European Commission

Patent-Based Indicators: Main Concepts and Data Availability

What is a patent?

A **patent** is a legal title granting its holder the right, in a specific country and for a limited time (usually 20 years), to prevent others from exploiting an invention for commercial purposes without authorisation. Subject to renewal fees, a patent remains valid for its whole legal duration. Patents are granted for inventions that are new, that bring an inventive step and that concern industrial applications. Almost all fields of technology are subject to patent, except areas involving (i) programs for computers, (ii) methods for treatment of the human or animal body by surgery or therapy, and diagnostic methods practised on the human or animal body, (iii) plant and animal varieties, and (iv) inventions contrary to order public or morality, although in all these areas some exceptions apply. Novelty is defined as not being already part of the state of the art that is *"everything made available to the public anywhere in the world by means of a written or oral description, by use, or in any other way, before the date of filing or priority"*.[1]

Patent application vs granted patent

Any natural or legal person can file a patent application to protect its invention. 18 months after a patent application is filed and following the first review process, if the latter is successful, the patent application is published. Subject to further investigation, the same patent can be granted. Therefore, a **published patent application** is not the same as a **granted patent**. Publishing a patent brings to the public domain knowledge of new improvements or ideas for which patent protection is sought, generating prior art from the date it is published. A granted patent, instead, is protected under law and gives the holder the right to benefit from the invention through manufacturing, selling or using, which then implies a sort of monopoly over this work for the legal duration of the patent. Even if a patent application does not result in a granted patent, it remains an important source of knowledge to boost technology development. Both published patent applications and granted patents provide benefits to holders.

There are several, but distinct, advantages of holding a published patent application or a granted patent. Patent applications, which are published but still pending for their granting process, can be changed or adjusted, something that is not possible to do once a patent is granted. An annual maintenance or renewal fee is required to keep a granted patent in force, and some national patent authorities also require a fee for published patent applications. These costs impact the economic value of a patent. Both types of patents are intangible assets, and therefore subject to commercial exchanges. In fact, manufacturers may be interested in obtaining the legal rights to fully exploit a patent based on capabilities that the patent holders may not have. The price to acquire the license of a patent application is generally lower than that for a granted patent, thereby motivating manufactures to try and obtain a license in this stage. The different economic value of a patent application versus a granted patent lies on the fact that, while the first has potential for singularity, the second meets all the requirements for patentability; hence originality and uniqueness are warranted. So, acquiring a granted patent is less risky than obtaining a license of a patent application.[2,3]

Patenting routes

To claim intellectual property rights, that is to request protection for inventions in specific territories, patent applicants have three different options (also called routes): the direct route; the Paris route; or the PCT route. The **direct route** concerns filing separate patent applications for the same invention directly to national offices where applicants seek protection. This option requires complying simultaneously with a number of procedures equal to the number of countries where protection is requested. Furthermore, this procedure must be drafted in different languages and the procedures themselves often differ. Moreover, each patent application has its own cost, therefore the total patenting expense increases with the number of applications filed.

A second route is the so-called **Paris route**. Applicants can file a single patent application in one of the 177 Member States of the Paris Convention for the Protection of Industrial Property.[4] Within the following 12 months, applicants can file separate patent applications in other Paris Conventions countries claiming the filing date of the first application. One of the main advantage of this route is that applicants can file the request in one language only, eliminating also coordination issues encountered when filing several direct

[1] EPO, European Patent Guide – How to get a European patent

[2] Waltmire E., They Have a Patent, Or Do They? Granted Patents & Published Applications, 2015. Online, access June 2020

[3] UPCOUNSEL, Patent Granted vs Published: Everything You Need to Know. Online, access June 2020

[4] WIPO, Summary of the Paris Convention for the Protection of Industrial Property

applications. Compared to the direct route, the Paris route gives applicants advantages at a cost that is potentially lower if the number of countries for the national route is high.

A special agreement within the Paris Convention is the **European Patent Convention** (EPC). It defines *"a single European procedure for the grant of patents on the basis of a single application and created a uniform body of substantive patent law designed to provide easier, cheaper and stronger protection for inventions in the contracting states"*.[5] There are 38 contracting states, plus two more where an European patent can be extended and 4 more where it can be validated.[6] In each country where an European patent is granted, the holder has the same rights as if the patent was granted through the national application (or direct route).

The process of obtaining a granted European patent is divided in two main steps, following the filing of the patent application. The first mandatory step results to a preliminary opinion on patentability sent to the applicant about six month from the first filing. 18 months after the date of first filing the European patent is published, becoming available in the public domain. Upon request from the applicant, the second step comprises a substantive examination and ends with the decision to grant or refuse of the application. At each stage of the procedure, the applicant may withdraw the application based on feedback received and on consideration of costs and benefits of pursuing an European patent. It is estimated that the European process costs are similar to filing 3 or 4 individual national applications until the grant stage.[7,8] European patent applications are subject to payment of annual renewal fees and, after granting, each country requires payment of additional renewal fees.

The third route is the **PCT route**.[9,10] It is named after the Patent Cooperation Treaty (PCT), an international treaty over 153 Contracting States allowing the request of protection for an invention in several countries simultaneously by means of a single patent application as if it was a direct route. After the first filing, applicants have 12 months to file the international (or PCT) patent application and a further 18 months of time before continuing with the national phase procedure in individual patent offices. This means that after 30 months applicants can claim as priority date the date of the first filing. The difference between the Paris route and the PCT route is that, subject to higher fees, applicants opting for PCT applications gain about 2.5 years from the priority date.

The PCT procedure starts by filing of an international application with a national or regional patent Office or WIPO. An International Searching Authority (ISA) gives feedback to the applicant on the potential of the invention. Soon after the 18 months from the date of the first filing the international patent is published and available to in the public domain. Upon applicant's request a supplementary international examination can be performed towards granting the invention. Usually, 30 months after the first filing the PCT procedure ends, and the granting process moves to the national phase, which completes the granting process of international patent applications. Applicants pursuing the PCT route generally pay three types of fees[11] and are also subject to pay additional fees during the national granting process. The marginal cost benefit of PCT application increases with the number of national applications to file as alternative. As for other routes, granted patents are subject to pay maintenance fees in those countries where applicants protect the invention.

PATSTAT as a data source

PATSTAT is the European Patent Office's (EPO) Worldwide Patent Statistical Database. It contains information of published patent applications (applicants, inventors, filing date, publication date, citations, patent families, legal events, technological categories, priorities, etc.) for which national patent offices have provided the EPO with data. It represents a unique tool for researches in several areas to study technology progress and advancement. PATSTAT is updated twice a year (spring and autumn version, providing a snapshot of the patent landscape, at the end of January and end of July, respectively). The data populating PATSTAT are extracted from DOCDB, the EPO's master bibliographic database, which covers more than 90 patent authorities worldwide, and from the INPADOC EPO worldwide legal status database.[12]

PATSTAT is one of the most used patent databases among scholars, because it allows in-depth patent analysis of patent applications. Along with knowledge of Structured Query Language (SQL), required to navigate the database, it is also necessary to have clear understanding of the data coverage and possible drawbacks. Pitfalls arise from the different patenting procedures, from the complexity of the granting process, and from other legal requirements that patent applicants are bound to follow.

Availability of patent data

PATSTAT provides information on the most important steps of the patenting procedure. However **availability of data** changes among releases. **A patent application is typically published 18 months after its filing date or its priority date**, and therefore not included in PATSTAT before the first publication. For example, a patent application filed in December 2016 that follows a direct or Paris route is published by mid 2018, hence fully available in PATSTAT 2018 Autumn version, with **almost 2 years lag from its filing date**. However, to gain the maximum benefit, more and more applicants follow the PCT route, **delaying as much as possible the entrance in the national phase**, and maintaining as priority date that of the first filing. This means that an international patent application filed in December

[5] EPO, European Patent Guide – How to get a European patent
[6] Contracting states are: Albania, Austria, Belgium, Bulgaria, Cyprus, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Monaco, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom. Upon request, the European patent is effective in Bosnia and Herzegovina and Montenegro (extension states) and in Marocco, Republic of Moldova, Tunisia and Cambodia (validation states)
[7] EPO, How much does a European patent cost?
[8] EPO, Schedule of fees
[9] WIPO, PCT Applicant's Guide - International Phase
[10] WIPO, Protecting your Inventions Abroad
[11] WIPO, PCT Fee Tables
[12] EPO, PATSTAT documentation

2016 is already available in the PATSTAT 2018 Autumn version. Assuming that the applicants uses the **30-month period to make the decision to continue to the national phase**, the resulting applications that go through this phase will be published by mid 2019, hence available in PATSTAT 2019 Autumn version, **about 4 years after the filing of a PCT application**.

The scheme below illustrates an example in PATSTAT of an international patent application following the PCT route. The *appln_id* is the identifier in PATSTAT for patent applications and *internat_appln_id* relates a patents application to its international patent application. *docdb_family_id* groups together applications claiming the same prior applications as priorities and generally refer to the same invention. *appln_auth* defines where a patent application is filed and where the national/regional phase is initiated, while the *receiving_office* is the patent office where the PCT application if firstly filed. In the example, the international patent application (WO) is filed at the EPO as receiving office (symbol EP), and the applicant has decided to continue the granting process through a national phase in China (CN), in Brazil (BR) in USA (US) and through a regional phase at the EPO.

The application filing date (*appln_filing_date*) is the date of receipt by the patent authority, in the example December 2016, except for the US where it was filed May 2019. The date of the earliest filing (*earliest_filing_date*) is the earliest date of the filing dates of the application itself, or its international application, or its Paris Convention priority applications, or the applications with which it is related via technical relations and continuations. The date of earliest filing is unique within the same family of applications. The date of earliest publication of an application (*earliest_publn_date*) indicates when it is first published. In the example this date is almost in line with the **18 month period** from the first filing for the PCT application and within the **30 month period** for those following the national or regional phases.

In PATSTAT the availability of information on patent applications depends on their date of earliest publication. In the example, the 2018 Autumn version, that provides the snapshot of the patent landscape up to July 2018, only discloses information of the first international patent application filed in December 2016 but published in June 2018. The two patent applications filed respectively in China and at EPO in December 2016 are published 30 months later in July 2019, therefore disclosed in the 2019 Autumn version which provides the snapshot of the patent landscape up to July 2019. The 2020 Spring version includes information up to January 2020, disclosing the last two patent applications filed in Brazil and USA and published in October and September 2019 respectively.

Choice of reference date for patent analysis

Patent datasets provide an excellent source of information to track the steps in patenting activity and layers of the process of technology development. A number of **research questions** can be addressed, depending on how patent information is combined and analysed. Three such research topics are summarised below.

Effort to protect an invention

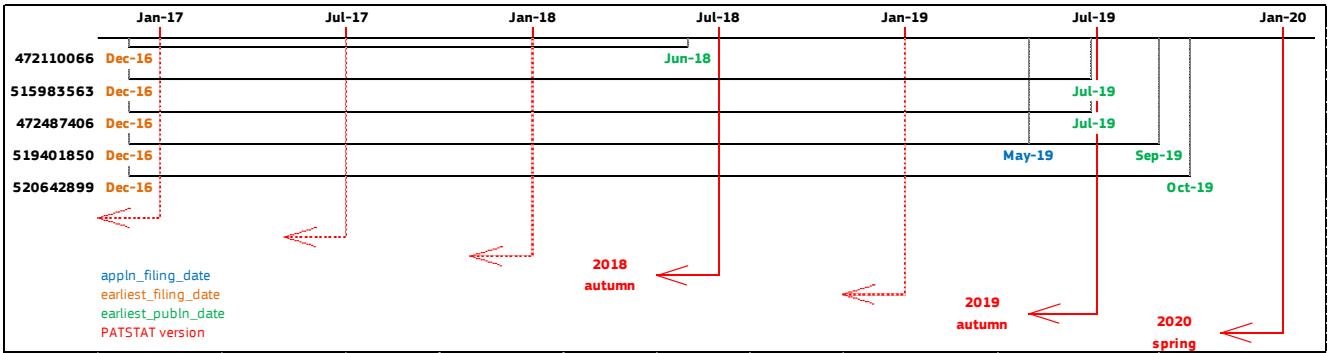
Monitoring the number of patent applications in relation to the **filing date** is a proxy of the effort to protect inventions. An invention can be protected by one or more patent applications; the higher the number of applications the higher the effort required in terms of procedural steps, time and monetary expense. The filing date indicates when this effort is finalised.

Knowledge diffusion

Monitoring the number of patent applications in relation to the **publication date** is a proxy of knowledge diffusion. When a patent application is published it becomes available in the public domain. From the date of publication, the information embedded in the patent application is not secret, therefore increasing the knowledge stock.

Development of new invention

Monitoring the number of patent families in relation to the **date of the earliest filing** is a proxy for the production of inventions. This analysis is best positioned to give an indication of the R&D activity producing the invention and when this has been performed, the earliest filing date being the closest to the date of inventive activity.



appln_id	internat_appln_id	docdb_family_id	appln_auth	receiving_office	int_phase	nat_phase	reg_phase	appln_filing_date	earliest_filing_date	earliest_publn_date
472110066	0	57442730	WO	EP	Y	N	N	1-Dec-2016	1-Dec-2016	7-Jun-2018
515983563	472110066	57442730	CN		Y	Y	N	1-Dec-2016	1-Dec-2016	9-Jul-2019
472487406	472110066	57442730	EP		Y	N	Y	1-Dec-2016	1-Dec-2016	24-Jul-2019
519401850	472110066	57442730	US		Y	Y	N	31-May-2019	1-Dec-2016	19-Sep-2019
520642899	472110066	57442730	BR		Y	Y	N	1-Dec-2016	1-Dec-2016	15-Oct-2019

Timelag in patent analysis

The **completeness** of patent data statistics at any given time depends on the research question addressed, and thus the date chosen as a reference for the analysis. The availability of patent data is related to when this information becomes public, and when PATSTAT is populated.[13] The figure to the right shows the trend for the number of patent applications filed (in blue), patent applications published (in red) and inventions produced (in green) per year, from 2000 to 2020. These values are extracted from the PATSTAT 2020 Spring version, and only refer to the patenting of inventions, excluding utility models and design patents.

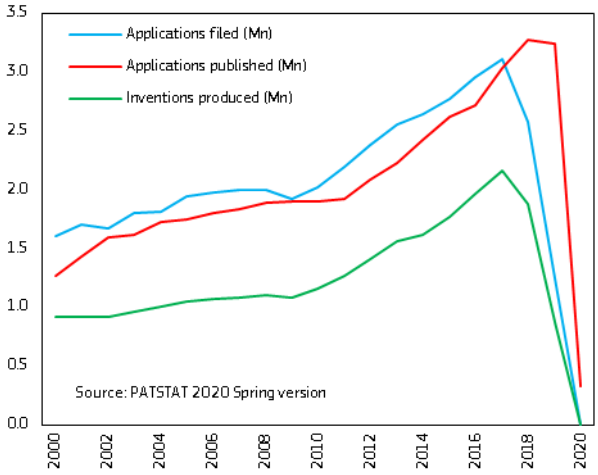
The 2020 Spring version provides the snapshot of the patent landscape up to January 2020, implying that up to this date information on the published patent application is complete.[14] Therefore, the analysis of **knowledge diffusion** (i.e. published patent applications) can be run up to 2019, with a high confidence level of completeness. **Patent applications are published between 18 and 30 months after they are actually filed**, that is when the **effort to patent** an invention is finalised. Consequently, an **analysis considering the date of filing will have on average 3.5 years lag**, meaning up to 2017. This is also the case for the analysis of **invention production** since it considers the filing date of the patent application that set the priority of a patent family. Considering that a patent family groups together several patent applications protecting the same invention, the number of invention is lower than the number of filed patent applications.

The JRC SETIS methodology

The JRC, in the context of the Strategic Energy Technologies Information System (SETIS) of the European Commission, monitors and reports on a number of key performance indicators that are instrumental to measure progress made in research, innovation and competitiveness (RIC) and are key drivers in the transition process towards a more secure and sustainable energy system.

JRC SETIS has developed a methodology[15] to derive indicators on the **global inventive activity**. It uses patent families as a proxy of invention production and considers the date of the earliest filing as the closest date to the inventive activity, hence the closest date also to R&D spending.[16] As explained in the previous section, statistics based on the date of the earliest filing have a 3.5 years lag. **Since there is no clear pattern in historical data, there is no robust nowcasting technique that can provide estimates for the most recent years**.

Data availability in PATSTAT and completeness of patent statistics



The JRC SETIS methodology restricts the analysis to **Climate Change Mitigation Technologies** (CCMTs) that are identified through the Y02 and Y04 schemes of the Cooperative Patent Classification (CPC). Only **patent applicants** are considered, being the owners of the patent and, thus, those directly investing and financing R&D activities. To protect an invention, applicants can file one or more patent applications to several patent offices following different routes. Applications to all offices are retrieved, with no restrictions regarding national or international route, which are therefore treated with the same level of relevance.

The inventive activity (or patent family) can involve more than one applicant (for which residence country is known) and can target the development of one or more aspects of a technology. In order to estimate proportionally the effort committed by each participant to the development of each technology aspect, the well-established technique of **fractional counting** is used. It assigns an equal share to all the combinations of CPC codes and patent applications protecting the invention, thus preventing multiple counting.

JRC SETIS uses PATSTAT as the source of patent information, applying a further automatic data clean-up process in order to **increase accuracy and completeness** of the dataset.[17]

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[13] EPO, Data completeness of PATSTAT Global, 2020 Spring Edition
[14] Delays in provision of data from national authorities can still reduce completeness for the most recent years
[15] Fiorini A., Georgakaki A., Pasimeni F., Tzimas E. Monitoring R&I in Low-Carbon Energy Technologies, *JRC Science for Policy Report*, 2017
[16] Pasimeni F., Fiorini A., Georgakaki A. Assessing private R&D spending in Europe for climate change mitigation technologies via patent data, *World Patent Information*, 2019
[17] Pasimeni F. SQL query to increase data accuracy and completeness in PATSTAT, *World Patent Information*, 2019