forward citations .....	138
8.3. Indicators based on procedural information and applicants' behaviour. ....	139
8.4. Other indicators .....	144
Notes .....	146
References .....	148
<b>Glossary</b> .....	151

**List of Boxes**

1.1.	A sample of regular patent statistics . . . . .	15
3.1.	Patentability criteria . . . . .	42
3.2.	Main provisions of the TRIPs Agreement . . . . .	44
4.1.	Methodologies for nowcasting . . . . .	69
4.2.	Nowcasting methods based on transfer rates . . . . .	70
4.A1.1.	Other definitions of patent families . . . . .	78
6.1.	The problem of equivalents. . . . .	110
7.1.	Regional dispersion of patenting . . . . .	131
8.1.	Reforms concerning the designation of states . . . . .	143
8.2.	A combined indicator (European protection): the scope year index. . . . .	144

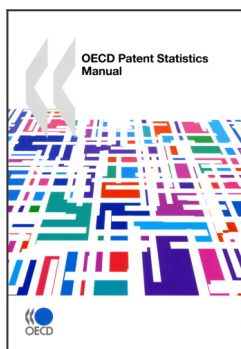
**List of Tables**

3.1.	Differences between the three main patent offices. . . . .	47
4.A1.1.	Differences in patent counts (EPO filings and grants) depending on the reference selected, 2000 . . . . .	80
4.A1.2.	Country shares in EPO applications with various criteria of attribution . . . . .	81
5.1.	Main characteristics of IPC codes (example). . . . .	86
5.2.	Examples of keywords/clues used to identify patentee sectors. . . . .	96
6.1.	Occurrence of patent and non-patent references (USPTO and EPO) . . . . .	109
6.2.	Occurrence of USPTO and EPO journal and non-journal references. . . . .	117
6.3.	Occurrence of USPTO and EPO non-journal sources . . . . .	118
6.4.	Citation categories at the EPO and PCT . . . . .	120
8.1.	Main indicators of patent value discussed in the literature. . . . .	140
8.2.	Shares of countries in total patent applications under different indicators (priority date 2000) . . . . .	141

**List of Figures**

2.A1.1.	Front page of an EPO patent application . . . . .	35
2.A1.2.	Sample front page of a JPO patent application . . . . .	36
2.A1.3.	Front page of a USPTO published patent application . . . . .	37
2.A1.4.	Front page of a PCT application . . . . .	38
3.1.	Timeline for PCT procedures. . . . .	54
4.1.	Share of countries in patents taken at the three major regions, 2005 . . . . .	65
4.2.	Patents applied for under the PCT procedure, EPO designations. . . . .	66

4.3.	Share of countries in patents filed under the PCT procedure, 2004 . . . . .	68
4.4.	Share of Euro-PCT applications entering the regional phase, 2002-04 . . . . .	68
4.5.	Share of countries in total triadic patent families, 2005 . . . . .	72
4.6.	Example of close and extended patent families. . . . .	73
4.7.	Triadic patent families over GDP, 2005 . . . . .	74
4.8.	Triadic patent families per million population, 2005. . . . .	74
5.1.	Trends in patenting of fuel cells, share of patents filed under the PCT, 1987-2004. . . . .	85
5.2.	Share of countries in fuel cell patents, 1987-2004. . . . .	89
5.3.	Share of related-techniques in fuel cell patents,1987-2004. . . . .	89
5.4.	Specialisation index of biotechnology patents filed at the EPO, 1995-2002 . . . . .	90
5.5.	Patenting by industry and business R&D,PCT applications 2002-04 . . . . .	93
5.6.	ICT patents by region in Europe, the United States and Japan . .	95
6.1.	Share of NPL in citations in search reports of PCT patent applications . . . . .	119
6.2.	Share of NPLin citations – all patents . . . . .	119
6.3.	Share of NPL in citations – ICT . . . . .	119
7.1.	Globalisation of S&T based on patent indicators . . . . .	129
7.2.	Foreign ownership of domestic inventions. . . . .	129
7.3.	Domestic ownership of inventions made abroad . . . . .	130
7.4.	Composition of cross-border ownership in PCT applications . . .	133



**From:**  
**OECD Patent Statistics Manual**

**Access the complete publication at:**  
<https://doi.org/10.1787/9789264056442-en>

**Please cite this chapter as:**

OECD (2009), "Indicators of the Internationalisation of Science and Technology", in *OECD Patent Statistics Manual*, OECD Publishing, Paris.

DOI: <https://doi.org/10.1787/9789264056442-8-en>

This work is published under the responsibility of the Secretary-General of the OECD. The opinions expressed and arguments employed herein do not necessarily reflect the official views of OECD member countries.

This document and any map included herein are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

You can copy, download or print OECD content for your own use, and you can include excerpts from OECD publications, databases and multimedia products in your own documents, presentations, blogs, websites and teaching materials, provided that suitable acknowledgment of OECD as source and copyright owner is given. All requests for public or commercial use and translation rights should be submitted to [rights@oecd.org](mailto:rights@oecd.org). Requests for permission to photocopy portions of this material for public or commercial use shall be addressed directly to the Copyright Clearance Center (CCC) at [info@copyright.com](mailto:info@copyright.com) or the Centre français d'exploitation du droit de copie (CFC) at [contact@cfcopies.com](mailto:contact@cfcopies.com).