European Commission

Patent costs and impact on innovation

International comparison and analysis of the impact on the exploitation of R&D results by SMEs, Universities and Public Research Organisations

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Contact: Richard Deiss

E-mail: Richard.Deiss@*ec.europa.eu*
Roman.Arjona@*ec.europa.eu*
RTD-PUBLICATIONS@ec.europa.eu

European Commission
B-1049 Brussels

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December 2014

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Carried out by Everis Spain S.L.U. – Madrid

For the Directorate-General for Research & Innovation

Directorate-General for Research and Innovation
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This report was prepared by a team of consultants and analysts from the Business Analytics and Business Intelligence units of everis Spain (www.everis.com), led by Dr. Ángel Sánchez (Project Director), Mr. Pablo Hortal (Project Manager) and Mr. David Cuesta (Chief Analyst).

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1. EXECUTIVE SUMMARY

Patents are an essential tool for promoting innovation and technological advancement. The patent system creates a framework that supports and incentivises the development of science and technology which fosters innovation, technology transfer and economic growth. A strong patent system results in benefits not only at EU level but at a global level and patent costs are one of its key elements. The two main objectives of this research are:

- To provide a comparison of patent costs levels and structures at country level.
- To analyse the impact of patent costs on R&D and innovation activities of SMEs, universities and PROs.

Three main data sources have been used in this research: information gathered from 40 European and international National Patent Offices (NPOs) regarding their fees and operational aspects, PATSTAT (and INPADOC) from which data from direct European and national patents was obtained, and the everis survey which was conducted in 11 countries covering topics such as patent costs, motivations for patenting, burdens and benefits of patenting.

The evidence collected shows wide differences in patent costs levels among NPOs. For example, fees paid for a patent maintained for 20 years in Germany can be more than 5 times higher than in Malta. However, the situation changes when costs are considered relative to the size of the market covered by the patent. For example, the cost of a German patent relative to the size of the German market is nearly 75 times lower than for Malta.

The costs for a European patent filed at the European Patent Office[1] and validated in 6 and 13 countries are high in absolute terms compared to national patents. However, relative to market size these costs are lower than in most NPOs analysed in EU Member States when translation costs and the simplified procedure are considered. Compared with the costs at the JPO (Japan) and the USPTO (USA), European patents relative to market size are relatively expensive; for example a patent for 6 European countries is 7.3 times more expensive than a USPTO patent, while a patent for 13 European countries is 11 times more expensive than a USPTO patent, which makes them less affordable for applicants.

Although there are differences in cost levels, most NPOs in Europe have similar fee structures, with relatively low entry fees (administrative fees) and with maintenance fees that increase with patent life. The progressive increase of maintenance fees aims at encouraging patentees to drop patents which are not valuable enough and hence to unlock lower value aging patents.

Litigation costs in Europe have also been analysed. Due to the fragmented nature of the European system, simultaneous litigation in four European jurisdictions can be twice as high as the fees for validating and maintaining a European patent in 13 countries for 20 years.

Another topic addressed is an evaluation of workloads at NPOs. Backlogs have been a cause of concern for NPOs due to the increase in patent filings in the last years. Delays in the patent granting process create uncertainty which affect business decisions. Cross analysis of pendency times, number of filings and examiners and grant rates combined with facts gathered from the literature suggest different levels of thoroughness in the examination process. Less comprehensive examination processes increase the likelihood of low quality patents which may impede the innovation process and/or increase the chances of litigation/opposition procedures, which add significant and unpredicted costs for applicants and licensees.

The study also examined the arguments in favour of lower and higher levels of patent fees. Low fees reduce the costs incurred by innovators and therefore increase the returns on innovative investments. However, lower costs are likely to lead to higher numbers of patent applications and may contribute to higher backlogs or less thorough examination processes if the number of examiners does not increase accordingly or if there are not efficiency gains in the examination process.

Patent life and the number of countries covered by patents have been analysed based on PATSTAT and INPADOC databases. Long living patents correspond to the technology fields of micro-structural and nano-technology, ICT, bio-science, medical technology and chemistry. Likewise,

[1] Although filed at the EPO, not all costs are set by the EPO. Validation fees (in some countries) and maintenance costs are charged on behalf of NPOs.

European patents with the highest number of validated countries show similar results for micro, nano, bio, medical and chemistry related technologies, which leads to the hypothesis that these require intensive investment on R&D and can be easily copied if they are not adequately protected. In addition, the return on investment is only achieved in the long term due to the high R&D investments required in these sectors. ICT-related patents have long lives but are validated in a lower number of countries. This fact is likely to be related to the dynamics of this industry rather than initial high investments.

Patents from Europe's largest economies have on average the longest lives which reflects the increased economic importance of patents in larger markets. However, it is also noticeable that patent life is affected by the fee structure as predicted by the literature. For example, the average life of Italian patents (16 years) is well ahead of German patents (13 years) while Italy has a low and flat renewal fee cost structure in which renewal fees increase only 22% from the 13th to the 20th year while in Germany fees increase by 150%.

Linear regression analyses have been carried out between patent costs relative to market size and other innovation-related indicators such as R&D expenditure, SMEs engaged in in-house R&D, employment in fast-growing firms, venture capital funding and high tech exports. The results do not allow inferring clear relations between costs and these indicators. However, the analyses did not take into account other relevant factors such as economic structure, other patent related costs (e.g. litigation and enforcement), or the patenting strategies of companies (e.g. the extent to which companies patent domestically or internationally).

The everis survey 2013 collected information about entrepreneurial activity and motivations for patenting. Respondents indicated that the cost of patents was a relevant factor although it was not possible to establish conclusive relations between patent costs and the responses given. Again this indicates that there are many factors, other than patent costs, that impact on innovative behaviour and a more sophisticated multi-variate analysis would be needed to examine this issue in greater depth.

2. INTRODUCTION

2.1 Context

This study on "Patent costs and impact on innovation: International comparison and analysis of the impact of the exploitation of R&D results by SMEs, Universities and Public Research Organisations" is aimed at contributing to the development of an evidence-based monitoring of the evolution of national research and innovation systems in Europe. The indicators developed shall allow for assessing the impacts of research policies and programmes on the competitiveness of Europe and its contribution to growth and to address societal and global challenges.

Patents are a basic tool for promoting innovation and technological advancement. The patent system establishes a legal framework that supports and incentivises the development of science and technology that, in the end stimulates innovation and economic growth. Therefore, strengthening the patent system will result in several benefits not only at EU level but at a global level.

The costs of filing and maintaining a patent influence the number of filings and the lifespan of patents. Special attention is paid to SMEs in some countries that take advantage of lower fees in order to promote innovation and competitiveness. Therefore they can be considered a part of the Intellectual Property policy. The single market for patents in Europe has been affected by the different levels of patent costs across Member States. Several measures have already been undertaken or are under development both by the EC and Member States to enhance the patent system. The results of this study shall contribute to a better understanding of the impacts of patent costs and how they can be turned into a tool for the development of an effective European knowledge market for patents and the promotion of licensing and technology transfer.

The present study has been carried out through an evolutionary approach with the following deliverables associated to each phase of the project:

- **D1** - **Literature review** considering patent costs calculation methodologies and previous work carried out on the effects of patent costs on PROs, Universities and SMEs.
- **D2** - **Methodology description** and roadmap of the tasks.
- **D3** - **Interim data** for a preliminary set of countries.
- **D4** - **Data** summary for the 40 countries targeted (see *Annex 7.1*).
- **D5** - **Methodological report** containing the conceptual frameworks and definitions for the estimation of patent costs and the data from D4.
- **D6** - **Report on the survey and case studies** with the corresponding methodology utilised and the results obtained.
- **D7** - **Analytical report** presenting the analysis carried out from the different information sources and the conclusions obtained.
- **D8** - **Final report** which presents the study and its context, the objectives and the methodology deployed; it presents a summary of the literature review, a synthesis of the data provided, the results, main findings and reasoned conclusions.
- **D9** - **Brochure and slides** presentations for dissemination that shall contain an executive summary of the project's main findings and recommendations.
- **D10** - **Dissemination workshop** which will be an opportunity to present the findings and conclusions, to review and discuss the issues of quality and comparability of the data collected in the project, and to present the analysis and results with this data.

The present document is the 8^{th} deliverable (D8) and corresponds to the final report.

2.2 Objectives

D8 summarises the results obtained in the previous seven deliverables and provides an integrated vision of the findings and the conclusions stemming from them. The primary objectives of this deliverable are:

- To provide a comparison of patent costs levels and structures at country level.
- To analyse the impact of patent costs on the R&D and innovation activities of SMEs, Universities and PROs.

The insight gathered during this project aims to provide valuable information to the EC and the Member States with regards to policy development in the field of Intellectual Property. As a result of the research undertaken in this project, the following questions related to the influence of patent costs in the following topics are looked into:

- Patent costs levels: Do differences between countries create barriers for the filing of patents?
- What is the average patent life and in how many countries is a patent validated?
- Utilisation rate of patents: Does the level of patent costs encourage the commercial use of patents or their licensing?
- Economic value of patents: Do patent costs influence the average value of patents?
- Motivations for patenting: Do patent costs influence the motivations of patent applicants?
- Is there a relationship between patent costs and macroeconomic parameters such as the investment on R&D at different levels (GERD, BERD and HERD)?
- Do patent costs influence business decisions of SMEs (investments, growth strategies, creation of new firms, access to VC funding or internationalisation), Universities and PROs (spin-off creation)?
- Are patent costs a barrier for patenting for SME, Universities and PROs?

3. METHODOLOGY OVERVIEW AND SOURCES OF INFORMATION

The analysis needed to be carried out in the present study is significantly complex since there is no single data source able to provide a complete and simultaneous snapshot of the behaviour of SMEs, Universities and PROs in terms of patenting. Therefore, different databases and sources of information have been used throughout the project.

Firstly, 40 National Patent Offices (NPOs) have been consulted to gather data regarding patent fees (according to the OECD patent costs can be split into administrative, process, translation and maintenance costs).

Secondly, the EPO databases PATSTAT and INPADOC have been extensively used as they are a comprehensive repository of worldwide patent statistics, including information on patent life and validated countries for European patents (this information is provided by INPADOC). In addition, PATSTAT also integrates information stemming from NPOs which deliver this data according to individual policies, which makes difficult the "simultaneous" view mentioned before.

In order to assess previous research in the various topics targeted in this study, a comprehensive literature review has been carried out. The main sources are summarised in Annex 7.6 Literature review.

Finally, these sources of data have been complemented by a survey (everis survey 2013) conducted in 11 countries, encompassing 6 European countries, 4 from Asia and the USA. A final set of 414 responses were collected providing valuable information on the motivations, costs, impacts and perceptions regarding patenting for two routes: "Direct National" (standard applications at the NPO level) and "Direct European" (applications directly filed at the EPO). Additional data sources like the "PatVal EU-II survey" (2010) and macroeconomic data obtained from Eurostat regarding the expenditure on R&D have also been used.

This data collection, integration and analysis activity has been undertaken as part of a methodology which comprises 5 tasks. Task 1 focused on the literature review of the project; Task 2 and Task 3 targeted the gathering of data and information on, respectively, patent costs and additional patent information, by country; Task 4 included the design and execution of the above-mentioned 11-country survey; Task 5 was designed to identify and obtain other patent-related information and economic indicators, and to analyse all information gathered; Finally, Task 6 focuses on the dissemination of project's result.

The relationship between the different tasks and project deliverables, as described in section 2.1, is shown in the following table.

Table 1 - Project tasks and associated deliverables

<table>
<tr><th>Task description</th><th>Associated deliverables</th></tr>
<tr><td>Task 1, "Review of related literature".

The objective of this task was to expose the state of the art concerning different topics. Basically, the different methodologies of calculating total patent costs, along the life of a patent, as well as the effects of patent costs in the behaviour of SMEs, Universities and PROs, including possible relations between patent costs, structural change, and competitiveness of SMEs.</td><td>• D1 - Literature review report.
• D2 - Study's methodology.</td></tr>
<tr><td>Task 2, "Data and information on patent costs".

The objective of this task was to collect patent cost data in the 40 countries and 3 groups of countries specified in Annex 7.1. Together with Task 3, it has 3 different deliverables as outputs (D3, D4 and D5).</td><td rowspan="2">• D3 - Interim data.
• D4 - The patent cost data (for the project's target countries) and related information.
• D5 - Methodological report (data quality).</td></tr>
<tr><td>Task 3, "Data and information on patents and average patent life".

The present task complemented the information obtained on patent costs in the previous task with information on patents and average patent life.</td></tr>
<tr><td>Task 4, "Survey and case studies of patenting SMEs, Universities and PROs".

The goal of this task was to develop and execute all the surveys and case studies planned in order to obtain a representative, high quality, set of data about the patent activity, the experience in patent filings, and the impact of patent costs in the patenting activity of SMEs, Universities and PROs.</td><td>• D6 - Report on survey and case studies.</td></tr>
<tr><td>Task 5, "Produce analytical work".

The essential objective of this task was to examine all data and information collected up until this point, with the objective of obtaining reliable conclusions of the impact of patent costs (levels and structure) on the patenting behaviour of the entities being targeted, on the economic development of SMEs, on their R&D investments and their internationalisation behaviour.</td><td>• D7 - Analysis report: an analytical report presenting the main conclusions.</td></tr>
<tr><td>Task 6, "Dialogue, meetings and dissemination".

This task, which is geared towards building awareness of the project, has as its fundamental objective the achievement of effective external communication of its concept, its results and the potential impact it could have within the European Union.</td><td>• D8 - Final report (the present document).
• D9 - Brochure and slides presentations for dissemination.
• D10 - Dissemination workshop.</td></tr>
</table>

The "Analytical report" (D7), which is the resulting deliverable of Task 5, has been developed using the CRISP-DM (Cross Industry Standard Process for Data Mining) methodology. This methodology, partly funded by the EC during the 1990s, is the most commonly used standard process model in both academic and industrial fields, and provides a solid framework for data analysis projects.

Figure 1 Phases of the CRISP-DM methodology process

The **business understanding** phase focuses on the business orientation of the problem, which is to obtain a better understanding of the patent cost structure among countries to develop and promote innovation through an enhanced patent system in Europe.

The **data understanding and preparation** phases deal with data gathering and quality assessment. The activities related to these two CRISP-DM phases have been carried out several times during the project.

Once data is gathered and quality is ensured (to a certain level, deemed appropriate for the analysis to be executed) a **model** is built to optimise the analytical work (**modelling phase**). In this case, most of the project's related information was integrated in a database where data quality and cleansing activities were undertaken. This information came from four main sources: NPO data (gathered manually from NPOs and integrated in the project's data repository using automatized processes), the PATSTAT and INPADOC databases (standard automated extraction, transformation and loading processes were applied), the everis survey 2013 (414 responses from 11 countries, automatically integrated) and other external sources (OECD data for GERD, BERD and HERD, as well as PatVal-EU II survey data were manually integrated in the project's data repository).

The model itself was mainly, as explained above, a data repository with certain rules and decisions to make data analysis more reliable and efficient. The **most representative features** of such model are the following:

- **Patent costs gathered from NPOs**. The selected **reference year was 2011**, since it was the one for which NPOs, in general, had the most recent and complete data. These costs have been divided into the four categories recommended by the OECD: administrative, process, translation and maintenance costs. It must be borne in mind that an NPO can only provide administrative and maintenance costs. The remaining two categories were estimated following Roland Berger's (RB) "Study on the cost of patenting" (2004). Although some of the data from the RB study may be outdated and must be taken with caution, the study is still the most comprehensive research covering all aspects of patent costs and therefore it has been used in some parts of this study.
- **Process costs** in the RB study were estimated as 9,840 € for a set of 14 OECD countries[2]. In order to have more precise (i.e. up-to-date) process costs for each country, several assumptions have been made:
  - Inflation adjustment: in order to carry these costs from one year to another, the average inflation rate for the OECD countries published by the World Bank[3] has been used.
  - Purchasing power parity adjustment: just updating process costs with inflation rates does not take into consideration differences in purchasing power standards among countries. Therefore, the updated costs were multiplied by the ratio of purchasing power parities between each country and the OECD. However, since a PPP conversion factor for the OECD does not exist, Germany's conversion factor has been used instead. An example of the calculations for the UK is provided below:

$$\text{Process costs UK } (£)_{2011} \approx \text{Process costs RB } (€)_{2004} \times \text{inflation adjustment factor } \text{OECD}_{2004-2011} \times \frac{\text{PPP conversion factor } UK\left(\frac{£}{\$}\right)_{2011}}{\text{PPP conversion factor Germany}\left(\frac{€}{\$}\right)_{2011}}$$

The starting point of the calculations is the process cost in Euros obtained as an average of the process costs for the countries covered in RB's study. This average cost (in Euros) is updated using the average inflation for the OECD countries and then it is multiplied by the ratio of PPP conversion factor for the target country which is given in Local currency divided by international dollars (in the example British pounds divided by international dollars) and the PPP conversion factor for the

[2] The countries covered in the RB study are Austria, Belgium, Switzerland, Germany, Denmark, Spain, Finland, France, Italy, The Netherlands, Sweden, the UK, the USA and Japan.

[3] http://data.worldbank.org/indicator/NY.GDP.DEFL.KD.ZG

country set as a reference, which is Germany (Euros divided by international dollars). The result is the process costs in local currency for the country considered (in the example British pounds for the UK)

- Regarding **translation costs**, the data from the RB study has also been used. Translation costs from English to the languages considered in the report have been updated using World Bank inflation rates for the OECD countries, and allocated to each country according to the languages accepted in its NPO. If several languages are accepted in one NPO, the lowest cost was selected. For those countries whose languages are not covered in RB's research, an average translation cost has been chosen except for China, South Korea and Japan where the difference between language families did not allow for an accurate comparison using RB's data. It must be taken into account when dealing with NPO data that only national filings are analysed. Therefore, the London Agreement[4] does not apply.

- Another decision included in the analysis model is related to the **patent application mechanisms**. In the last decade, several NPOs have established different fees depending on whether the filing is paper based or electronic based. In order to follow a consistent criterion among countries and throughout the temporal scope considered, **only costs for paper based applications** have been taken into account. No extra charges for late payment are assumed in any case.

- Regarding the **length of the text** considered, the RB study has also been taken into account. According to this study, the **"model patent"** has **28 pages** (including 4 pages of claims) and **13 claims**.

- **European patent costs**: the costs of filing, validating and maintaining a European patent have been calculated for the model patent previously described. Costs depend on the countries where the patent is validated. In this study costs are considered for 2011 in the 6 and 13 most frequently validated countries:

  - The 6 European countries group includes those countries where at least 40% of European patents are validated. These countries are Germany, France, Italy, The Netherlands, Switzerland and the UK.

  - The 13 European countries model patent corresponds to the countries in which at least 12% of European patents are validated. In addition to Germany, France, Italy, The Netherlands, Switzerland and the UK, Austria, Belgium, Denmark, Finland, Ireland, Spain and Sweden are also included.

  Administrative fees for the European patent are comprised by the administrative and designation fees charged by the EPO plus any other validation fees charged by the receiving NPOs. Maintenance costs are the most important costs component for European patents since it is a bundle of the maintenance fees charged by each NPO. Translation costs have been calculated according to the London Agreement[5] and the process costs have been estimated as the average of the process costs for each country included in the aggregate.

- Other features of the model deal with patent costs expressed in **Purchasing Power Parity (PPP)**. PPP conversion factors published by the World Bank[6] have been used and, consequently, data in local currencies has then been transformed into international dollars, allowing for homogenous comparisons between countries.

- **Patent costs expressed in Euros** are calculated using exchange rates published by the World Bank[7] which provide the cost based in dollars that are then transformed into Euros using the dollar-Euro exchange rate for 2001, 2006 and 2011. For 1991 and 1996 the conversion from dollars to Euros has been made using the fluctuation of the German Mark as a reference for the Euro area.

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[4] http://www.epo.org/law-practice/legal-texts/london-agreement.html

[5] The London Agreement has only been applicable for Finnish EP validations from the 1st of November 2011. For simplicity purposes, Finland translation costs are calculated as if only claims need to be translated.

[6] http://data.worldbank.org/indicator/PA.NUS.PPP

[7] http://data.worldbank.org/indicator/PA.NUS.FCRF

- Average patent life and number of validated countries. This information has been gathered from EPO's PATSTAT (release 10/2012), including INPADOC (release 10/2012). The different dataset utilised are summarised in the following table.

Table 2 - Description of PATSTAT 10-2012 data

	Number of Distinct Patents
Total PATSTAT 10-2012 (table TLS201_APPLN)	73,177,050
Filed in 1991, 1996, 2001, 2006, 2011 [1]	5,507,696
With technology field [2]	5,058,893
With type of applicant [3]	4,627,308
With economic sector [4]	5,041,250
Dataset Alpha: [1] + [2] + [3] + [4]	4,109,457
Filed in 1991, 1996, 2001, 2006, 2011 and granted [5]	2,242,188
Dataset Beta: [1] + [2] + [3] + [4] + [5]	1,858,873
European patents with (high certainty) patent life [6]	78,371
Dataset Gamma: [1] + [2] + [3] + [4] + [5] + [6]	76,579
European patents validated in one or more countries [7]	177,616
Dataset Delta: [1] + [2] + [3] + [4] + [5] + [7]	173,266

[1] Field APPLN_FILING_DATE = 1991, 1996, 2001, 2006 or 2011 in table TLS201_APPLN
[2] Technology field is known and valid (i.e. different to NULL, Unknown and N/A)
[3] Type of applicant is known and valid (i.e. different to NULL, Unknown and N/A)
[4] Economic sector is known and valid (i.e. different to NULL, Unknown and N/A)
[5] Field PUBLN_FIRST_GRANT = 1 in table TLS211_PAT_PUBLN
[6] Legal status code PG25 (at INPADOC table) in all validated countries (see explanation in Section 0)
[7] Legal status codes including PG25 or PGFP (at INPADOC table)

- **Correlation analysis**, applied to obtain the **linear regression coefficient of determination (R^2)**, is used to explore the possible relationship between several economic indicators and patent costs. This method provides a clear indication of how close the variation of a pair of two variables is to a certain regression line (R^2 measures the share of the variation in "y" explained by the variation in "x"; a coefficient of determination of 1 implies that the regression models the correlation perfectly well).

Evaluation and deployment are the final phases of the CRISP-DM methodology. The former pays attention to the evaluation of the model (i.e. the results obtained and shown in "D7 - Analysis Report") to be carried out by the Commission and project stakeholders. The latter focuses on the needed activities for the deployment (dissemination and future application) of the model (and its corresponding results and conclusions). This document and the dissemination workshop are a key part of the means for the evaluation and deployment of the project's results.

Several challenges have been encountered during the execution of the project.

The most relevant are:

- The lack of available data of patent costs at NPO level has limited the analysis of the evolution in time of patent costs.
- The limited data provided by NPOs, such as the average number of claims or pendency times, have restricted the number of countries for which the analysis of patent costs through the 3C-index is done or the analysis of workloads at their POs respectively.
- The lagging of data integration in PATSTAT and INPADOC (specifically the information delivered by NPOs) required taking the year 2001 as a reference year for several analyses. Data was incomplete for the years 2011 and even 2006 due to two facts: data is not registered in PATSTAT until patents are published at their corresponding POs, and the sending of patent data by the NPOs to the EPO varies between countries.
- The intrinsic complexity of measuring the average patent life and the limited detail of the survey (everis survey 2013) for some required elements of analysis have indeed been challenges that have been tackled during the execution of the project.

Despite these limitations, a set of relevant conclusions have been reached which can be used as a base or guide for future analysis and decision-making by the Commission.

4. RESULTS

The results obtained in the different analyses are divided into 4 sections that cover the questions previously raised:

- **Section 1**: Patent costs and procedure in NPOs.
- **Section 2**: Profile of patents filed in NPOs and the EPO.
- **Section 3**: Economic indicators.
- **Section 4**: Investment & internationalisation impacts, barriers and burdens regarding patenting costs.

In order to provide a good understanding of the work carried out and the results obtained, a similar structure has been followed in each section:

- Introduction: a brief outline of the issue in question and its relevance.
- Data sources and data preparation: the main data sources are identified and the different processes of data treatment are described.
- Analysis: based on the processed data and the objectives for each section, analysis and presentation of the results are performed.
- Conclusions and recommendations: according to the results of the analytical phase, conclusions are drawn.

4.1 Patent costs and procedure in NPOs

In this section a cost analysis of the patenting process is carried out at an NPO level. Costs are considered using different perspectives in order to identify costs structures that could have an impact on the patent applicant behaviour. Finally, a description of the NPOs' workload is undertaken and put into perspective with how costs can impact on it.

4.1.1 Patent costs: a cross-country comparison

The goal of this subsection is to provide a **cross-country comparison** of the costs of obtaining and maintaining a patent. As indicated above, according to the "Patent Statistics Manual" of the OECD, four main components of patent costs can be identified[8]:

- **Administrative costs:** filing fees, search, examination, country designation, grant/publication fees and validation fees that are due to the corresponding patent office.
- **Process costs:** costs associated with the drafting of the application and with the monitoring of the procedure (interaction with examiners and the patent office) on the applicant's side. These costs can be incurred in-house or externalised.
- **Translation costs**: in the case of applications abroad, such costs arise once a European patent is granted at the EPO, and depend on the length of the patent and whether the country where the patent is validated is part of the London Agreement or not. The more countries covered, the higher the translation costs. In the case of national patents, only those entities that originally write their patents in a language different than the official one(s) of the destination NPO incur in translation costs.
- **Maintenance costs:** are renewal fees to keep the patent valid during a maximum period of 20 years (extensible for certain types of patents).

[8] OECD Patent Statistics Manual, Paris, 2009.

Administrative and maintenance costs for direct national applications were obtained from the NPOs while translation and process costs were taken from the RB study on the topic. RB's data was obtained in 2004 for a set of 14 OECD countries hence it has been conveniently updated using OECD inflation rates. However, taking an average value for all NPOs might create distortions, especially for less developed countries. In order to have more precise data for each country, process costs have been adjusted according to the relative purchasing power parity between each country analysed and a reference country. As indicated earlier, since there is not a PPP indicator for the OECD, Germany has been chosen instead. Translation services can be considered a more global market, therefore only OECD inflation rates are used.

It must be noted that from the point of view of an NPO, translation and process costs are transparent; when patents are filed they are already translated and processed. Besides this, considering translation costs for the analysis will bias towards estimating costs for foreign applicants, since national applicants do not incur in translation costs. Besides this, updated RB's data for process and translation costs may not factor in changes in law firms procedures, strategies or advances in translation tools. Therefore, **only costs set by the NPOs (administrative and maintenance costs for 10/20 years) comprise the overall costs that are used for most of the analysis**.

In order to provide a consistent cost analysis throughout the NPOs selected, the same model patent defined in the RB study has been used. As mentioned, this model patent has 13 claims, 28 pages (including 4 pages of claims), and is written in English.

Costs are expressed in four ways to provide different angles of analysis:

- Patent costs expressed in absolute terms (Euros)[9] provide a global perspective of the selected NPOs and allow for an objective comparison of costs for a foreign applicant willing to protect his/her inventions in different country.
- Patent costs expressed in relative terms. Patent costs expressed just in absolute terms do not take into account the attractiveness of each market. Several parameters can be used to measure the attractiveness of a market. In the literature the population of a country and GDP are frequently used, the latter being the option chosen. Therefore, relative costs are calculated dividing costs expressed in Euros by the GDP of each country in billions of Euros (1,000,000,000 €).
- Patent costs adjusted in terms of PPP[10] are a very useful indicator to provide an insight on the impact of patent costs for a local inventor willing to protect its invention in his/her own country.
- The 3C-index[11] is a synthetic indicator that allows for a cost comparison between countries considering market size (measured in terms of population) and technological capacity measured in terms of average number of claims (instead of the number of patents).
- Cost per claim per GDP, which is a variation from the 3C-index that measures the attractiveness of a country in terms of its economic output.

Following the OECD's definition of patent costs, the total patent costs for the 40 NPOs selected plus an European patent (6 and 13 countries) are shown below.

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[9] Exchange rates used are obtained from the World Bank (http://data.worldbank.org/indicator/PA.NUS.FCRF). Currency exchange for Euro countries prior to 2001 is calculated using the German Mark as a reference.

[10] Local Currency to PPP expressed in international dollars is calculated using conversion factors published in the World Bank Data repository (http://data.worldbank.org/indicator/PA.NUS.PPP).

[11] "The cost factor in patent systems" (2006) by B. van Pottelsberghe and D. François.

Table 3 - Patent costs structure EUR (2011)

	Patent Costs Structure 2011 EUR [10]			
Patent Office	Administrative [1]	Maintenance [2]	Process [3]	Translation [4]
Austria	660 €	12,300 €	12,199 €	1,718 €
Belgium	350 €	4,340 €	12,331 €	1,798 €
Bulgaria	411 €	6,547 €	4,963 €	1,991 €
Croatia	812 €	5,207 €	7,519 €	2,020 €
Cyprus	546 €	4,263 €	9,889 €	2,039 €
Czech Republic	370 €	6,870 €	8,047 €	1,942 €
Denmark	2,179 €	6,807 €	15,143 €	2,256 €
Estonia	320 €	5,362 €	7,703 €	2,142 €
Finland	1,020 €	8,635 €	13,332 €	2,448 €
France	742 €	5,608 €	12,414 €	1,798 €
Germany	550 €	13,170 €	11,443 €	1,718 €
Greece	590 €	7,325 €	10,188 €	2,039 €
Hungary	725 €	8,311 €	6,502 €	2,108 €
Ireland	550 €	4,628 €	12,159 €	0 €
Italy	1,935 €	6,620 €	11,294 €	1,798 €
Latvia	333 €	5,201 €	7,320 €	2,020 €
Lithuania	220 €	4,407 €	6,679 €	2,020 €
Luxembourg	270 €	2,842 €	13,318 €	1,718 €
Malta	196 €	2,400 €	8,207 €	0 €
Netherlands	914 €	11,040 €	12,224 €	2,110 €
Poland	182 €	3,552 €	6,507 €	1,991 €
Portugal	200 €	5,475 €	9,224 €	2,020 €
Romania	690 €	5,920 €	5,599 €	1,991 €
Slovakia	402 €	5,157 €	7,473 €	1,983 €
Slovenia	460 €	5,143 €	9,193 €	2,129 €
Spain	737 €	4,903 €	10,368 €	1,734 €
Sweden	925 €	6,193 €	14,361 €	2,260 €
UK	323 €	5,244 €	11,827 €	0 €
6 European countries [5]	**5,987 €**	**46,659 €**	**12,727 €**	**2,099 €**
13 European countries [6]	**9,683 €**	**93,243 €**	**12,789 €**	**8,344 €**
Iceland	471 €	2,578 €	12,179 €	2,020 €
Norway	1,206 €	7,906 €	16,926 €	2,020 €
Switzerland	689 €	3,499 €	17,161 €	0 €
EFTA countries [7]	**789 €**	**4,661 €**	**15,422 €**	**1,347 €**
Brazil	611 €	11,288 €	9,298 €	2,019 €
Canada	1,090 €	3,489 €	13,248 €	0 €
China	379 €	9,162 €	5,736 €	
India	407 €	2,959 €	3,423 €	0 €
Israel	244 €	6,950 €	11,656 €	0 €
Japan	2,124 €	13,971 €	14,236 €	
Russia	907 €	1,716 €	6,242 €	2,020 €
South Korea	881 €	9,233 €	8,153 €	
USA	3,453 €	5,446 €	10,573 €	0 €
Non European [8]	**1,122 €**	**7,135 €**	**9,174 €**	**673 €**
TOTAL [9]	**1,089 €**	**9,323 €**	**10,280 €**	**1,752 €**

[1] Administrative costs in Euros.
[2] Maintenance costs for 20 years in Euros.
[3] Process costs in Euros.
[4] Translation costs in Euros.
[5] Costs for a European patent validated in 6 countries (DE, FR, IT, NL, CH and UK).
[6] Costs for a European patent validated in 13 countries (DE, FR, IT, NL, CH, UK, AT, BE, DK, FI, IE, ES and SE).
[7] Arithmetic mean of the costs for EFTA countries.
[8] Arithmetic mean of the costs for other countries NPOs.
[9] Arithmetic mean of the costs for all NPOs.
[10] 2011 refers to the filing year

Note: administrative costs for 6 European countries and 13 European countries patents are pre-grant and designation fees charged by the EPO plus validation fees charged by NPOs. Maintenance fees are the sum of maintenance fees charged by each NPO. Process costs are calculated as the average of process costs in the validated countries. Translation costs are the sum of translation costs taking into account the London Agreement (when applicable)

Source: NPOs

Overall patent costs for the NPOs considered are shown in Table 4. Patent life has a big impact on patent costs the patentee pays since in most countries maintenance costs' annual payments increase sharply at the end of the patent's lifespan. In order to assess the impact of patent life on the overall costs, the analysis is carried out for a 10 and 20 years patent life.

Table 4 - Overall patent costs EUR (2011)

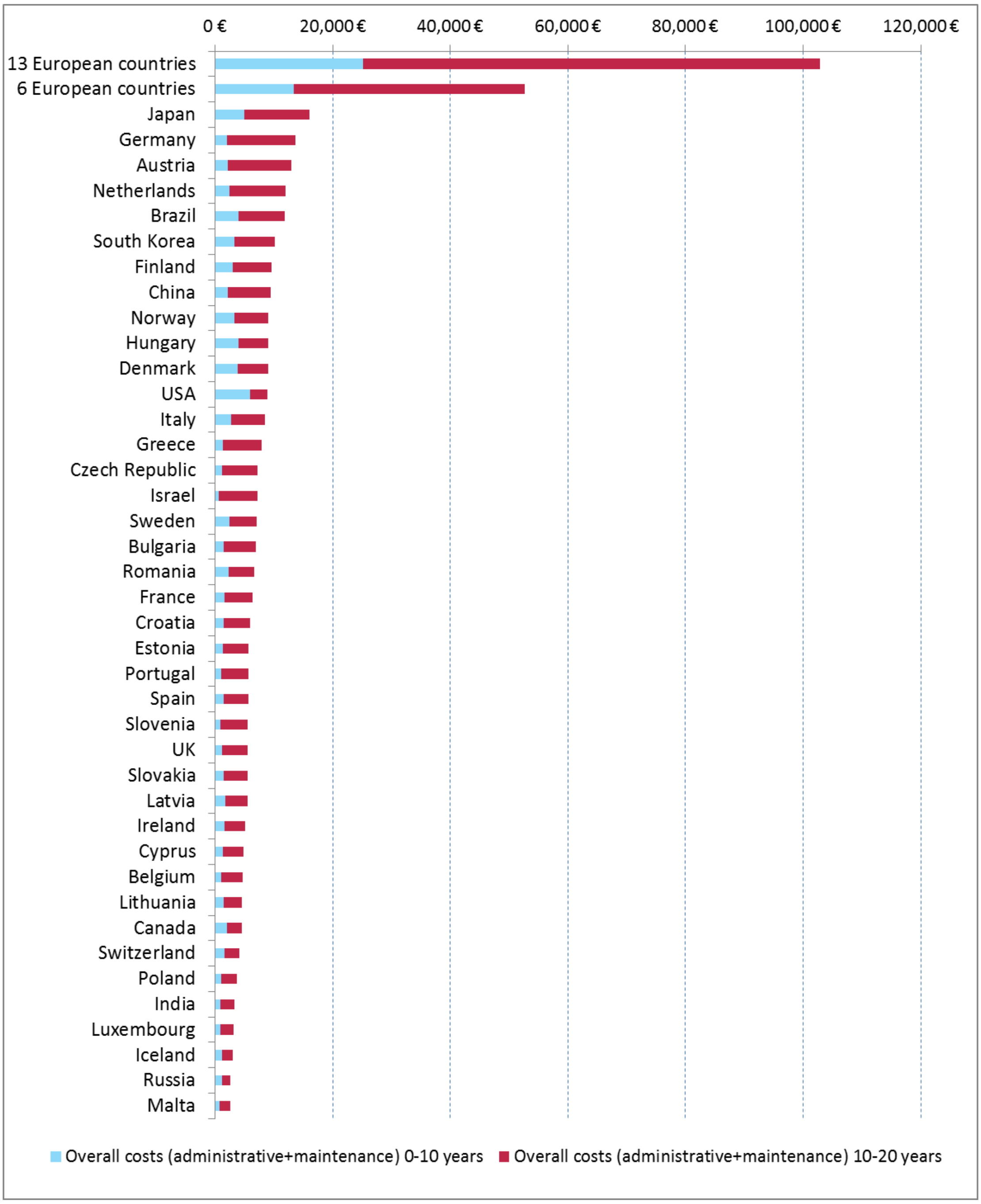
	Overall Patent Costs (administrative+ maintenance cost) 2011 EUR [9]		
Patent Office	Overall costs 10 years [1]	Overall costs 20 years[2]	Overall Cost 10 years/20 years [3]
Austria	2,160 €	12,960 €	17%
Belgium	1,125 €	4,690 €	24%
Bulgaria	1,434 €	6,958 €	21%
Croatia	1,496 €	6,019 €	25%
Cyprus	1,307 €	4,810 €	27%
Czech Republic	1,142 €	7,240 €	16%
Denmark	3,921 €	8,986 €	44%
Estonia	1,393 €	5,682 €	25%
Finland	2,955 €	9,655 €	31%
France	1,560 €	6,350 €	25%
Germany	1,970 €	13,720 €	14%
Greece	1,375 €	7,915 €	17%
Hungary	3,956 €	9,037 €	44%
Ireland	1,688 €	5,178 €	33%
Italy	2,805 €	8,555 €	33%
Latvia	1,799 €	5,534 €	33%
Lithuania	1,438 €	4,627 €	31%
Luxembourg	889 €	3,112 €	29%
Malta	801 €	2,596 €	31%
Netherlands	2,454 €	11,954 €	21%
Poland	1,015 €	3,734 €	27%
Portugal	1,025 €	5,675 €	18%
Romania	2,380 €	6,610 €	36%
Slovakia	1,412 €	5,558 €	25%
Slovenia	906 €	5,603 €	16%
Spain	1,497 €	5,640 €	27%
Sweden	2,409 €	7,118 €	34%
UK	1,153 €	5,567 €	21%
6 European countries [4]	**13,342 €**	**52,646 €**	**25%**
13 European countries [5]	**25,151 €**	**102,926 €**	**24%**
Iceland	1,160 €	3,049 €	38%
Norway	3,273 €	9,113 €	36%
Switzerland	1,677 €	4,188 €	40%
EFTA countries [6]	**2,037 €**	**5,450 €**	**37%**
Brazil	4,051 €	11,899 €	34%
Canada	2,036 €	4,580 €	44%
China	2,193 €	9,541 €	23%
India	900 €	3,366 €	27%
Israel	679 €	7,194 €	9%
Japan	4,918 €	16,095 €	31%
Russia	1,211 €	2,623 €	46%
South Korea	3,293 €	10,114 €	33%
USA	5,942 €	8,898 €	67%
Other countries [7]	**2,802 €**	**8,257 €**	**34%**
TOTAL [8]	**2,840 €**	**10,412 €**	**27%**

[1] Overall patent costs (administrative + maintenance 10 years) in Euros.
[2] Overall patent costs (administrative + maintenance 20 years) in Euros.
[3] Ratio Overall patent costs 10 years - Overall costs 20 years.
[4] Overall patent costs for a European patent validated in 6 countries (DE, FR, IT, NL, CH and UK).
[5] Overall patent costs for a European patent validated in 13 countries (DE, FR, IT, NL, CH and UK, AT, BE, DK, FI, IE, ES and SE).
[6] Arithmetic mean of the overall patent cost for EFTA countries.
[7] Arithmetic mean of the overall patent cost for other countries NPOs.
[8] Arithmetic mean of the overall patent cost for all NPOs.
[9] 2011 refers to the filing year

Note: administrative costs for 6 European countries and 13 European countries patents are pre-grant and designation fees charged by the EPO plus validation fees charged by NPOs. Maintenance fees are the sum of maintenance fees charged by each NPO.

Source: NPOs

Figure 2 - Overall patent costs EUR (2011)



The fees for filing and maintaining for 20 years a granted model European patent validated in 6 countries can be 3.3 times more expensive than a Japanese patent, and 5.9 times more than a patent granted by the USPTO. The main cause for the higher overall costs of European patents is the maintenance fees charged by the NPOs.

Overall costs for the 6 European countries patent are slightly higher than filing 6 national patents, however, when the reduction in translation costs due to the London Agreement and the more simple procedure are considered, the European patent becomes more competitive. Fees paid for the 13 European countries patent during 20 years of patent life are already lower than the sum of the fees charged if 13 national patents were filed. If translation costs are considered, the 13 European countries patent is even more competitive.

Individual countries such as Germany, Austria and The Netherlands exhibit significantly higher maintenance costs than others NPOs considered in the study, although their filing costs are very similar to the average cost of EU-28 countries. On the other hand, Japan exhibits the highest costs mainly due to the impact of per claim fees which are charged during the examination and in each annual payment for the renewal of the patent.

Despite its high overall patent costs, Germany is the leading European market in terms of patent filings. This may be explained by the importance in terms of market size and dynamism and the medium-high technology intensity of the companies that operate in the German market, which may force companies to prioritise protecting their inventions in Germany even though costs are higher. However, it cannot be ruled out the possibility that costs can become a barrier for small enterprises with low IP protection budgets. The case of Japan is somehow different with most of the filings coming from Japanese inventors; the high number of filings may be explained by the medium-high technology intensity of the companies and from incentives to patent inventions.

Another important element to be considered when comparing overall patent costs is how they progress over time. Annual payments for maintenance increase at the end of the patent lifespan; the ratio between accumulated cost for a 10 year patent lifespan and the accumulated overall cost for a 20 year patent is a good indicator of the progression over time of maintenance fees. Lower ratios indicate sharp increases at the end of patent life which can be considered an incentive to maintain only highly valuable patents (for the patent holder perspective) and, up to a certain point, a way to promote innovation by unlocking the use of IP that may not be valuable for the inventor but can be put in to use for a third party.

When considering only maintenance costs for 10 years, the country order changes considerably. Countries with highly progressive maintenance fees such as Germany, Austria or the Netherlands have no longer the highest costs. In this case, Finland, the USA, Japan, Brazil, Norway, Italy, Hungary or Denmark have the highest overall costs. Patent holders in these countries do not have such a high economic disincentive to drop less valuable patents.

The USPTO has a high ratio between 10 year and 20 year overall costs, however its cost structure for renewal fees is quite different. Maintenance costs are divided into 3 renewal payments at 3½, 7½ and 11½ years after the grant. Considering that on average time to grant is 33 months, this costs structure promotes that those patent holders who consider their IP valuable enough at the 14th year of the patent life will pay the renewal fee and lock it until the end of the patent life. Otherwise the patent will be dropped and the IP will be available for third party users, which is the effect that a highly progressive maintenance fee structure would have.

Average patent lives of European patents are studied in section 4.2. One of the key results is that patents live longer in larger economies as a consequence of the higher income potential of the patent which would compensate for the increasing maintenance fees at the end of the patent life. Interestingly, average patent life in Italy is nearly 16 years, which is longer than the following European country with the longest average patent life, Germany, where patents live just over 13 years. When renewal fees are considered, Italy has a low and flat renewal fee cost structure in which renewal fees increase only 22% from the 13th year to the 20th and remain flat from the 15th year. By contrasts, maintenance fees from the 13th year to the 20th in France, the UK and Germany increase 2.3, 2.4 and 2.55 times respectively. This fact is aligned with our previous assumptions regarding renewal fee progressiveness.

When considering costs in terms of PPP, countries from Eastern Europe such as Hungary or Bulgaria, Romania or the Czech Republic have overall costs which are not only above the average of the EU-28 area, but also among the 40 countries covered. Despite the high administrative costs, the number of filings has been very high in Hungary in the past, though the number of grants is quite low thus only administrative costs are partially incurred but no maintenance fees in most of the cases.

Other important countries in terms of economic size such as the USA, China or Japan have different cost structures. While in the USA, filing costs are higher than the average when expressed both in Euros and PPP, their maintenance costs are lower. Japan's patent costs are the highest when expressed in Euros but when considered in PPP their overall costs are lower than other Asian countries thus not constituting a barrier for patent protection for local inventors. China and South Korea have overall costs in absolute terms very similar to other large economies. However, in terms of PPP, overall costs are higher, especially their maintenance costs. This might become a barrier for protecting the inventions of smaller local entities.

Regarding other emerging economies, they display a diverse behaviour. While India has lower costs both in terms of filing and maintenance than the averages, Brazil has significantly higher costs not only when compared with other emerging economies but among the 40 countries analysed. In order to reduce the impact of high fees on SMEs, these countries have implemented costs reductions which are described in section 4.1.3.

However, patent costs measured in absolute terms do not explain the patenting behaviour of patentees. Since a patent grants an exclusive right to exploit an invention in a certain market, patent costs need to be measured in relative terms to the size of the market where the protection is sought. GDP has been chosen to measure the market attractiveness for patenting an invention and patent costs is expressed in relative terms to GDP as shown in Table 5.

Table 5 - Relative overall patent costs (2011)

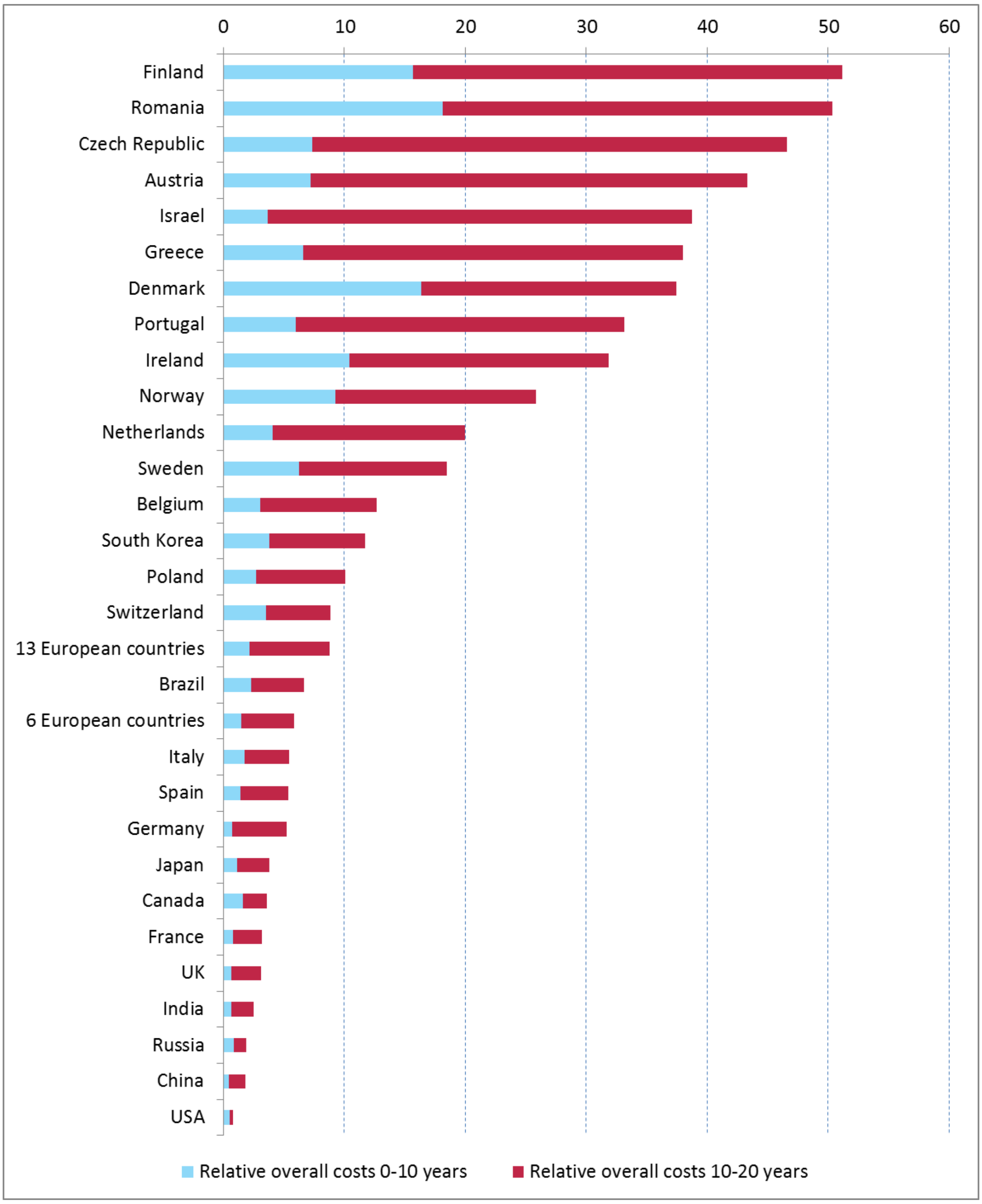
	Relative overall Patent Costs (administrative+maintenance costs) to GDP (billion €) 2011 [9]		
Patent Office	Overall costs 10 years [1]	Overall costs 20 years[2]	Overall Cost 10 years/20 years [3]
Austria	7.2	43.3	17%
Belgium	3.0	12.7	24%
Bulgaria	37.2	180.7	21%
Croatia	33.8	136.0	25%
Cyprus	73.1	269.1	27%
Czech Republic	7.3	46.6	16%
Denmark	16.3	37.4	44%
Estonia	85.9	350.4	25%
Finland	15.7	51.2	31%
France	0.8	3.2	25%
Germany	0.8	5.3	14%
Greece	6.6	38.0	17%
Hungary	40.0	91.4	44%
Ireland	10.4	31.8	33%
Italy	1.8	5.4	33%
Latvia	87.8	270.1	33%
Lithuania	46.6	150.0	31%
Luxembourg	21.3	74.6	29%
Malta	121.7	394.3	31%
Netherlands	4.1	20.0	21%
Poland	2.7	10.1	27%
Portugal	6.0	33.2	18%
Romania	18.1	50.3	36%
Slovakia	20.5	80.6	25%
Slovenia	25.1	155.0	16%
Spain	1.4	5.4	27%
Sweden	6.2	18.5	34%
UK	0.7	3.1	21%
6 European countries [4]	**1.5**	**5.8**	**25%**
13 European countries [5]	**2.1**	**8.8**	**24%**
Iceland	114.8	301.8	38%
Norway	9.3	25.8	36%
Switzerland	3.5	8.8	40%
EFTA countries [6]	**42.6**	**112.2**	**38%**
Brazil	2.3	6.7	34%
Canada	1.6	3.6	44%
China	0.4	1.8	23%
India	0.7	2.5	27%
Israel	3.7	38.7	9%
Japan	1.2	3.8	31%
Russia	0.9	1.9	46%
South Korea	3.8	11.7	33%
USA	0.5	0.8	67%
Other countries [7]	**1.7**	**7.9**	**21%**
TOTAL [8]	**20.2**	**71.2**	**28%**

[1] Relative overall patent costs (administrative + maintenance 10 years) to GDP (billion €) in 2011.
[2] Relative overall patent costs (administrative + maintenance 20 years) to GDP (billion €) in 2011.
[3] Ratio overall patent costs 10 years - Overall costs 20 years
[4] Relative overall patent costs for a European patent validated in 6 countries (DE, FR, IT, NL, CH and UK).
[5] Relative overall patent costs for a European patent validated in 13 countries (DE, FR, IT, NL, CH and UK, AT, BE, DK, FI, IE, ES and SE).
[6] Arithmetic mean of the relative overall patent cost for EFTA countries.
[7] Arithmetic mean of the relative overall patent cost for other countries.
[8] Arithmetic mean of the relative overall patent cost for all NPOs.
[9] 2011 refers to the filing year.

Note: administrative costs for 6 European countries and 13 European countries patents are pre-grant and designation fees charged by the EPO plus validation fees charged by NPOs. Maintenance fees are the sum of maintenance fees charged by each NPO. GDP value used to calculate relative costs for European 6 and 13 countries aggregates is the sum of the GDPs of the countries where the patent is validated.

Source: NPOs

Figure 3 - Relative overall patent costs (2011)



Note: in order to improve the clarity of the data presented, costs for Malta, Estonia, Iceland, Latvia, Cyprus, Bulgaria, Slovenia, Lithuania, Croatia, Hungary, Slovakia and Luxembourg have been removed from the previous chart. Data can still be consulted in Table 5.

Relative costs show a completely different perspective. For example, Malta (costs data are provided in Table 5 but are not shown in Figure 3 for clarity purposes) which was the country with the lowest absolute overall costs is now the country with the highest relative costs.

Relative overall costs for the model patent filed at the EPO and validated in 6 and 13 countries are now lower than most of the NPOs considered. 6 European countries and 13 European countries patents provide exclusive rights on countries that represent 67% and 87% of the economic output of the EU-28 and EFTA countries respectively. Despite this, relative overall costs for the 6 European countries patent is 7.3 times higher than the same patent filed at the USPTO and 1.5 times higher than in the JPO. Maintenance costs account for most of the difference in relative costs between the 6 European countries patent and the same patent filed at the USPTO and the JPO. Relative maintenance costs of the 6 European countries patent are 10.6 and 1.5 times higher than the costs in the USA and Japan respectively.

The 3C-index shows a new perspective by measuring the cost relative to two parameters:

- Market size of the country where the patent is filed. Bigger countries may be able to produce a higher number of endogenous patents while, at the same time, creating a relevant market opportunity capable of attracting foreign patent filings.
- Number of claims: Choosing the number of claims instead of patent count as a measure of technological capacity reduces the impact of patenting behaviours between markets.

It is calculated as the sum of administrative costs and translation costs for each NPO divided by the average number of claims and the population of the country expressed in million inhabitants.

Only a few of the NPOs included in the study have data on the average number of claims. The results for these NPOs where all data was available are the following:

Table 6 - 3C-index and cost per claim per trillion EUR (2011)

Patent Office	3C index 2011 [3]	Costs per claim per trillion € GDP 2011 [4]
6 European countries [1]	2.03	66.44
13 European countries [2]	3.47	114.11
Czech Republic	29.7	2007.5
Hungary	23.7	2388.3
Lithuania	127.5	12524.1
Malta	22.9	1449.6
Slovakia	65.0	4696.9
Spain	4.5	200.1
Norway	35.8	502.1
Japan	1.7	51.5
South Korea	1.7	65.2
USA	0.7	18.5

[1] European Patent validated in 6 countries (DE, FR, IT, NL, CH and UK)
[2] European Patent validated in 13 countries (DE, FR, IT, NL, CH, UK, AT, BE, DK, FI, IE, ES and SE)
[3] 3C-index - (Administrative + translation costs) in Euros. Population in million inhabitants
[4] Costs - (Administrative + translation costs) per claim per trillion € GDP

Note 1: administrative costs for 6 European countries and 13 European countries patents are pre-grant and designation fees charged by the EPO plus validation fees charged by NPOs. Translation costs are the sum of translation costs taking into account the London Agreement (when applicable)
Note 2: Data shown only for NPOs with available data

When compared in terms of the 3C-index, NPOs show wide differences between them. Bigger markets such as the USA, Japan and South Korea or the 6 European countries/13 European countries markets have low costs measured in terms of the 3C-index which is translated in terms of high number of patent filings. Malta also has a low 3C-index mainly because of the very low administrative and the lack of translation costs, however since it is such a small market it does not have the critical mass to attract patent filers.

Spain's 3C-index is also low because of its high population and moderate costs but the number of filings is comparative low compared not only with other large economies in the EU but also with less populated countries such as the Nordic countries (which also have higher costs). Several hypotheses may be raised, although the importance in the Spanish economy of low and medium-low technology intensive sectors such as the primary sector or the tourism sector may impact the number of filed patents.

Measuring market attractiveness in terms of GDP allows differentiating between countries with similar population but different levels of wealth. Using this approach implies several changes such as Japan and South Korea. Japan has lower relative costs than South Korea and also a higher number of patent applications. The same can be said for Norway which now has lower relative costs than Malta and a higher number of patent filings. The Czech Republic and Hungary also change their relative order although their relative costs and 3C-index are very similar.

Throughout this study, patent costs data for different years have been gathered allowing to compare them with the evolution of inflation. Table 7 shows the data available (most NPOs were not able to provide a complete set of data for all the years considered):

Table 7 - Evolution of absolute overall patent cost in EUR (1991, 1996, 2001, 2006, 2011)

	Overall Patent Costs in EUR [1]						Average inflation
National Patent Office	1991 [2]	1996 [3]	2001 [4]	2006 [5]	2011 [6]	Costs CAGR [7]	rates [8]
Austria					12,960 €		
Belgium					4,690 €		
Bulgaria					6,958 €		
Croatia		5,335 €	5,883 €	6,105 €	6,019 €	0.8%	4.1%
Cyprus			4,810 €	4,810 €	4,810 €	0.0%	2.8%
Czech Republic					7,240 €		
Denmark	6,301 €	7,351 €	7,848 €	7,835 €	8,986 €	1.8%	2.0%
Estonia					5,682 €		
Finland					9,655 €		
France					6,350 €		
Germany					13,720 €		
Greece		3,947 €	4,000 €	3,774 €	7,915 €	4.7%	3.3%
Hungary		9,333 €	7,223 €	9,568 €	9,037 €	-0.2%	7.1%
Ireland				5,178 €	5,178 €	0.0%	-1.2%
Italy					8,555 €		
Latvia					5,534 €		
Lithuania			4,459 €	4,623 €	4,627 €	0.4%	3.8%
Luxembourg	2,534 €	2,603 €	3,656 €	3,097 €	3,112 €	1.0%	3.1%
Malta				2,382 €	2,596 €	1.7%	3.2%
Netherlands					11,954 €		
Poland		1,901 €	2,951 €	3,645 €	3,734 €	4.6%	4.5%
Portugal	725 €	2,266 €		4,906 €	5,675 €	10.8%	3.5%
Romania			16,172 €	6,610 €	6,610 €	-8.6%	12.5%
Slovakia				3,710 €	5,558 €	8.4%	1.0%
Slovenia					5,603 €		
Spain	4,578 €	3,716 €	4,697 €	5,192 €	5,640 €	1.0%	3.3%
Sweden					7,118 €		
UK	5,217 €	4,987 €	5,647 €	5,148 €	5,567 €	0.3%	2.3%
Iceland					3,049 €		
Norway	7,526 €	8,434 €	7,581 €	8,266 €	9,113 €	1.0%	4.0%
Switzerland		6,138 €	5,291 €	3,891 €	4,188 €	-2.5%	0.9%
Brazil					11,899 €		
Canada				4,427 €	4,580 €	0.7%	2.3%
China					9,541 €		
India			1,914 €	3,843 €	3,366 €	5.8%	6.2%
Israel		8,936 €	7,576 €	5,593 €	7,194 €	-1.4%	3.0%
Japan	34,635 €	54,512 €	21,991 €	15,458 €	16,095 €	-3.8%	-0.8%
Russia					2,623 €		
South Korea				4,001 €	10,114 €	20.4%	2.7%
USA	5,753 €	7,309 €	10,415 €	9,087 €	8,898 €	2.2%	2.0%

[1] Overall patent costs (administrative + maintenance) in Euros;
[2] 1991 refers to the filing year;
[3] 1996 refers to the filing year
[4] 2001 refers to the filing year;
[5] 2006 refers to the filing year;
[6] 2011 refers to the filing year.
[7] Cost increase from the first year with available data to 2011;
[8] Accumulated inflation from the first year with available data to 2011.

Note: Data shown only for NPOs with available data

Based on the data provided by the NPOs, Table 7 shows the evolution of patent costs over time. The Compound Annual Growth Rate (CAGR) of overall patent cost from 2011 to the first year where data was available has been calculated and it is compared with the average inflation rate between these years. Despite the fact that the set of data is not complete for most of the countries, in general terms it can be concluded that patent costs have increased below the inflation rate in most of the countries analysed. South Korea is the most notable exception because of the introduction in 2009 of additional fees per claim. The increase of costs for Portugal is due to the low costs it had in 1991. However if we consider their data from 2001 onwards, patent costs have grown below inflation. The other two exceptions are Japan and Greece. Japan has suffered a prolonged deflationary period with negative inflation rates whereas its fees have been adjusted. This is particularly important in the case of per claim fees which were applied both in the pre-grant stage (examination and granting) and during the 20 years maintenance period. In years covered in the research, per claim fees suffered a steep increase in 1996 but reduced gradually the following years. It must be noted that the average number of claims of patents filed at the JPO increased from 7.2 in 2000[12] to 9.7 in 2011[13]. In the case of Greece, patent costs have suffered a huge price increase in 2011, probably caused by the need to increase the NPO income in a scenario of severe economic downturn.

Litigation costs are not always considered as an integral part of the IP policy. The aim of this part of the report is to review some of the existing literature in order to provide some detail on this topic, especially in Europe where, unlike in the USA, little information is available.

Patent protection at a reasonable cost is an essential part of an IP system in order to promote innovation, but affordable IP rights enforcement can be just as important. Not being able to pursue the rights that a patent provides to its owner or licensee makes it nearly useless and litigation costs can be a barrier especially for SMEs and individuals.

One of the main changes in the European patent system is the creation of the unitary patent which has a unitary effect in all jurisdictions that have acceded to the measure without having to validate it in each NPO and paying the corresponding validation and maintenance fees. Along with the unitary patent, the Unified Patent Court (UPC) will have exclusive jurisdiction with respect to unitary patents and European patents granted by the EPO which have designated one or more Member States.

The creation of the UPC has brought up the interest in the topic of litigation costs in Europe. In the current situation, both national patents and European patents validated in a Member State of the EPC are subject to national laws which lead to a fragmented system. This implies that enforcing a European in different Member States will require initiating legal actions in each state that, in some cases may lead to contradictory decisions. In order to better measure the impact in terms of costs on the patentee or the licensee of a patent, a review of litigation costs across Europe has been carried out.

As previously mentioned, research on litigation in Europe had been limited until recently. Recent research on the topic includes Cremers et al[14] or Graham et al[15]. These research studies focus on the differences in procedures, litigation cases outcomes, cross-border litigation and technology implications in litigation cases for the most important jurisdictions in Europe. Though costs are commented in these papers, they are not the central part of them. In this regard, a recent report issued by law firm CMS[16] offers a broad set of data provided by practitioners about costs and other practical topics related to litigation in 19 states. Data about time to first hearing, patent litigation costs for a first instance decision, costs for patent litigation proceedings for an appeal and the availability of cross-border injunctions:

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[12] http://www.trilateral.net/statistics/tsr/2001/TSR.pdf
[13] http://www.fiveipoffices.org/statistics/statisticsreports/statisticsreport2011edition/Patentactivity.pdf
[14] Patent Litigation in Europe. Katrin Cremers, Max Ernicke, Fabian Gaessler, Dietmar Harhoff, Christian Helmers, Luke McDonagh, Paula Schliessler, and Nicolas van Zeebroeck. ZEW research 2013
[15] Comparing Patent Litigation Across Europe: A First Look. Stuart J.H. Graham, Nicolas Van Zeebroeck. Stanford Technology Law Review. (2014)
[16] International Patent Litigation. CMS (2013).

Table 8 – Litigation timing and costs (EUR)

Patent Office	Time for first hearing (months)	Time until decission (months)	Litigation costs in EUR	Appeal costs in EUR	International injunction available
Austria	3	N/A	70,000-80,000 infringement, 10,000-20,000 invalidity	20,000-30,000 infringement 5,000-10,000 invalidity	Yes
Belgium	8-12	9-15	30,000	30,000	No specific position
Bulgaria	2-6	N/A	N/A	N/A	No
Croatia	3-6	12-36	5,000-150,000	1,000-150,000	No
Czech Republic	3-12	24	5,000-10,000	4,000-6,000	Yes (rarely)
France	N/A	18-22	4,0000-150,000	30,000-150,000	No
Germany	8-12	N/A	40,000-100,000	40,000-100,000	Yes (under rules of the competent Jurisdiction)
Hungary	4-6	N/A	35,000-50,000	17,500-25,000	Yes (rare)
Italy	3-5	24-48	25,000-35,000	30,000-35,000	No
Netherlands	9-12 normal porceedings, 6-8 accelerated	N/A	50,000-250,000 normal proceedings, 40,000-150,000 accelerated proceedings, 25,000-100,000 preliminary injuction	40,000-250,000	Yes. Limited to defendants based in NL and when patent validity is in dispute
Poland	3-6 for infringement, 6 or more for validity	24-36	40,000-100,000	20,000-50,000	No
Portugal	12-36	N/A	10,000	5,000	No
Romania	3-5	N/A	N/A	N/A	No
Spain	2-3	N/A	35,000-50,000	17,500-25,000	No
UK	12-18 (Patent court) 9-15 (PCC)	N/A	50,000-500,000	100,000-200,000	Yes (rare)
Switzerland	12-18	N/A	125,000-250,000	8,000-17,000	Yes (mainly for Swiss residents)
China	2-4	N/A	12,500-25,000, 40,000-150,000 for complex cases	20,000-40,000	No
Russia	N/A	6-8	20,000-40,000	10,000-20,000	No

Source: CMS 2013

All data gathered must be taken as a reference for standard cases. All practitioners contributing to the report indicate that for highly complex cases timing until first action and time to decision can be substantially longer and costs may increase significantly.

Although patent courts have jurisdiction on national patents and European patents validated in their territory, international injunctions are available in some states as indicated in Table 9. This was the case in The Netherlands where cross- border injunction was available to prevent infringing activities. However the availability of cross-border injunctions has been limited since 2007 (as decided by the European court of justice). Cross-border actions are limited and rare in every jurisdiction.

Mejer and Van Pottelsberghe[17] also provide litigation costs estimations for patents with an amount in dispute equivalent to about 1 million €. These costs are shown below.

Table 9 – Litigation timing and costs and litigation activity in four EPC contracting stated and USA (in €1000)

	Germany	France	The Netherlands	United Kingdom	Cumulative 4 EPC	United States
Litigation cost[1]						
1st Instance	50 to 250	50 to 200	60 to 200	150 to 1,500	310 to 2,150	n.a.
2nd Instance	90 to 190	40 to 150	40 to 150	150 to 1,000	320 to 1,490	n.a.
Total	140 to 440	90 to 350	100 to 350	300 to 2,500	630 to 3,640	420
Litigation activity[2]						
# of patents in force	412,000	389,000	141,000	319,000	-	1,650,000
# of patents litigated	200 (nullity) 500 (infringement)	300	70	85	-	3,075

Source: Economic Incongruities in the European Patent System. Malwina Mejer and Bruno van Pottelsberghe de la Potterie. (2009)

17 Economic Incongruities in the European Patent System. Malwina Mejer and Bruno van Pottelsberghe de la Potterie. (2009)

Both sources provide similar results with the UK being the most expensive jurisdiction. Patentees or licensees must initiate separate proceedings in each jurisdiction where infringement occurs or invalidity is claimed. Cumulated costs for multiple litigations can be very high, especially for SMEs and individuals which may consider patent enforcement unaffordable.

Patent litigation is not common however as can be seen in Table 9. Litigation activity ranges between 1.7 per 1,000 patents in force in Germany, 0.77 per 1,000 patents in France, 0.5 per 1,000 patents in The Netherlands or 0.26 per 1,000 in the UK. This ratio for the USA is 1.86 patents litigated per 1,000 patents in force. Graham and Zeebroeck[18] calculated the number of decisions in each country and year relative to the number of patents of the same average age in the same country. Results range from 34.7 litigations per 1,000 granted patents in Belgium to 2.1 in the UK (this ratio for the USA is 25, 7.7 for Germany, 23.2 for France and 28.7 for The Netherlands).

Cremers et al[19] investigated parallel cases of cross border litigation. They identified matched patent families across jurisdictions and differentiated two cases: (1) The same patent with either same claimant or defendant (less restrictive case) and (2) The same patent with the same claimant and defendant (more restrictive case). The results are shown below:

Table 10 – Parallel cases in different jurisdictions

	DE	FR	NL	UK‡	cases with parallel case**	total cases**	share
Parallel cases (same patent, either same claimant or defendant)							
DE		102	71	61	1,009	6,427	16%
FR	816		33	27	113	840	13%
NL	517	31		38	92	302	30%
UK‡	505	24	41		84	165	51%
*Parallel cases (same patent & **same** claimant and defendant)*							
DE		34	24	21	127	5,121	2%
FR	68		16	13	51	840	6%
NL	46	16		18	44	302	15%
UK‡	35	14	19		43	166♣	26%

* Based on patent numbers

** For which patent numbers available

‡ England and Wales

§ Exceeds number of cases where patents are available because 1 cases was retrieved from references in UK court records to parallel cases in other jurisdictions.

Source: Patent Litigation in Europe. Cremers et al. 2013.

The share of patents duplicated in Germany is low in relative terms compared with The Netherlands and the UK, but in absolute terms the number of cases in The Netherlands and the UK is still lower. The authors explain the bigger share in the UK and The Netherlands by the larger share of EPO patents among litigated patents that have entered into force in the other jurisdictions.

The authors also analyse the value of ligated patents taking in considerations characteristics which are commonly interpreted as proxies for the value of patents (backward citations, forward citations, non-patent citations, number of inventors and number Of IPC classes). The results suggest that litigated patents in the UK are the most valuable. This may reflect the large share of pharmaceutical patents litigated in the UK.

One phenomenon that has drawn the attention of innovative industries is the non-practicing entities or patent trolls which have, so far, operated mainly in the USA. Harhoff[20] describes a non-practising entity (or patent troll) as "a company that acquires patents of failed companies or independent innovators and uses these to threaten suit against infringing companies without

[18] Comparing Patent Litigation Across Europe: A First Look. Stuart J.H. Graham, Nicolas Van Zeebroeck. Stanford Technology Law Review. (2014)

[19] Patent Litigation in Europe. Katrin Cremers, Max Ernicke, Fabian Gaessler, Dietmar Harhoff, Christian Helmers, Luke McDonagh, Paula Schliessler, and Nicolas van Zeebroeck. ZEW research 2013

[20] The strategic use of patents and its implications for enterprise and competition policies. Dietmar Harhoff (2007)

having the intention of using the patent they assert". Patent trolls may take advantage of dubious quality patents which are usually very broad and cover extremely lucrative processes. The author identifies low quality examination processes that lead to weak patents as a cause of the proliferation of patent trolls. Since patent trolls' victims are those who are not willing or able to fight a patent infringement case through an invalidity trial (normally SMEs or individuals), a fast, low cost patent litigation system with a broad geographical coverage and with cost recovery mechanisms may deter trolls from acting.

4.1.2 Country clustering

The goal of this clustering is to identify groups of countries with similar patent costs structures and/or levels. A Ward hierarchical clustering[21] method with Euclidean distance in the R programming language and software environment[22] for statistical computing and graphics to identify groups of countries with similar administrative, maintenance costs for the first 10 years and maintenance costs from the 10th to the 20th year (in Euros) were used. After running several iterations of the algorithm, 5 clusters were chosen:

Table 11 - Groups of countries with similar patent costs structures (2011)

Cluster	Patent Office	Relative administrative costs to GDP (billion €) [1]	Relative maintenance costs years 0-10 to GDP (billion €) [2]	Relative maintenance costs years 10-20 to GDP (billion €) [3]
A	Belgium	0.9	2.1	9.7
A	France	0.4	0.4	2.4
A	Germany	0.2	0.5	4.5
A	Italy	1.2	0.6	3.6
A	Poland	0.5	2.2	7.3
A	Spain	0.7	0.7	4.0
A	UK	0.2	0.5	2.5
A	6 European countries [4]	0.7	0.8	4.3
A	13 European countries [5]	0.8	1.3	6.6
A	Switzerland	1.5	2.1	5.3
A	Brazil	0.3	1.9	4.4
A	Canada	0.9	0.7	2.0
A	China	0.1	0.3	1.4
A	India	0.3	0.4	1.8
A	Japan	0.5	0.7	2.6
A	Russia	0.7	0.2	1.0
A	South Korea	1.0	2.8	7.9
A	USA	0.3	0.2	0.3
B	Austria	2.2	5.0	36.1
B	Czech Republic	2.4	5.0	39.2
B	Denmark	9.1	7.3	21.1
B	Finland	5.4	10.3	35.5
B	Greece	2.8	3.8	31.4
B	Hungary	7.3	32.7	51.4
B	Ireland	3.4	7.0	21.5
B	Luxembourg	6.5	14.8	53.3
B	Netherlands	1.5	2.6	15.9
B	Portugal	1.2	4.8	27.2
B	Romania	5.3	12.9	32.2
B	Slovakia	5.8	14.6	60.1
B	Sweden	2.4	3.8	12.2
B	Norway	3.4	5.9	16.5
B	Israel	1.3	2.3	35.1
C	Bulgaria	10.7	26.6	143.4
C	Croatia	18.3	15.5	102.2
C	Lithuania	7.1	39.5	103.4
C	Slovenia	12.7	12.3	129.9
D	Cyprus	30.6	42.5	195.9
D	Latvia	16.3	71.5	182.3
D	Iceland	46.7	68.2	187.0
E	Estonia	19.7	66.2	264.4
E	Malta	29.7	92.0	272.6

[1] Relative administrative costs to GDP (billion €).
[2] Relative maintenance costs for years 0 to 10 to GDP (billion €).
[3] Relative maintenance costs for years 10 to 20 to GDP (billion €) in 2011.
[4] Relative overall patent costs for a European patent validated in 6 countries (DE, FR, IT, NL, CH and UK).
[5] Relative overall patent costs for a European patent validated in 13 countries (DE, FR, IT, NL, CH and UK, AT, BE, DK, FI, IE, ES and SE)

Note: administrative costs for 6 European countries and 13 European countries patents are pre-grant and designation fees charged by the EPO plus validation fees charged by NPOs. Maintenance fees are the sum of maintenance fees charged by each NPO. GDP value used to calculate relative costs for European 6 and 13 countries aggregates is the sum of the GDPs of the countries where the patent is validated

[21] http://www.stat.cmu.edu/~cshalizi/350/lectures/08/lecture-08.pdf

[22] http://stat.ethz.ch/R-manual/R-patched/library/stats/html/hclust.html

- **Cluster A**: cluster A is comprised of the low relative overall costs countries. Countries in cluster A range from big economies (in terms of population, GDP per capita or both) such as Japan, the USA, China or India to medium sized economies like Switzerland and Poland, which have lower absolute patent costs. Despite having the highest absolute overall costs, both 6 European countries and 13 European countries aggregates are part of cluster A thanks to the importance of the market opportunity they provide. 6 European countries aggregate provides patent protection in a market twice as big as the Japanese market while in the case of 13 European countries aggregate, the market potential is slightly bigger than the USA.
- **Cluster B**: this cluster is composed of medium/small economies with medium/high overall costs. On the one hand, medium sized economies with high absolute costs like the Netherlands or Sweden cannot reach cluster A. On the other hand, smaller economies from Eastern Europe with moderate absolute overall costs which have high relative costs.
- **Cluster C:** cluster C is comprised only of four small economies from Eastern Europe and the Baltic countries. Their absolute costs are similar to the average of the EU countries but the small size of their economies leads to high relative costs.
- **Clusters D and E**: all the countries in these clusters correspond to very small countries, with the biggest of them in terms of population (Latvia) having just 2 million inhabitants. These low populated have small economies measured in terms of GDP and as a consequence their relative costs are very high.

4.1.3 Patent costs: policies to promote innovation for SMEs

Several NPOs offer discounts on administrative and/or maintenance costs of patents for SMEs, in order to increase their competitiveness by boosting innovation and provide opportunities to thrive and grow. The objective of this analysis is to identify those countries where discounts are applied as of 2011 and the importance of these discounts on the overall cost of the patenting process. Eligibility criteria change between countries and in some cases they are very restrictive with the types of SMEs that can benefit from cost reductions. In most cases, the criterion of what is considered an SME differs from the one set by the EC[23]. The specific requirements are specified in each case.

Some NPOs offer fee reductions for natural persons, universities and non-for profit organisations but only those directed specifically to SMEs have been selected.

According to the information gathered, the NPOs shown in the following table have been identified to offer price reductions.

[23] For the EC an SME is defined as an enterprise having less than 250 persons employed and less than EUR 50 million turnover or a balance sheet of no more than EUR 43 million. SMEs can be divided into several classes: micro enterprises with less than 10 persons employed, small enterprises with 10-49 persons employed and medium-sized enterprises with 50-249 persons employed

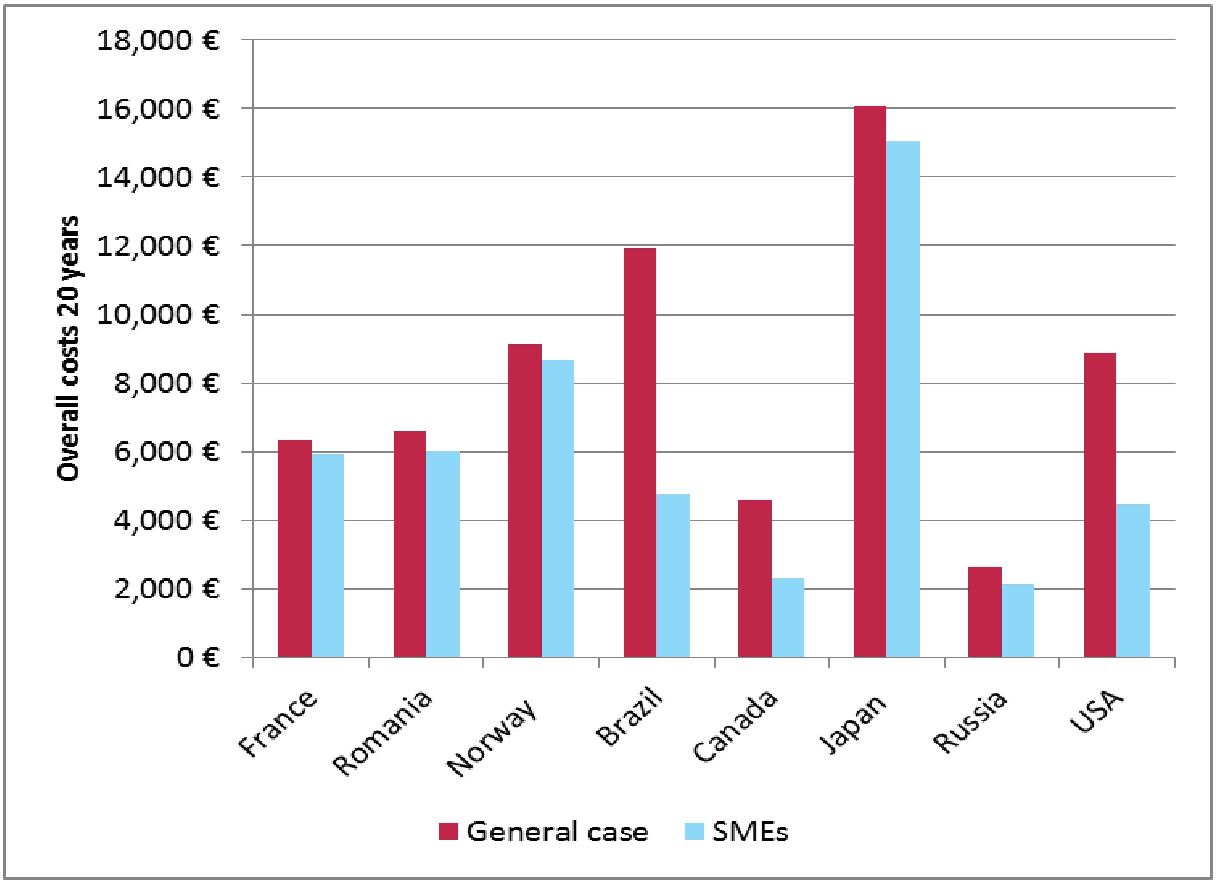
Table 12 - Overall patent cost in EUR for SMEs (2011)

	Overall Patent Costs EUR 2011 [6]								
	General case				SMEs				Cost reduction (%) [5]
Patent Office	Administrative Costs [1]	Maintenance Costs 20 years [2]	Overall Costs (administrative + maintenance costs) [3]	Relative overall patent costs to GDP (billion €) [4]	Administrative Costs [1]	Maintenance Costs 20 years [2]	Overall Costs (administrative + maintenance costs) [3]	Relative overall patent costs to GDP (billion €) [4]	
France	742 €	5,608 €	6,350 €	3.2	371 €	5,569 €	5,940 €	3.0	6%
Romania	690 €	5,920 €	6,610 €	50.3	345 €	5,675 €	6,020 €	45.8	9%
Norway	1,206 €	7,906 €	9,113 €	25.8	770 €	7,906 €	8,677 €	24.6	5%
Brazil	611 €	11,288 €	11,899 €	6.7	245 €	4,515 €	4,760 €	2.7	60%
Canada	1,090 €	3,489 €	4,580 €	3.6	545.22 €	1,744.72 €	2,290 €	1.8	50%
Japan	2,124 €	13,971 €	16,095 €	3.8	1,129 €	13,905 €	15,034 €	3.5	7%
Russia	907 €	1,716 €	2,623 €	1.9	454 €	1,680 €	2,134 €	1.6	19%
USA	3,453 €	5,446 €	8,898 €	0.8	1,726 €	2,723 €	4,449 €	0.4	50%

[1] Administrative costs in Euros
[2] Maintenance cost for 20 years in Euros
[3] Overall patent costs (administrative + maintenance cost 20 years) in Euros
[4] Relative overall cost (administrative + maintenance cost 20 years) to GDP (billion €) in 2011
[5] Overall cost reduction for SME compared with the general case (%)
[6] 2011 refers to the filing year

Note: Data shown only for NPOs with available data

Figure 4 - Cost reductions in overall patent costs for SMEs in EUR (2011)



When analysing fee reductions for SMEs it must be noted that each NPO sets different eligibility criteria which must be stated in order to make accurate comparisons:

- **France:** fee reductions are applicable to SMEs with less than 1,000 employees and with no more than 25% of its shares owned by a company with more than 1,000 employees. Costs reductions are limited to a 50% cost of the pre-grant fees, a 50% reduction of the renewal fees from the 2nd to the 5th year and a 25% reduction of the renewal fees for the 6th and 7th year.
- **Norway:** fee reductions in Table 12 are only available for SMEs with no more than 20 full-time equivalent employees. Fee reductions are limited to the filing fees.
- **Romania:** Romanian legal framework does not require a certain number of employees to obtain fee reductions. Instead, costs reductions are depended on the turnover of the company. Companies with a turnover of less than 2 million Euros (as shown in Table 12 will pay only 50% of the pre-grant fees and the maintenance fees for the first 5 years. In case that the company has a turnover of less than 1 million, pre-grant fees and maintenance fees payable are only 20% of those in the general case.

- **Brazil:** fee reductions comprise all pre-grant and maintenance fees in Brazil (-60%). Reductions are applicable to SMEs with a turnover of less than R $3,600,000.
- **Canada:** fee reductions comprise all pre-grant and maintenance fees (-50%). Companies with less than 50 employees which are not controlled by other companies with more than 50 employees may apply for fee reductions.
- **Japan:** Japan provides a 50% examination fee reduction for SMEs that lack funding as well as for SMEs dedicated to R&D (at least 3% of their budget). SMEs that lack funding may benefit from a 50% maintenance fees reduction for the first three years or a three year grace period. SMEs dedicated to R&D have a three year 50% reduction of annual fees.
- **Russia:** the Russian Patent Office (Rospatent) offers a 50% fee reduction for pre-grant fees (filing, examination and grant) as well as 50% reduction of the maintenance fees from the 3rd to the 5th year.
- **USA:** SMEs (companies with less than 500 employees which have not assigned, granted, conveyed a license to an entity, person or non-profit organisation which does not fulfil the SMEs requirements) will only pay 50% of the pre-grant fees and maintenance fees to the USPTO.

On average, price reductions of the overall costs are significant for the USA, Brazil and Canada where costs reductions are available for both in pre-grant (administrative costs) and for every annuity of the maintenance fees. The rest of the NPOs offer reductions that only affect pre-grant fees and, in some cases, the first years of the renewal fees. However, this may still be an incentive for SMEs that will reduce the upfront cost of patenting. Maintenance costs may not be fully incurred if the economic value of the patent does not compensate for them. This is reasonable for SMEs where patenting for defensive purposes is not common and the real value of a patent cannot be determined accurately at the time of the application.

Other support schemes for SMEs in force from 2012 (therefore not included in Table 12) and covering national and/or international applications are the following:

- The USPTO offers from 2012 (thus not included in Table 12) a 75% reduction of the fees for micro entities (company with less than 500 employees, which has not been named inventor in more than 4 patents applications for which the national fee was not paid, had gross income that does not exceed 3 times the median household income and has not assigned, granted, conveyed a license to an entity which does not fulfil the aforementioned requisites).
- China: the SIPO office does not offer fee reductions but supports legal entities with financial difficulties regardless their nationality. These entities may request, prior justification of their situation, deferred payment of 70% of the application fee, the examination fee and the maintenance fees for first 3 years from granting the patent of national patents and PCT national phase entries. Entities repay the full amount when the invention has created income.
- Israel: Israel’s patent office established in 2012 (thus not included in Table 12) reduced filing fees (40%) for companies with a turnover of less than ILS 10 million.
- Spain: The Spanish patent office subsidises 90% of the fees and translation costs of Spanish SMEs patenting abroad.
- India: India offers reduced fees for small entities engaged in the manufacture of production goods or in the rendering of services where the investment in machinery or equipment does not exceed the limits specified for a medium enterprise.

4.1.4 Workload in NPOs: cross-country comparison

The goal of this section is to identify different indicators that allow the comparison of POs in terms of workload and provide some reasons for the observed data. All data regarding patent offices was gathered contacting NPOs and the EPO. The total number of patents filed and granted at each NPO and the EPO was extracted from PATSTAT.

The processing time shows the duration of the different processes in the patent procedure and its timing (which also determines the timing of the fees paid). The processes taken into account in the analysis are:

- **First action pending time:** Time between filing and the first action undertaken by the patent office. This parameter is particularly significant because it shows the PO's backlog.
- **Searching time:** Time between filing and completing the searching process.
- **Examination time:** Time between filing and the issuing of the results of the examination.
- **Pending time:** Time between granted, lapsed or denied and filing date.

Other relevant processes related to patents are:

- **Trial time:** Time taken for the patent trials to resolve at the national courts.
- **Opposition time:** Time for the resolution of an opposition (when there is a resolution regarding a patent, appeals can be launched; not to be confused with trials).

Table 13 - Average processing time (2011)

	Average processing time 2011 (months) [1]					
Patent Office	First Action Pending	Searching	Examination	Pending	Trial	Opposition
EPO	7.7	7.7	36.7	44.0		20.4
Austria	8.4			23.8		
Belgium				18.0		
Bulgaria				54.0		
Cyprus		9.0				
Czech Republic		61.1		81.1		57.1
Estonia	4.2					9.0
France				32.5		
Germany				27.0		
Greece		12.0				
Hungary				34.5		
Latvia				18.0		
Lithuania				18.0		
Luxembourg		6.0		18.0		
Malta				18.0		
Poland		18.0		71.1		
Portugal			3.5	24.0		
Romania				55.2		
Slovakia				0.0		
Spain		21.0		30.6		
UK		4.0	39.0			
Norway	22.1					17.5
Canada	18.0					
China	11.4			22.9		
Israel				34.0		
Japan	25.9			34.0		
Russia			10.4			
South Korea	16.8			22.8	9.5	
USA	28.0			33.7		

[1] 2011 refers to the average processing time in months for patents processed during 2011

Note1: Data shown only for patent offices with available data
Note 2: All processing times start from the date of filing

Table 14 - Workload in the patent offices (2001)

Patent Office	Examiners [1]	Average Claims [2]	Filings [3]	Filings per examiner [4]	Filed claims per examiner [5]	Grants [6]	Grant rate [7]	Grants per examiner [8]	Granted claims per examiner [9]
EPO	2,917	12	113,006	39	452	56,831	50%	19	228
Austria	108		1,090	10		1,012	93%	9	
Belgium	0		539						
Bulgaria	37		455	12		442	97%	12	
Croatia	13		709	55		277	39%	21	
Cyprus	0		40						
Czech Republic		18	3,849			1,236	32%		
France	80		13,149	164		10,811	82%	135	
Germany	532		102,068	192		16,761	16%	32	
Greece	7		323	46		241	75%	34	
Hungary	73	11	4,171	57	629	582	14%	8	88
Ireland	4		449	112					
Lithuania	4	10	92	23	221	85	92%	21	204
Malta	0	18							
Poland	58		5,957	103		2,719	46%	47	
Portugal	9		130	14		66	51%	7	
Slovakia	31	17	1,783	58	978	615	34%	20	337
Spain	160		1,980	12		1,925	97%	12	
UK	158		17,987	114		8,103	45%	51	
EU-28 Total [10]	1,274		154,771			44,876	29%		
EU-28 Average [11]				69	609			29	210
Norway	71		5,721	81		2,229	39%	31	
Canada	150		39,876	266		16,060	40%	107	
Israel	26		6,310	243					
Japan	1,096	8	358,801	327	2,488	117,008	33%	107	811
South Korea	371	7	74,536	201	1,366	14,344	19%	39	263
USA	3,061	17	239,310	78	1,305	192,603	80%	63	1,050
Non european Total [12]	4,704		718,833			340,015	47%	72	
Non european Average [13]				223	1,720			63	708

[1] Number of patent examiners in each patent office
[2] Average number of claims for patents processed
[3] Number of distinct patents filed in the patent office
[4] (Filings / Examiners) for countries with available data on both items
[5] ((Filings * Average Claims) / Examiners) for countries with available data on all 3 items
[6] Number of distinct patents granted in the patent office
[7] Number of grants / number of filings
[8] (Grants / Examiners) for countries with available data on both items
[9] (Grants * Average Claims / Examiners) for countries with available data on all 3 items
[10] Sum for the EU-28 patent offices as of 2014
[11] Arithmetic mean for the EU-28 patent offices as of 2014
[12] Sum for non-EU-28 patent offices
[13] Arithmetic mean for non-EU-28 patent offices

Note 1: Data shown only for patent offices with available data
Note 2: Belgium and Cyprus do not have patent examiners since the examination is carried out by the EPO. Malta does not have examiners since it does not carry out examination of patents
Note 3: 2001 has been chosen as the reference year since filing data for 2006 and 2011 was not complete. For further details see 'Methodology overview and sources of information'.

Sources: [1, 2] NPOs; [3] PATSTAT 10-2012, Dataset Alpha; [6] PATSTAT 10-2012, Dataset Beta

Despite the limitations in terms of gathering a complete set of data for every country (especially for trials and oppositions), certain conclusions can be drawn. On average, countries outside Europe have a much higher workload in terms of filings per examiner. This also means a long first action pending time (e.g. 25.9 months for Japan or 16.8 months for South Korea). However, once the process begins, the time until grant (estimated from the pending time) can be considered short (8.1 months for Japan or 8 months for South Korea) thus these NPOs can be considered very efficient. Across Europe, the French and German patent offices have the highest workloads measured in terms of filings per examiner, while Spain or Austria have much lower ratios.

However some considerations have to be made on the previous analysis:

- Analysing the workload as the number of claims per examiner shows smaller differences between NPOs. The average number of claims for the JPO and KPO are lower (9.8 and 9.7 respectively) than for most European NPOs, the EPO and the USPTO.
- The JPO outsources the searching and documentation process to an Industrial Property Coordination Centre which eases the workload for the examiners. The KIPO also outsources part of the prior art searching. Outsourcing these tasks reduces the examination pendency.
- The stricter the granting process, the lower the grant rate. A measure of how thorough the granting is can be looked at in terms of the granted claims per examiner. In general terms, European NPOs have lower granted claims per examiner ratios which could suggest that the comprehensiveness and, as a consequence, the time required for the examination process is higher than in other NPOs. Though a more severe process can slow the granting process and add some process costs (therefore deterring patentees from filing more patents), it is also important since it can reduce litigation procedures in the long term that can have an even bigger impact on the operations of an entity.
- Table 10 shows that the USPTO has a very high number of claims per examiner, only comparable to those from the KIPO and JPO despite the fact that part of their searching and documentation is outsourced. This fact combined with the high rate of grants and the comparatively low pendency time, may induce to think a less rigorous examination process is carried out. This fact has been highlighted in the literature van Pottelsberghe de la Potterie and François[24] and van Pottelsberghe de la Potterie and Mejer[25]. In this last paper the authors sum up the main reasons for backlogs at the USPTO which are 1) The greater scope of patentable subject matters at the USPTO which increase the number of patent applications, 2) The relative novelty of inventions approach of the USPTO which allows filing applications after the dissemination of the patentable matter, 3) The reduced transparency during prior art identification, 4) The delays caused by the amendment of claims provided by the continuation procedure and 5) The high turnover of USPTO examiners (33%) which leads to that the examiners have, on average 3 years of experience in processing patent applications.

Based on the previous comments, it is not straightforward to make an accurate comparison on the workloads for the different NPOs. Granting time (although dependant on the differences between patent office procedures) is probably the best indicator to measure the combination of workload and operational efficiency. Long granting periods do have an impact on business decisions. Streamlining some processes by increasing the use of electronic means and/or increasing the number of examiners would remove some of the barriers for the use of patents as the choice to protect IP.

Though patent costs have not been taken into consideration in the analysis of the workload of POs, according to evidence collected by de Rassenfosse and van Pottelsberghe[26] from different authors, pre-grant fees have a direct impact. Some relevant examples are listed below:

- Archontopoulos et al (2007)[27] identified a decrease in the number of patent claims at the USPTO due to a fee per claim increase (price elasticity of about -0.20), which translated into a reduction of the POs' workload.
- MacLeod et al (2003)[28] and Nicholas (2010)[29] analysed the increase in the number of applications caused by the reductions in patent costs after the 1883 Patent Act in Britain. A 150% increase in patent applications caused by an 84% reduction of the fees (elasticity -66%) was reported. But one interesting fact is the decrease in the patent quality highlighted by Nicholas (2010) with the increase of the number of patent applications "concentrated in the low value distribution of patents" as measured by renewal data. Even though the event quoted happened more than 130 years ago, it exemplifies the side effects of lowering (significantly)

[24] The cost factor in patent systems. B. van Pottelsberghe de la Potterie, D. François, (2006).

[25] Patent backlogs at USPTPO and EPO: Systemic Failure vs deliberate delays. Malwina Mejer, B. van Pottelsberghe de la Potterie.

[26] The role of fees in patent systems: theory and evidence. Gaétan de Rassenfose, Bruno van Pottelsberghe, (2010).

[27] When small is beautiful measuring the evolution and consequences of the voluminosity of patent applications at the EPO, E. Archontopoulos et al, (2007).

[28] Patents and Industrialisation: An Historical Overview of the British Case, 1624-1907. C. MacLeod and A. Nuvolari, (2003).

[29] Cheaper patents, T. Nicholas, (2010).

patent fees in order to spur patent activity: an increase of POs' workload, a decrease of patent quality and, in this particular case, a reduction of the income of the POs.

- Lazaridis and van Pottelsberghe (2007)[30] identified an indirect effect of the reduction of the number of claims triggered by the increase of per claim fees, which is the reduction in the number of interactions between the PO and the applicant. This fact not only implies a reduction of process costs but also a delay in the granting process that the authors estimated in 1 year per two additional claims.
- de Rassenfosse and van Pottelsberghe (2008)[31] estimated the price elasticity at the trilateral offices (EPO, USPTO and JPO) over 26 years, obtaining a long term elasticity of around -0.30 and a short term elasticity between -0.06 and -0.12.

de Rassenfosse and van Pottelsberghe[32] developed a model to study the price elasticity of patents for the members of the European Patent Convention. According to this model, they propose a patent production function which depends on several variables such as the number of full time scientists and researchers, the stock of knowledge and the incentives to patent. Patent costs (calculated as the administrative fees) are part of the 'incentives to patent' variable among other factors such as GDP and the strength of patent protection. Different estimations of these parameters were carried out and all of them led to negative values of the price elasticity of priority filings.

The previous examples describe the trade-offs between making patents more affordable and the operation of POs:

- **Economic sustainability:** administrative fee reductions may lead to a decrease in the PO income if the number of applications do not increase sufficiently (a preliminary estimation of price-elasticity is needed). In addition, an increase in the number of examiners shall be required and, consequently, the operational costs will increase too. Therefore, a comprehensive economic study is needed if the POs have to be self-sustainable.
- **Service requirements:** an increase in the workload for POs caused by patent costs reductions may have two hidden costs for patent applicants that can exceed initial savings:
  - Increase of the granting time: delays caused by the higher workloads at the PO may affect business decisions on issues such as investment, access to venture capital funding or market internationalisation.
  - Quality of the services: reducing the comprehensiveness of the examination process may lead to an increase in the litigation costs in the future, as well as the associated business impacts for patent holders in the case of a negative ruling of patent courts.

In all the references mentioned, price **elasticities** are negative and **lower than 1**. Despite this, patent costs are certainly a key part of the IP policy since a good balance between affordability and POs workload is required if the impact of patenting at the PO level is to be maximised. This conclusion is also supported by de Rassenfosse and van Pottelsberghe[33] who, based on the negative elasticity of patent filings, suggest that fees "should be considered a tool of intellectual property policy, especially in the current context of backlogs".

The financial sustainability of an NPO is also affected by the timing of payments. Van Pottlesberghe and Danguy[34] simulated cash flows generated by Euro-direct patent filing validated in 6 countries. According to the authors, a European Patent begins to generate income in the 13th year and, taking into account average survival rates, 30% of the total patent applications filed at the EPO contribute to compensate for the net cumulated losses generated by the remaining 70%. An increase in the pre-grant fees should reduce the cross-subsidisation of short life patents by the ones maintained for a longer period. The authors also admit that, in order to minimise the effect of higher pre-grant fees on SMEs, specific fees for SMEs should be set.

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[30] The rigour of EPO's patentability criteria: An insight into the "induced withdrawals", G. Lazaridis and B. van Pottelsberghe, (2007).

[31] A Policy Insight into the R&D-Patent Relationship, G. de Rassenfosse and B. van Pottelsberghe, (2008).

[32] Per un pugno di dollari: A first look at the price elasticity of patents, de Rassenfosse and B. van Pottelsberghe, (2007).

[33] Per un pugno di dollari: A first look at the price elasticity of patents, de Rassenfosse and B. van Pottelsberghe, (2007)

[34] Patent fees for a sustainable EU (community) patent system. B. van Pottelsberghe de la Potterie, J.Danguy (2010)

The combination of fee levels and the thoroughness of the examination procedures defines the level of “patent friendliness” of a patent system. On the one hand, a more patent friendly system facilitates the access to patent protection by setting affordable fees and/or a streamlined examination procedure while, on the other hand, a more strict patent system may set higher fee levels and/or a more comprehensive examination levels aimed at deterring low quality/low value patent filings. However, both systems have several trade-offs. Patent friendly systems foster patent filings which can be an advantage for SMEs, PROs and universities which normally have low IP protection budgets and, sometimes, do not have a clear idea of the value of their inventions at the time of filing. Patent friendly systems also have several drawbacks, not only for the NPOs but for the whole system: Low fees increase patent propensity which in the end contributes to higher workloads and backlogs for NPOs.

- Proliferation of low quality and/or defensive patents becomes a barrier for innovators as they become part of the prior art and prevent high quality patents from being granted.
- Low quality patents create difficulties for examiners in the identification of prior art and the novelty of the invention, lengthening the examination and increasing backlogs.
- If the quality of the examination decreases due to higher workloads, the chances of litigation/opposition procedures increase. This adds significant and unpredicted costs during patent lifetime for the applicants and licensees.
- Low quality patents pave the way for non-practicing entities which act mainly against SMEs or individuals who are not willing or able to enter into litigation processes. Patent trolls deter from patent filing and lead to less robust IP protection alternatives such as secrecy.

More strict patent granting procedures try to reduce low quality filings which negatively affect the patent system and NPO operation. High fees and increased thoroughness of the examination are used to act on patent filings, but this approach also has some drawbacks:

- It is a long term strategy since behavioural changes take a long time to settle and, in the mid-term, increase workloads and backlogs due to longer examination processes.
- Higher pre-grant fees may act as a deterrent not only for low quality filings but for SMEs, universities and PROs with limited budgets.
- Stricter grant procedures increase process costs for the applicant since a more thorough patent examination requires further work on patent drafting and processing which adds to the external/in-house process costs. These are the single most important cost item for national patent filings which can turn unaffordable for SMEs.

Despite the low degree of elasticity of patents, acting on patent fees may provide a tool to reduce backlogs, contribute to the sustainability of POs and deter from patenting behaviours that block innovation. Building from the findings gathered in the literature and the data obtained, the following fee structure is proposed:

- **Administrative fees**: cash flow analysis of Euro PCT patents showed that long living patents subsidises short lived ones. Increasing pre-grant fees reduces temporal differences between fees income and PO's costs at the beginning of the process while reducing speculative filings.
- **Maintenance fees**: the progressive increase of renewal fees encourages patentees to drop patents which are not valuable enough while POs obtain a reasonable income from the most valuable ones. Relatively flat renewal fee structures contribute to a higher share of long living patents that generate additional income too but do not incentivise patentees to unlock low value aging patents. However, a sharply progressive increase of the renewal fees during the life of the patent may have the perverse effect of encouraging enterprises to drop prematurely a patent, while the economic value of the patent is yet to be revealed by the market. This can notably be the case for the most radical innovations that face difficulty in finding a large market at their early development stages. This is also the case for niche markets before they become mainstream. For this reason, the coexistence of different patent systems in the world, on the one hand systems with sharply progressive cost structure of renewal fees (as in Europe) and on the other hand systems with a flat or a degressive rate (as in the USA), may constitute an economic advantage for the most innovative enterprises benefitting of this flat or declining structure of maintenance fees. This is notably the case for small enterprises that because of the lack of resources are less likely to be able to allocate sufficient resources for an early development in large markets.
- **Creation of incentives for SMEs, PROs and universities**: the increase of the pre-grant fees proposed may become a barrier for the access to the patent system of innovators which often lack the required funds. In addition, innovators do not always have a clear idea of the value of their IP at the time of application. Hence, high fees may prevent them from filing patents or force them to delay the process as much as possible in order to postpone the payment of grant and maintenance fees. Two possible incentive schemes are proposed:
  - **Fee reductions**: specific pre-grant and renewal fees for the first years for SMEs, PROs and universities should be implemented. A 50% reduction is proposed. A fee reimbursement mechanism should be in place in case of the patents are sold or licensed to other entity different from the ones for which the fee reduction was intended.
  - **Grace period**: payment of some of the fees should be postponed at least until the fifth year. However, grace periods may be used for defensive patenting at no or low cost.

4.2 Profile of patents filed in NPOs and the EPO

The aim of this section is to analyse the consequences of patent costs on the patenting behaviour of applicants, indicated by the number of patents and average patent life in the countries within the scope of the study, as well as the number of validated countries in European applications. The comparison is carried out by type of applicant (i.e. assignee sector), technology field and economic sector.

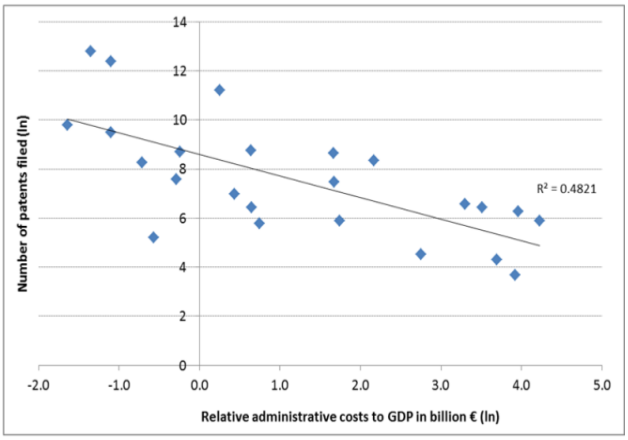
The base sample comprises **direct national and European applications**. International applications (PCT) have been discarded due to the fact that their filing fees are fixed but their inclusion nonetheless introduces unnecessary complexity into the analysis. Additionally, their absence enhances the level of comparability with all other analyses carried out in the report, as these do not encompass PCT applications either (aside from a marginal element of the study's survey).

The first analysis is how costs may influence the number of filings. As previously mentioned in section 4.1.4, de Rassenfosse and van Pottelsberghe[35] developed a model to study the price elasticity of patents for the members of the EPC. According to this model, they propose a patent production function which depends on several variables such as the number of full time scientists and researchers, the stock of knowledge and the incentives to patent. Patent costs (calculated as the administrative fees per million capita) are part of the 'incentives to patent' variable among other factors such as GDP and the strength of patent protection.

Similarly, we have used relative administrative costs (pre-grant fees) to GDP (billion €) for NPOs with available data for 2001 to explore their relation with patent filings extracted from PATSTAT. Natural logarithms of the number of filings and relative administrative costs and the corresponding results are presented below:

Figure 5 - Number of filings vs Relative administrative fees (2001)

Patent office	Patents filed [1]	Relative administrative costs to GDP (billion €) [2]
Austria	1090	1.54
Croatia	709	27.20
Cyprus	40	50.52
Czech Republic	3849	0.49
Denmark	365	5.73
Estonia	625	33.64
France	13149	0.33
Greece	323	2.10
Hungary	4,171	8.71
Lithuania	92	15.63
Luxembourg	75	40.39
Poland	5,957	0.78
Romania	530	52.35
Slovakia	1783	5.31
Spain	1980	0.75
UK	17,987	0.19
Iceland	363	68.27
Norway	5,721	5.27
Switzerland	621	1.92
India	182	0.57
Israel	6,310	1.90
Japan	358,801	0.26
South Korea	74536	1.29
USA	239,310	0.33



[1] Patents filed in 2001
[2] Relative administrative costs to GDP (billion €)

Note 1: Data shown only for NPOs with available data
Note 2: 2001 has been chosen as the reference year since filing data for 2006 and 2011 was not complete. For further details see 'Methodology overview and sources of information'

Source: PATSTAT 10-2012, Dataset Alpha, NPOs

[35] Per un pugno di dollari: A first look at the price elasticity of patents, de Rassenfosse and B. van Pottelsberghe, (2007).

The relatively low determination coefficient shows the necessity of carrying out a multivariate analysis, although the negative low elasticity is in concordance with results from the literature.

The fact that patents may have multiple applicants has been taken into account with the objective of avoiding double counting. To determine the **country of origin**, only applicants (and not inventors) have been considered.

The analyses in which technology fields and economic sectors have been determined from the patent's IPC codes have made use of the following tables: '*IPC - Technology field concordance table*' and '*IPC - NACE concordance table*' (both found in the Annex below).

When comparing by country of origin, technology field or economic sector, **no fractional** technique[36] has been applied (in case of patents with applicants from different countries, or multiple technology fields or economic sectors) as this way of proceeding (i.e. not using this technique) is deemed as providing closer-to-reality numbers when making patent listings based on these properties (country of origin, technology field or economic sector). In other words, when making patent listings based on country of origin, technology field or economic sector, fractionised patents would count as less than 1, which would be incorrect.

Assignee sector allocation has been determined through the usage of the assignment taxonomy which has been developed by ECOOM (KU Leuven) and Sogeti as part of the framework of the Eurostat work on harmonized patent statistics based on PATSTAT. The quality levels obtained in terms of completeness and accuracy reach 99% ('Data Production Methods for Harmonized Patent Indicators: Assignee sector allocation', 2009, Du Plessis, M., Van Looy, B., Song, X & Magerman, T.).
The assignee sector classification used (the ECOOM-EUROSTAT-EPO PATSTAT Person Augmented Table EEE-PPAT), which discriminates by individual, company, government, university, hospital, non-profit and/or unknown, has been the one equivalent to the PATSTAT release deployed in the project (i.e. 10/2012). With the objective of minimising unnecessary complexity, patents with multiple assignee sector codes assigned to them (which account for less than 0.3% of the total sample volume) have been assigned the first code available in the above mentioned classification.

The number of **validated countries**, which only applies to European patents, has been calculated as the distinct number of countries which include either of the following two codes within the legal status database INPADOC (10/2012 version):

- PG25: Patent lapsed or withdrawn at the NPO.
- PGFP: Annual fee paid to the NPO.

With regards to **average patent life**, only European patents have been considered. It has also been taken into account that, as far as a European patent is concerned, its maximum term is 20 years from its filing date. The patent may lapse earlier if the annual renewal (maintenance) fees are not paid or if the patent is revoked by the patentee or after opposition proceedings. In certain cases (medical or plant protection product patents) it is possible to extend the period of protection. Therefore, taking into account that the PATSTAT release used in the project is 10/2012, the year **1991** (i.e. patents filed in 1991) has been used as the sole reference from the set of years under study, as this is the only year in which standard (non-extensible) patents have had the chance to reach their maximum term.

For the calculation of the life of patents of the selected sample (European patents filed in 1991), the same two legal status codes listed above have been used (PG25 and PGFP). Within the deployed methodology the Single Renewal Approach (SRA) was used, which consists of measuring the longest renewal reached in any EPC contracting state, based on the idea that as long as the patent is maintained in at least one market, it suggest that the patent still carries sufficient value to its holder and is probably still being exploited. Therefore, in theory, a patent is considered to be alive whilst it remains in force in at least one of the countries in which it was validated. However, due to the inconsistent timing of some of the legal status data delivered from NPOs to the EPO, identifying whether a patent remains alive is not always straightforward. The methodology used to calculate the life of a patent included finding out the last date of all the patent's PG25 codes available (patent lapsed or withdrawn at the NPO), and the last date (plus one year as yearly renewal fees are paid in advance) of all its PGFP codes available (annual fee paid to NPO). From these two dates:

[36] Fractional technique: when counting patents by applicant countries for example, one counts a distinct patent with applicants from x different countries as 1/x of a patent.

- If the one corresponding to the **PG25** code was the latest of both of them, it was used (together with the filing date) to calculate the life of the patent directly.
- Otherwise, if the date (plus one year) corresponding to the **PGFP** code was the latest, a decision had to be made, depending on its closeness to the present date (in the case the present date is represented by the date of the release version of PATSTAT used: 10/2012), on whether a patent is still alive (and a life can therefore not be determined), or whether it can be considered as dead (allowing a life to be determined).

This decision included the allowance of the following tolerance periods:

- 6 months due to the fact that if the payment of a renewal fee is not made in due time, the renewal fee may still be validly paid within 6 months of the due date.
- A further 6 months due to the erratic nature of delivered data mentioned above[37].

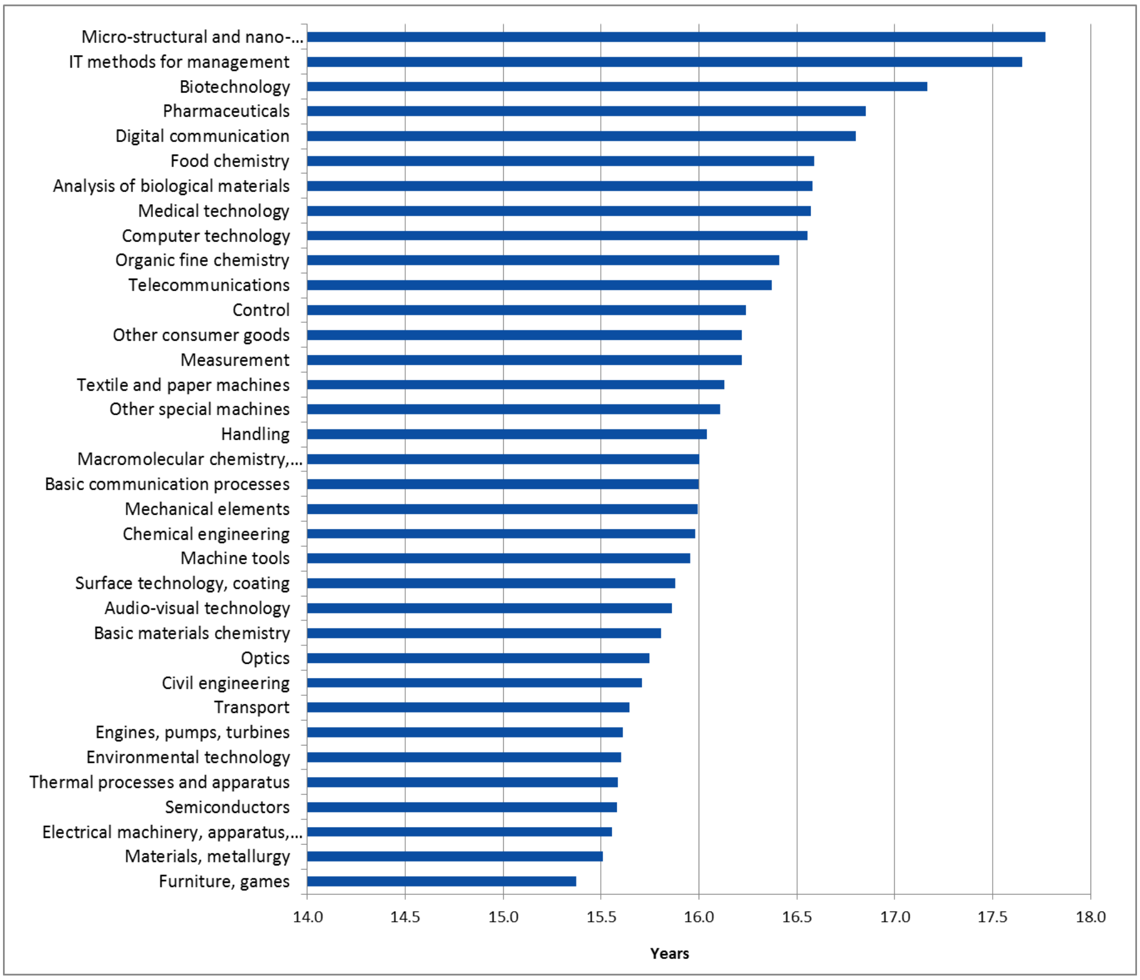
Therefore, if the gap between the present date (10/2012) and the PGFP code date (plus one year due to fee prepayment) is more than 1 year (the sum of the two tolerance periods listed above), the patent was deemed dead, and a life could be determined (together with the filing date).

Examining the number of patents by type of applicant (see Annex 7.5) the weight of patents assigned to 'Company' is so overwhelmingly high compared to all other types of applicants ('Government', 'Hospitals', 'Individual' and 'University') that displaying graphically 'average patent life' or 'average number of validated countries' per type of applicant is not practical. Instead, the following figures show the total weighted average patent life by technology field and economic sector (for patents filed in 1991), and the total weighted average number of validated countries by technology field and economic sector (for patents filed in 2001). Thereafter, these weighted average patent lives and number of validated countries are displayed side by side, by technology field and economic sector.

An interesting behaviour is displayed in Figure 6 and Figure 8 below. The former shows that the patents with the longest life correspond to the technology fields of micro-structural and nano-technology, ICT (information and communication technology), bio-science (biotechnology and pharma), medical technology and chemistry (particularly food and organic fine chemistry). The latter shows similar results with respect to micro, nano, bio, medical and chemistry related technologies, which leads to the hypothesis that these require intensive investment on R&D and can be easily copied if they do not have adequate IP protection mechanisms. In addition, the return on investment is only achieved after a long period due to the high investments carried out during the development phase. In this context patents become assets and therefore their lives tend to be longer. In the case of ICT related patents however, their life period is long but the average number of countries in which they are validated in is average. This fact is likely to be related to the dynamics of this industry rather than initial high investments.

[37] This tolerance period is obviously very subjective, but has been considered reasonable by everis.

Figure 6 - Weighted average patent life in years by technology field (1991)

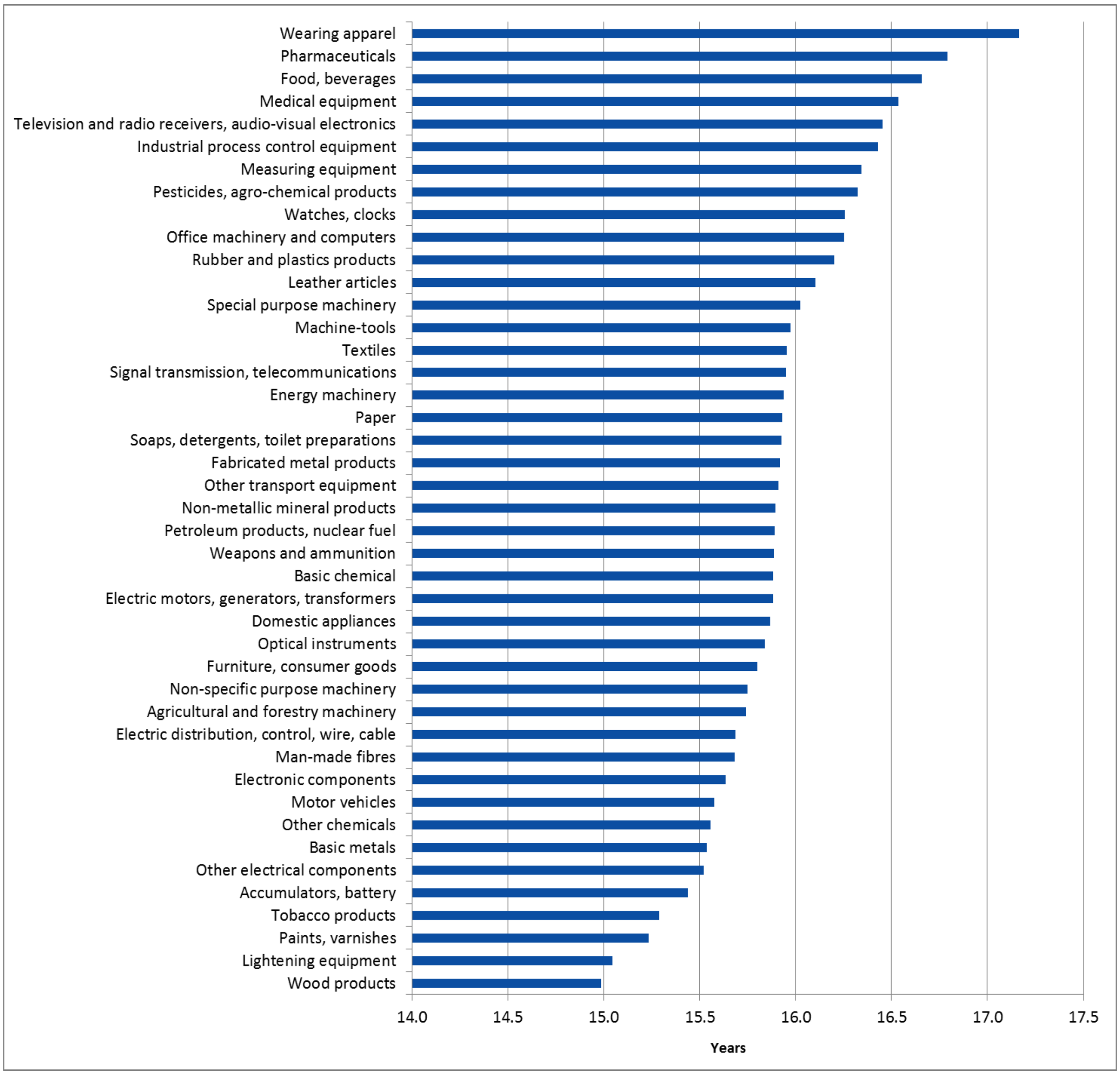


Weighted average patent life (in years) of patents filed in 1991

Note 1: Data available only for European patents;
Note 2: Patents can belong to more than one technology field
Note 3: 1991 has been used as the sole reference year as this is the only year in which standard (non-extensible) patents have had the chance to reach their maximum term

Source: PATSTAT 10-2012, Dataset Gamma

Figure 7 - Weighted average patent life in years by economic sector (1991)

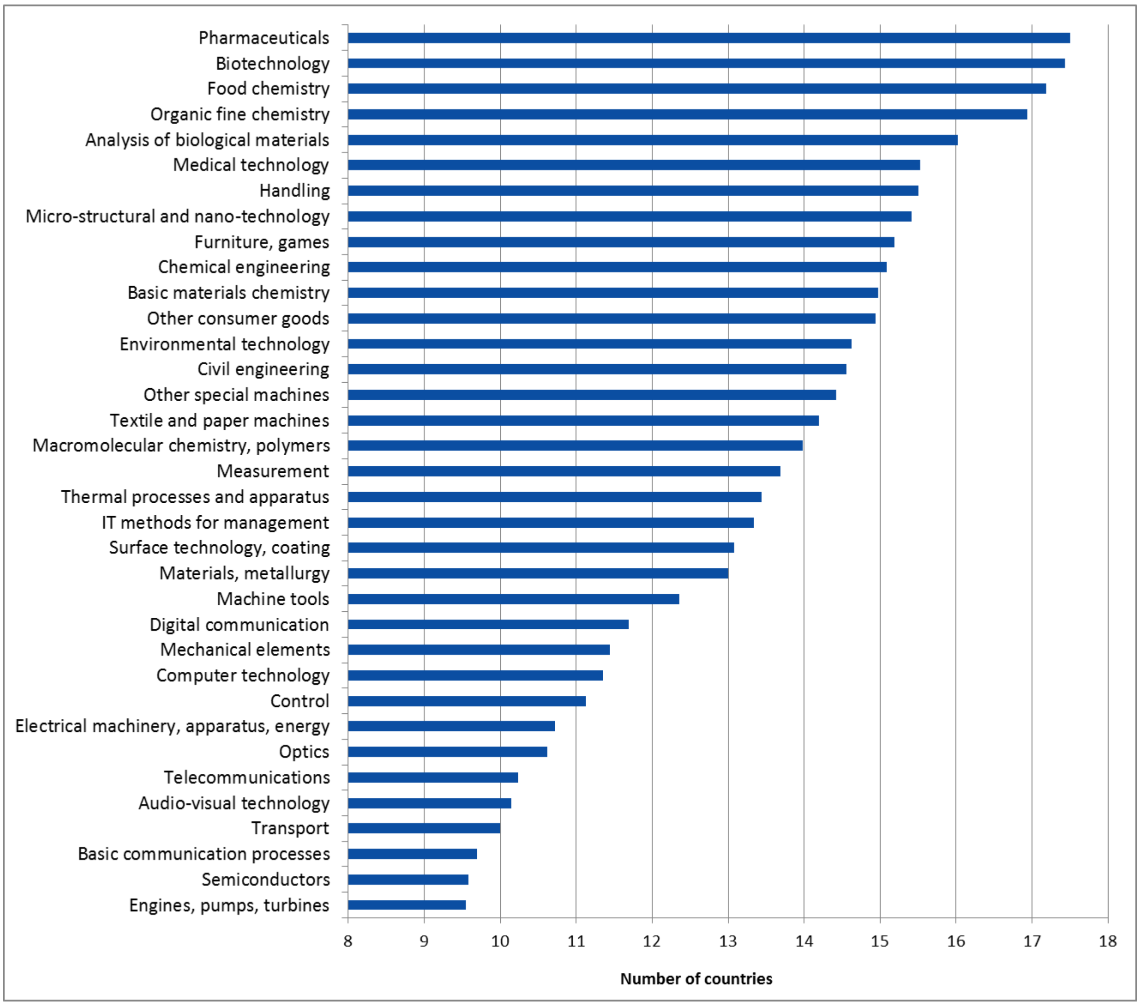


Weighted average patent life (in years) of patents filed in 1991

Note 1: Data available only for European patents
Note 2: Patents can belong to more than one economic sector
Note 3: 1991 has been used as the sole reference year as this is the only year in which standard (non-extensible) patents have had the chance to reach their maximum term

Source: PATSTAT 10-2012, Dataset Gamma

Figure 8 - Weighted average number of validated countries by technology field (2001)

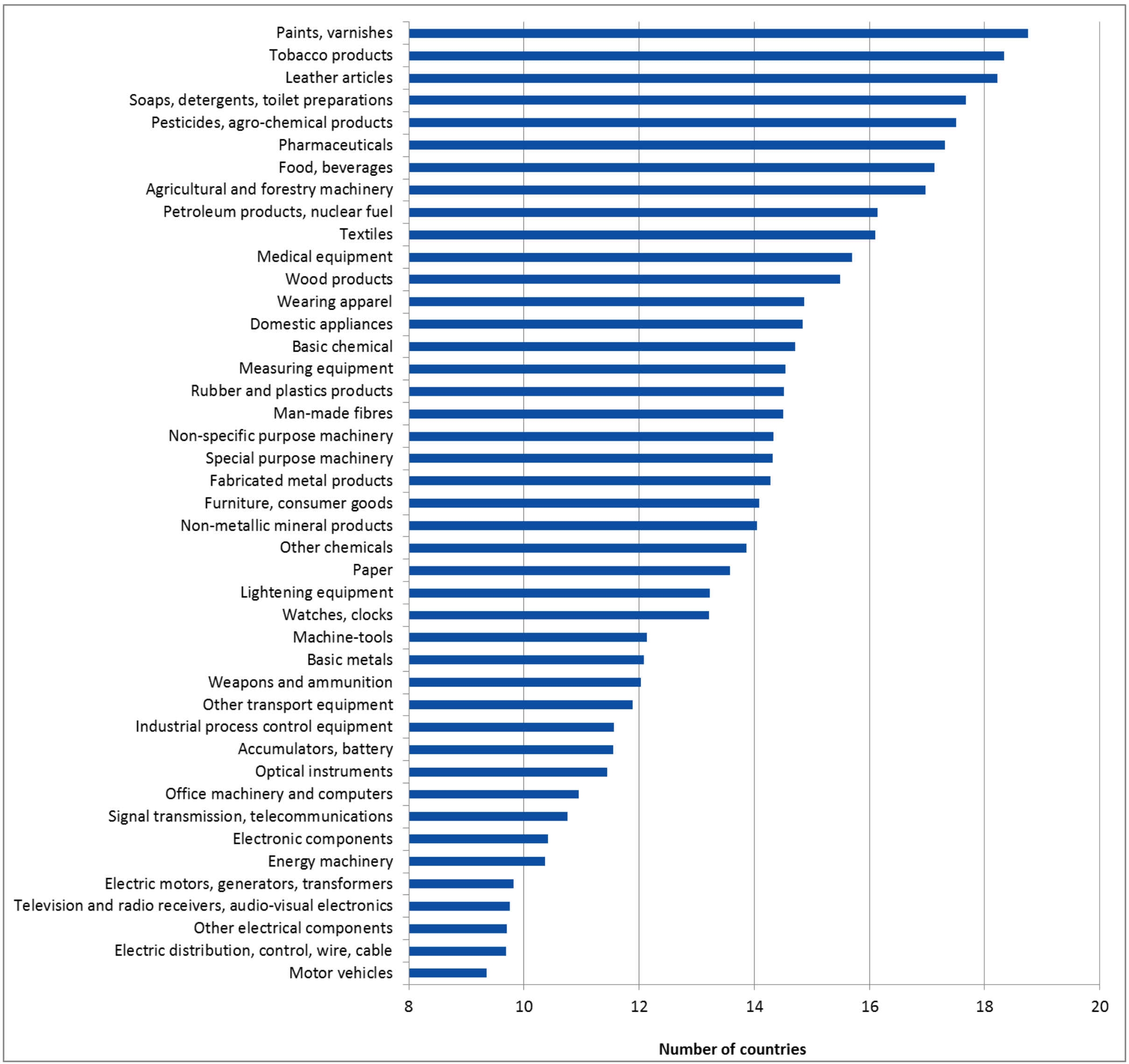


Weighted average number of validated countries (for patents filed in 2001)

Note 1: Data applicable only for European patents
Note 2: Patents can belong to more than one technology field
Note 3: 2001 has been chosen as the reference year since filing data for 2006 and 2011 was not complete. For further details see 'Methodology overview and sources of information'

Source: PATSTAT 10-2012, Dataset Delta

Figure 9 - Weighted average number of validated countries by economic sector (2001)



Weighted average number of validated countries (for patents filed in 2001)

Note 1: Data applicable only for European patents
Note 2: Patents can belong to more than one economic sector
Note 3: 2001 has been chosen as the reference year since filing data for 2006 and 2011 was not complete. For further details see 'Methodology overview and sources of information'

Source: PATSTAT 10-2012, Dataset Delta

Comparing economic sectors in terms of length of patent life and number of countries validated (Figure 7 and Figure 9 above) there is a clear lack of similarity. This makes sense if one takes into account that becoming international implies having a global IP strategy, considering in each case the local (national) singularities of any specific economic sector.

As indicated earlier, the following tables show the above weighted average patent lives and number of validated countries displayed side by side, by technology field and economic sector.

Table 15 - Weighted average patent lives in years (1991) and number of validated countries (2001) by technology field

Technology Field	Weighted average patent life in years [1]	Weighted validated countries [2]
Electrical machinery, apparatus, energy	15.6	10.7
Audio-visual technology	15.9	10.1
Telecommunications	16.4	10.2
Digital communication	16.8	11.7
Basic communication processes	16.0	9.7
Computer technology	16.6	11.4
IT methods for management	17.7	13.3
Semiconductors	15.6	9.6
Optics	15.7	10.6
Measurement	16.2	13.7
Analysis of biological materials	16.6	16.0
Control	16.2	11.1
Medical technology	16.6	15.5
Organic fine chemistry	16.4	16.9
Biotechnology	17.2	17.4
Pharmaceuticals	16.9	17.5
Macromolecular chemistry, polymers	16.0	14.0
Food chemistry	16.6	17.2
Basic materials chemistry	15.8	15.0
Materials, metallurgy	15.5	13.0
Surface technology, coating	15.9	13.1
Micro-structural and nano-technology	17.8	15.4
Chemical engineering	16.0	15.1
Environmental technology	15.6	14.6
Handling	16.0	15.5
Machine tools	16.0	12.4
Engines, pumps, turbines	15.6	9.5
Textile and paper machines	16.1	14.2
Other special machines	16.1	14.4
Thermal processes and apparatus	15.6	13.4
Mechanical elements	16.0	11.4
Transport	15.6	10.0
Furniture, games	15.4	15.2
Other consumer goods	16.2	14.9
Civil engineering	15.7	14.6

[1] Weighted average patent life (in years) of patents filed in 1991; Source: PATSTAT 10-2012, Dataset Gamma

[2] Weighted average number of validated countries for patents filed in 2001; Source: PATSTAT 10-2012, Dataset Delta

Note 1: Data available/applicable only for European patents

Note 2: Patents can belong to more than one technology field

Note 3: 2001 has been chosen as the reference year for the weighted validated countries calculation since filing data for 2006 and 2011 was not complete. For further details see 'Methodology overview and sources of information'

Note 4: 1991 has been used as the sole reference year for patent life calculation as this is the only year in which standard (non-extensible) patents have had the chance to reach their maximum term

Table 16 - Weighted average patent lives in years (1991) and number of validated countries (2001) by economic sector

Economic Sector	Weighted average patent life in years [1]	Weighted validated countries [2]
Food, beverages	16.7	17.1
Tobacco products	15.3	18.3
Textiles	16.0	16.1
Wearing apparel	17.2	14.9
Leather articles	16.1	18.2
Wood products	15.0	15.5
Paper	15.9	13.6
Petroleum products, nuclear fuel	15.9	16.1
Basic chemical	15.9	14.7
Pesticides, agro-chemical products	16.3	17.5
Paints, varnishes	15.2	18.8
Pharmaceuticals	16.8	17.3
Soaps, detergents, toilet preparations	15.9	17.7
Other chemicals	15.6	13.9
Man-made fibres	15.7	14.5
Rubber and plastics products	16.2	14.5
Non-metallic mineral products	15.9	14.0
Basic metals	15.5	12.1
Fabricated metal products	15.9	14.3
Energy machinery	15.9	10.4
Non-specific purpose machinery	15.7	14.3
Agricultural and forestry machinery	15.7	17.0
Machine-tools	16.0	12.1
Special purpose machinery	16.0	14.3
Weapons and ammunition	15.9	12.0
Domestic appliances	15.9	14.8
Office machinery and computers	16.3	10.9
Electric motors, generators, transformers	15.9	9.8
Electric distribution, control, wire, cable	15.7	9.7
Accumulators, battery	15.4	11.5
Lightening equipment	15.0	13.2
Other electrical components	15.5	9.7
Electronic components	15.6	10.4
Signal transmission, telecommunications	15.9	10.8
Television and radio receivers, audio-visual	16.5	9.8
Medical equipment	16.5	15.7
Measuring equipment	16.3	14.5
Industrial process control equipment	16.4	11.6
Optical instruments	15.8	11.4
Watches, clocks	16.3	13.2
Motor vehicles	15.6	9.3
Other transport equipment	15.9	11.9
Furniture, consumer goods	15.8	14.1

[1] Weighted average patent life (in years) of patents filed in 1991; Source: PATSTAT 10-2012, Dataset Gamma

[2] Weighted average number of validated countries (for patents filed in 2001); Source: PATSTAT 10-2012, Dataset Delta

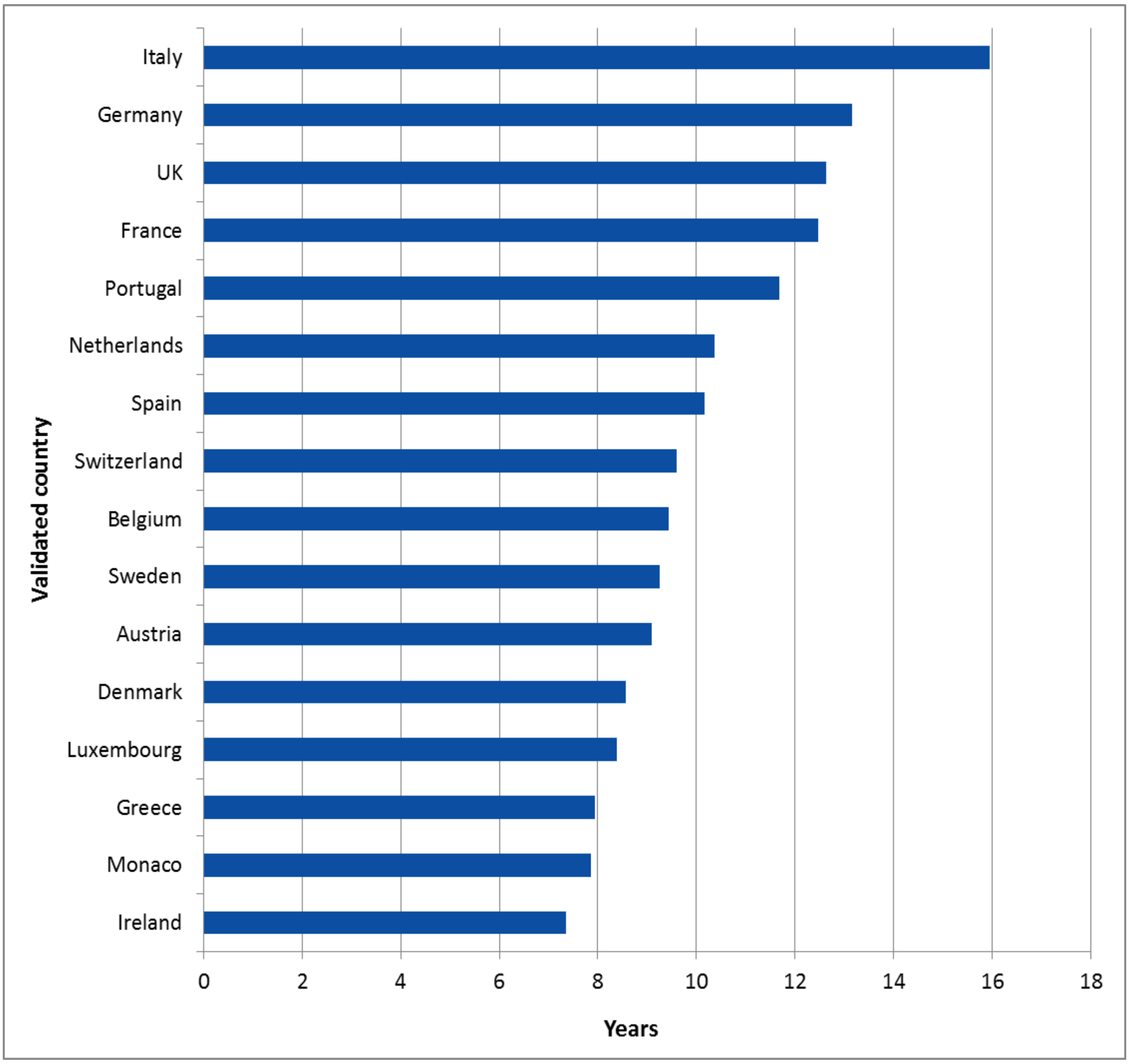
Note 1: Data available/applicable only for European patents
Note 2: Patents can belong to more than one economic sector
Note 3: 2001 has been chosen as the reference year since filing data for 2006 and 2011 was not complete. For further details see 'Methodology overview and sources of information'
Note 4: 1991 has been used as the sole reference year for patent life calculation as this is the only year in which standard (non-extensible) patents have had the chance to reach their maximum term

The last analysis in the current section is focused on the average patent life per country and number of validated countries per country. Based upon the above premises and the most adequate available data as explained earlier, this analysis is based on the following data extracts:

- Arithmetic mean of patent lives per validated country (for patents filed in 1991).
- Arithmetic mean of the number of patents validated in destination countries, per origin country of applicants (for patents filed in 2001).

The outcome of these data extracts is depicted below:

Figure 10 - Arithmetic mean of patent lives per validated country in years (for patents filed in 1991)



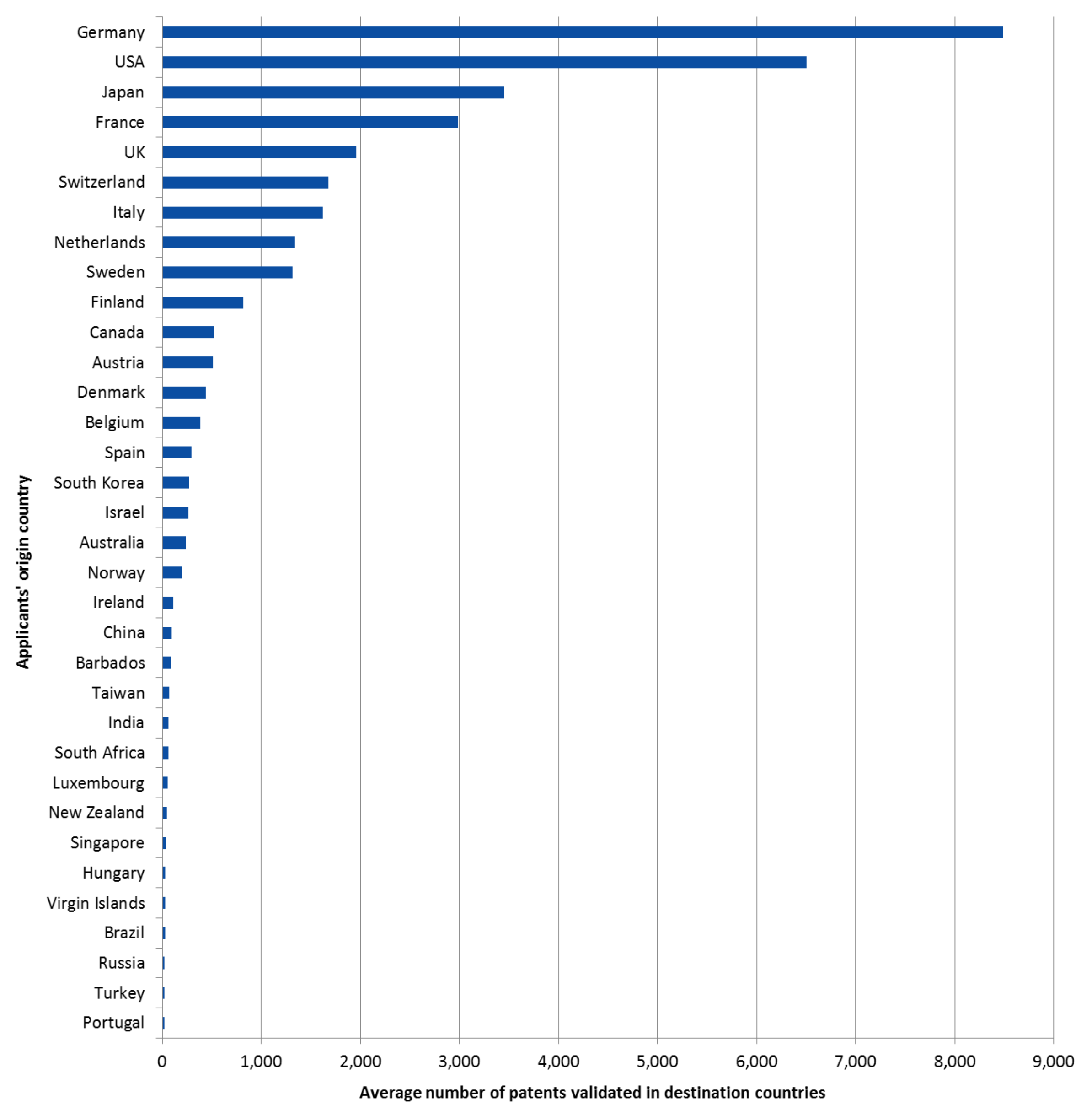
Arithmetic mean of patent lives per validated country (for patents filed in 1991)

Note 1: Data applicable only to European patents
Note 2: 1991 has been used as the sole reference year for patent life calculation as this is the only year in which standard (non-extensible) patents have had the chance to reach their maximum term

Source: PATSTAT 10-2012, Dataset Gamma

The patent lives per validated country indicator is lead as anticipated by Europe's largest economies, even though there is the notable exception of Italy in which patents reach a mean of almost 16 years, well ahead of the second country in line, Germany, with just over 13 years.

Figure 11 - Arithmetic mean of the number of patents validated in destination countries, per origin country of applicants (for patents filed in 2001)



Arithmetic mean of the number of patents validated in destination countries, per origin country of applicants (for patents filed in 2001)

Note 1: Data applicable only to European patents
Note 2: Only origin countries with more than an average of 20 patents validated in destination countries are displayed
Note 3: 2001 has been chosen as the reference year since filing data for 2006 and 2011 was not complete. For further details see 'Methodology overview and sources of information'

Source: PATSTAT 10-2012, Dataset Delta

As expected, large economies with a strong patenting culture lead the way in the average number of patents validated in destination countries. Specifically though, it is Europe's largest economy, Germany, which is positioned way ahead of the rest (including the USA and Japan). This fact makes sense as the scope under consideration only includes European patents, and the local factor (geographical proximity and the effect this has on economic ties) has a big influence in this indicator.

4.3 Economic indicators

The aim of the present section is to investigate the possible relationship between the patent costs in a country and several economic indicators from data stemming from different sources.

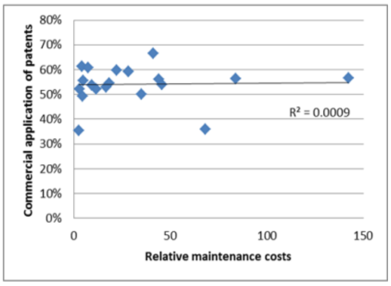
This section is divided into four different subsections, dealing each of them with a specific analysis. These analyses focus on the economic value of patents, the motivations behind patenting, the relationship between patenting and R&D investment and, finally, some results stemming from the everis survey 2013 addressing different perceptions of patenting cost from SMEs, PROs and Universities.

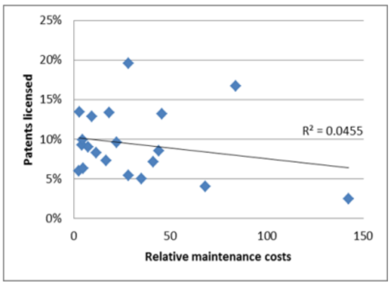
4.3.1 Utilisation rate and economic value of patents

The main data sources used in this topic are "PatVal-EU II" (more than 13,000 surveyed inventors in 2010) and the NPOs maintenance costs for patents (2011) obtained during the project. The next figure shows the considered countries and the corresponding linear regression.

Figure 12 - Patent utilisation (commercialisation or licensing) for the 20 European countries considered in PatVal-EU II (2010) vs Relative maintenance costs (2011)

National Patent Office	Relative maintenance costs [1]	Commercial application of the patented inventions	Patents Licensed
Austria	41.1	66.67%	7.18%
Belgium	11.8	52.16%	8.26%
Czech Republic	44.2	56.00%	8.51%
Denmark	28.4	59.32%	5.41%
Finland	45.7	53.96%	13.16%
France	2.8	35.37%	5.97%
Germany	5.0	55.58%	6.36%
Greece	35.1	50.00%	5.00%
Hungary	84.1	56.25%	16.67%
Ireland	28.5	59.32%	19.61%
Italy	4.2	61.34%	9.26%
Luxembourg	68.1	36.00%	4.00%
Netherlands	18.4	54.39%	13.33%
Poland	9.6	53.66%	12.90%
Slovenia	142.3	56.52%	2.50%
Spain	4.7	49.39%	9.93%
Sweden	16.9	53.01%	7.30%
UK	3.0	52.08%	13.44%
Norway	22.4	59.79%	9.57%
Switzerland	7.4	60.68%	9.05%
	R^2 [2]	0.0009	0.0455





[1] Relative maintenance costs 20 years to GDP (billion €) in 2011
[2] Linear regression: coefficient of determination

Sources: NPOs, PatVal-EU II

Maintenance costs are used instead of "overall patent costs" (administrative plus maintenance costs) since the PatVal-EU II survey refers to European patents and, therefore, NPOs only account for maintenance costs of such patents.

As can be seen in the figure there is no linear or established relationship between the patent costs and the exploitation in the shape of new, commercial products or just by the mechanism of licensing to any third-party.

This could lead us to conclude that, based on the available data, the utilisation of the patents in the internal product development activity or licensing is not related with the patent costs. It is also remarkable the small amount of licensed patents, on average below 10% of the total. This leads to the following working hypothesis: patents are mostly filed by strategic or internal motivations (new product development in the case of enterprises) rather than for licensing purposes.

The second analysis carried out deals with the economic value of patents. This is a complicated topic since the best indications of the economic value of such assets are the accomplishment of a deal for a certain price or the exploitation of a new product (or the improvement of current ones), being sure of the contribution of the corresponding patents to these products. Since there is not a well-accepted model regarding this topic (i.e. widely used by patenting organisations) the best information source must be, again, a survey. In this case the previously-mentioned PatVal-EU II.

Figure 13 - Economic value of patents for the 20 European countries considered in PatVal-EU II (2010) vs Relative maintenance costs (2011)

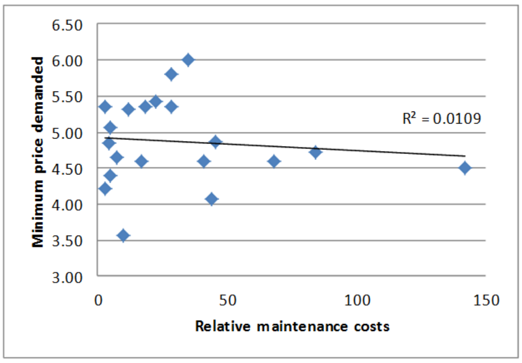
National Patent Office	Relative maintenance costs [1]	Minimum price demanded by patent-holder [2]			
		Patent granted & part of a patent family	Patent not granted & part of a patent family	Patent granted & not part of a patent family	Patent not granted & not part of a patent family
Austria	41.1	4.59	4.35	3.62	3.29
Belgium	11.8	5.32	5.48	3.71	3.80
Czech Republic	44.2	4.08	5.40	3.61	3.08
Denmark	28.4	5.35	5.81	4.39	3.76
Finland	45.7	4.86	5.50	3.76	3.40
France	2.8	4.21	4.03	3.25	3.27
Germany	5.0	4.40	4.53	3.19	3.30
Greece	35.1	6.00	3.00	4.25	4.30
Hungary	84.1	4.73	4.57	4.67	3.00
Ireland	28.5	5.80	5.13	4.23	3.35
Italy	4.2	4.85	4.28	3.91	4.06
Luxembourg	68.1	4.60	1.50	4.08	3.17
Netherlands	18.4	5.35	4.98	3.85	3.42
Poland	9.6	3.57	3.50	4.11	3.54
Slovenia	142.3	4.50	5.17	4.40	3.78
Spain	4.7	5.07	5.07	4.33	4.19
Sweden	16.9	4.59	4.78	3.91	3.77
UK	3.0	5.36	5.32	3.91	4.07
Norway	22.4	5.43	5.75	4.51	4.28
Switzerland	7.4	4.64	5.09	3.58	3.44
	R^2 [3]	0.0109	0.0110	0.2059	0.0623

[1] Relative maintenance costs 20 years to GDP (billion €) in 2011

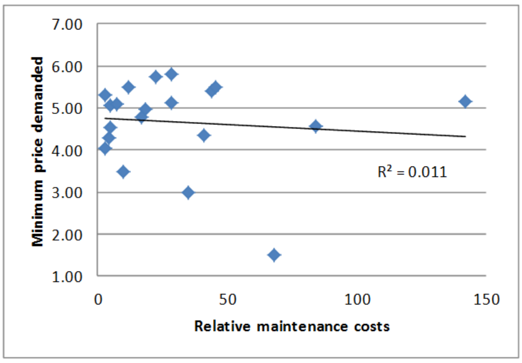
[2] 1 = Less than 30.000 € / 2 = > 30.000 € to € 100.000 € / 3 = > 100.000 € to € 300.000 € / 4 = > € 300.000 € to € 1 million € / 5 = > 1 million € to 3 million € / 6 = > 3 million € to € 10 million € / 7 = > 10 million € to 30 million € / 8 = > 30 million € to € 100 million € / 9 = > 100 million € to 300 million € / 10 = More than 300 million €

[3] Linear regression: coefficient of determination

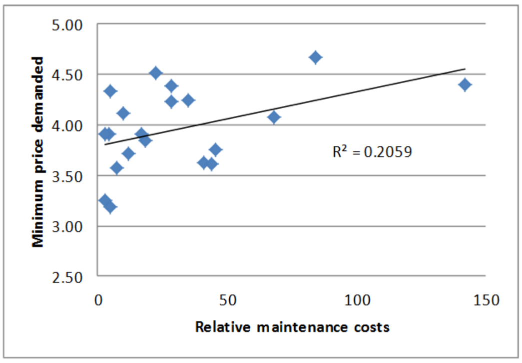
Patent granted & part of a patent family



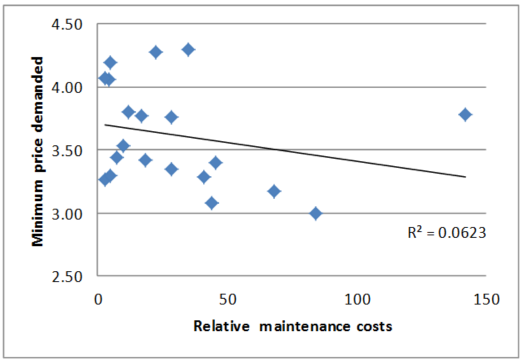
Patent not granted & part of a patent family



Patent granted & not part of a patent family



Patent not granted & not part of a patent family



As in the first analysis, there is no relationship between the relative overall patent costs and the economic value of patents, measured using a numerical value from 1 to 9 (as can be seen in Note 3 of the figure displayed above) corresponding to a certain interval for the economic value of a patent. It must be borne in mind that such economic value is just an estimate of the inventors. However, it is pretty clear according to PatVal-EU II data that being part of a patent family is more relevant than being granted. This could be a reinforcement of the above mentioned hypothesis that claims that a patent is a strategic asset. In this sense, to be part of a set of patents allows the patent to add value to its "relatives" and, at the same time, its perceived value is also increased.

4.3.2 Motivation for patenting

The third and final analysis of this item deals with the motivations behind patenting and their relationship with patent costs. In this case, two different data sources for motivations have been used: PatVal-EU II and everis survey (only for "universities", since this is the only case where surveyed information on costs is available for all the countries).

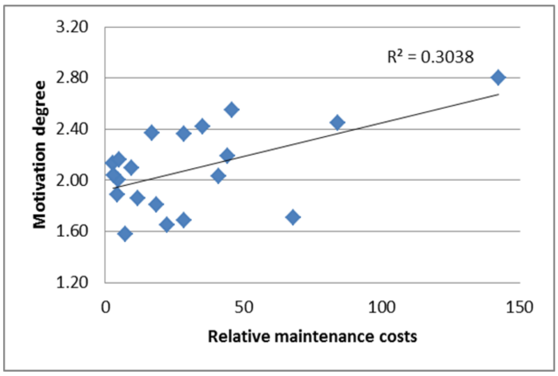
Figure 14 – Motivations for patenting for the 20 European countries considered in PatVal-EU II (2010) vs Relative maintenance costs (2011)

		Motivations for making this particular invention [2]					
National Patent Office	Relative maintenance costs [1]	Monetary rewards	Career advances and opportunities for new or better jobs	Prestige and reputation	Innovations increase the performance of the organization I work for	Satisfaction from showing that something is technically possible	Intellectual challenge
Austria	41.1	2.03	1.77	2.72	3.82	3.80	3.97
Belgium	11.8	1.86	2.10	3.22	3.71	4.06	4.07
Czech Republic	44.2	2.19	1.72	3.39	3.54	4.17	3.59
Denmark	28.4	1.69	2.16	3.04	3.51	3.92	3.97
Finland	45.7	2.55	2.09	2.84	3.02	3.57	3.87
France	2.8	2.13	1.90	2.76	3.47	3.78	3.74
Germany	5.0	2.16	1.74	2.63	3.84	3.68	3.79
Greece	35.1	2.42	2.32	2.86	3.26	3.95	3.75
Hungary	84.1	2.45	1.72	3.17	3.63	3.48	4.44
Ireland	28.5	2.36	2.30	2.93	3.07	4.04	3.87
Italy	4.2	1.89	2.05	2.58	3.37	4.07	3.88
Luxembourg	68.1	1.71	1.92	2.79	3.56	3.88	3.81
Netherlands	18.4	1.81	1.76	2.99	3.58	3.99	3.96
Poland	9.6	2.10	2.21	3.73	3.56	4.16	4.48
Slovenia	142.3	2.80	2.63	3.42	3.64	4.24	4.31
Spain	4.7	2.00	2.35	3.30	3.29	3.93	3.96
Sweden	16.9	2.37	1.96	2.85	3.39	3.76	3.86
UK	3.0	2.04	2.24	3.16	3.52	3.95	4.05
Norway	22.4	1.65	1.75	2.64	3.33	3.89	3.93
Switzerland	7.4	1.58	1.67	2.59	3.83	3.80	3.88
	R^2 [3]	0.304	0.071	0.078	0.005	0.005	0.127

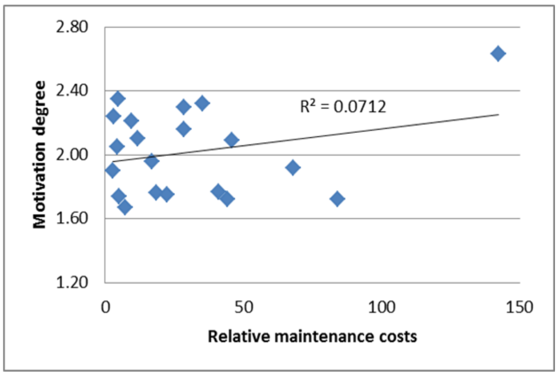
[1] Relative maintenance costs 20 years to GDP (billion €) in 2011
[2] Answers were given on a 5 point Lickert Scale (1 - not important, 5 - very important); we assume equidistance and, therefore, provide means
[3] Linear regression: coefficient of determination

Sources: NPOs costs in 2011, PatVal-EU II

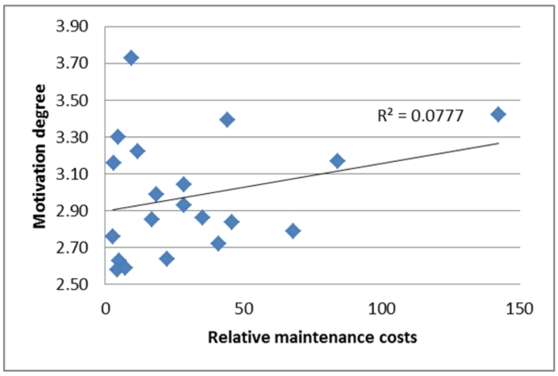
Monetary rewards



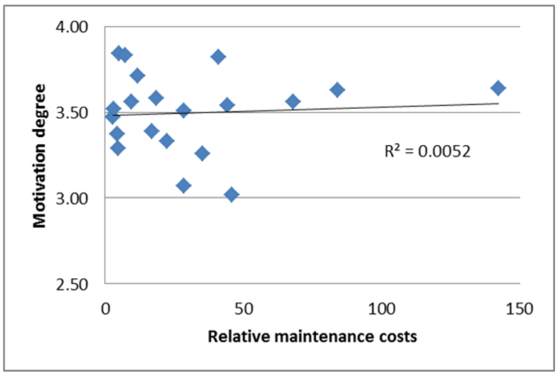
Career advances and opportunities for new or better jobs



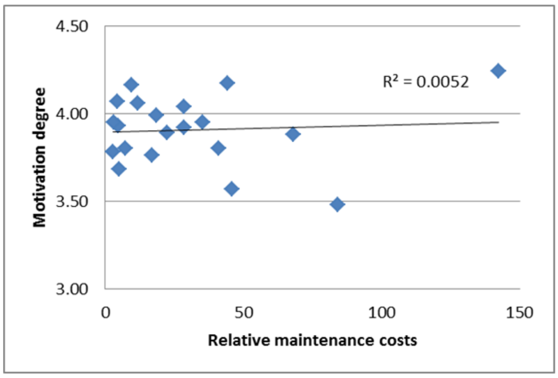
Prestige and reputation



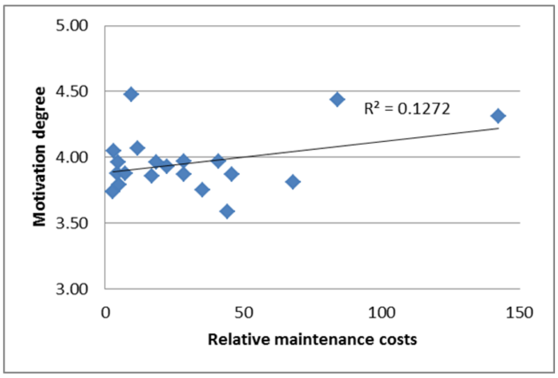
Innovations increase the performance of the organization I work for



Satisfaction from showing that something is technically possible



Intelectual challenge



The results displayed in the figure do not indicate any pattern or correlation with the overall patent costs for the 20 analysed countries. The two "motivations" with the highest mean values correspond to "satisfaction from showing that something is technically possible" and "intellectual challenge". It is worth remarking that this survey (PatVal-EU II) was addressed to inventors, that is, those who are involved in innovative activities as the ones corresponding to R&D.

In order to have a complementary view of the motivations, the everis survey (2013) has also been used. The surveyed motivations are 5 and different to the ones corresponding to PatVal-EU II.

Table 17 - Motivations for patenting in SMEs, universities and PROs

SMEs

		Main reasons for patenting [1]				
Country of Origin	Interviews	Prevent imitations	Preserve freedom of operation	Block competitors' access to technology	Raise the monetary value of your entity	License out
China	13	3.8	3.2	3.7	4.0	3.3
France	16	3.8	3.8	3.6	3.8	3.6
Germany	11	4.4	4.0	4.5	4.3	3.5
India	6	3.3	3.2	3.2	3.3	3.2
Japan	19	3.5	3.1	3.6	2.5	2.9
Poland	6	3.2	3.0	3.0	3.0	2.5
South Korea	7	3.4	4.0	3.4	3.9	2.6
Spain	26	3.8	3.7	3.6	3.7	3.3
Sweden	19	3.8	4.2	4.2	4.2	3.4
UK	14	3.9	3.9	3.6	4.1	4.2
USA	15	4.3	4.7	4.7	4.5	4.0

PROs

		Main reasons for patenting [1]				
Country of Origin	Interviews	Prevent imitations	Preserve freedom of operation	Positive image for your entity	Raise the monetary value of your entity	License out
China	11	4.1	3.8	4.2	3.9	4.1
France	12	3.7	3.8	4.0	3.0	3.9
Germany	14	3.0	3.7	3.8	3.4	4.2
India	5	3.4	3.6	3.6	3.6	3.8
Japan	17	3.5	3.4	3.1	2.9	3.2
Poland	6	3.5	3.7	5.0	3.7	3.3
South Korea	6	2.5	2.5	4.0	3.5	4.3
Spain	9	3.7	3.7	3.9	3.6	4.0
Sweden	7	2.0	3.6	3.7	3.1	3.4
UK	8	2.9	2.9	3.3	3.4	4.5
USA	1	3.0	5.0	1.0	1.0	5.0

Universities

		Main reasons for patenting [1]				
Country of Origin	Interviews	Prevent imitations	Preserve freedom of operation	Positive image for your entity	Raise the monetary value of your entity	License out
China	18	3.6	3.9	3.8	3.4	4.2
France	16	3.4	3.4	4.3	3.2	4.3
Germany	10	3.0	3.0	3.7	3.3	4.0
India	14	4.1	3.9	4.3	3.1	3.8
Japan	18	3.3	3.8	3.6	3.2	3.7
Poland	7	3.3	3.1	4.3	3.9	4.3
South Korea	13	3.9	3.3	3.4	3.4	3.4
Spain	19	3.5	3.2	4.1	4.1	4.7
Sweden	15	3.5	3.5	3.1	3.5	3.5
UK	23	3.2	3.2	3.2	3.3	4.7
USA	13	3.4	3.5	3.5	3.3	4.5

[1] Main reasons for patenting (arithmetic mean of the respondent's level of agreement (1 - Completely disagree; 2 - Disagree; 3 - Partially agree; 4 - Agree; 5 - Completely agree))

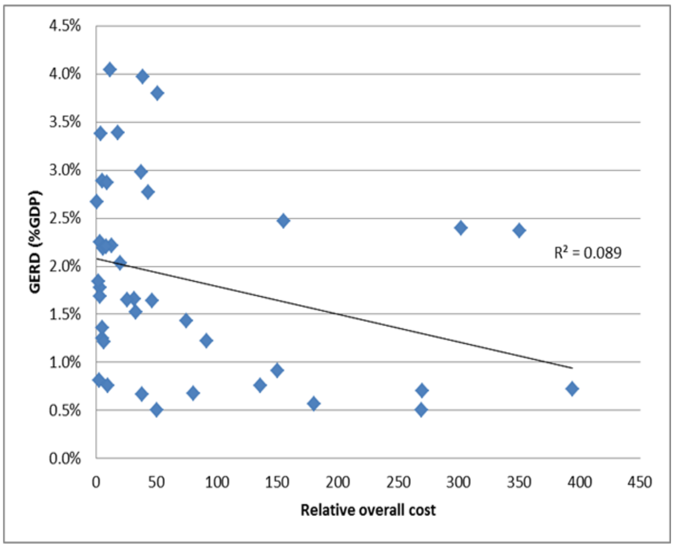
Source: everis survey 2013

4.3.3 Relationship between patent costs and investment in research

The first analysis of this topic focuses on the relationship between overall patent costs (administrative and maintenance costs) and the GERD (Gross Expenditure on R&D), BERD (Business Enterprise Expenditure on R&D) and HERD (Higher Education Expenditure on R&D) using standard correlation analysis.

Figure 15 - GERD vs Relative overall patent costs (2011)

Patent Office	Relative Overall Costs (administrative+ maintenance) [1]	GERD [2]
Austria	43.3	2.8%
Belgium	12.7	2.2%
Bulgaria	180.7	0.6%
Croatia	136.0	0.8%
Cyprus	269.1	0.5%
Czech Republic	46.6	1.6%
Denmark	37.4	3.0%
Estonia	350.4	2.4%
Finland	51.2	3.8%
France	3.2	2.3%
Germany	5.3	2.9%
Greece	38.0	0.7%
Hungary	91.4	1.2%
Ireland	31.8	1.7%
Italy	5.4	1.3%
Latvia	270.1	0.7%
Lithuania	150.0	0.9%
Luxembourg	74.6	1.4%
Malta	394.3	0.7%
Netherlands	20.0	2.0%
Poland	10.1	0.8%
Portugal	33.2	1.5%
Romania	50.3	0.5%
Slovakia	80.6	0.7%
Slovenia	155.0	2.5%
Spain	5.4	1.4%
Sweden	18.5	3.4%
UK	3.1	1.8%
6 European countries [4]	5.8	2.2%
13 European countries [5]	8.8	2.2%
Iceland	301.8	2.4%
Norway	25.8	1.7%
Switzerland	8.8	2.9%
Brazil	6.7	1.2%
Canada	3.6	1.7%
China	1.8	1.8%
India	2.5	0.8%
Israel	38.7	4.0%
Japan	3.8	3.4%
South Korea	11.7	4.0%
USA	0.8	2.7%
	R^2 [3]	**0.089**



[1] Relative overall costs include administrative and maintenance costs (2011) to GDP (billion €) in 2011
[2] Gross domestic expenditure on R&D (GERD) (% of GDP) (2011)
[3] Linear regression: coefficient of determination
[4] Costs for a European patent validated in 6 countries (DE, FR, IT, NL, CH and UK)
[5] Costs for an European patent validated in 13 countries (DE, FR, IT, NL, CH, UK, AT, BE, DK, FI, IE, ES and SE)

Note 1: Only patent offices with available data (costs and GERD) are shown
Note 2: Administrative costs for 6 European countries and 13 European countries patents are pre-grant and designation fees charged by the EPO plus validation fees charged by NPOs. Maintenance fees are the sum of maintenance fees charged by each NPO. GDP value used to calculate relative costs for European 6 and 13 countries aggregates is the sum of the GDPs of the countries where the patent is validated

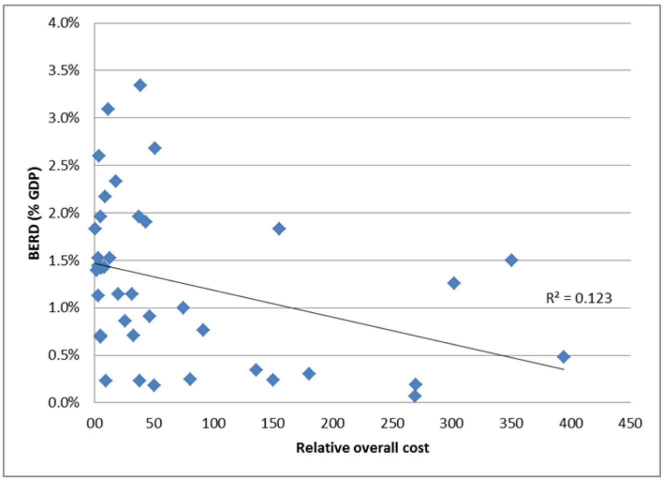
Sources: NPOs (costs) and Eurostat 2011 except for Brazil and India (World Bank 2011), Switzerland (OECD 2008) and Canada, Israel, Japan and South Korea (OECD 2011)

As can be seen in the depicted figure there is no relationship between the GERD and the overall patent costs gathered at NPO level. Since the patenting activity is highly related to the innovative activities of enterprises, a stronger relationship with BERD (Expenditure on R&D in the business enterprise sector) could be expected. This hypothesis is not true according to our second analysis, that is, the correlation analysis of patent costs vs BERD.

However, it is difficult to raise a conclusion since in some countries a significant share of total local patents comes from foreign countries and, therefore, they are not influenced by BERD, GERD or HERD at the local (NPO) level.

Figure 16 – BERD vs Relative overall patent costs (2011)

Patent Office	Relative Overall Costs (administrative+ maintenance) [1]	BERD [2]
Austria	43.3	1.9%
Belgium	12.7	1.5%
Bulgaria	180.7	0.3%
Croatia	136.0	0.3%
Cyprus	269.1	0.1%
Czech Republic	46.6	0.9%
Denmark	37.4	2.0%
Estonia	350.4	1.5%
Finland	51.2	2.7%
France	3.2	1.4%
Germany	5.3	2.0%
Greece	38.0	0.2%
Hungary	91.4	0.8%
Ireland	31.8	1.1%
Italy	5.4	0.7%
Latvia	270.1	0.2%
Lithuania	150.0	0.2%
Luxembourg	74.6	1.0%
Malta	394.3	0.5%
Netherlands	20.0	1.1%
Poland	10.1	0.2%
Portugal	33.2	0.7%
Romania	50.3	0.2%
Slovakia	80.6	0.3%
Slovenia	155.0	1.8%
Spain	5.4	0.7%
Sweden	18.5	2.3%
UK	3.1	1.1%
6 European countries [4]	5.8	1.4%
13 European countries [5]	8.8	1.4%
Iceland	301.8	1.3%
Norway	25.8	0.9%
Switzerland	8.8	2.2%
Canada	3.6	1.5%
China	1.8	1.4%
Israel	38.7	3.3%
Japan	3.8	2.6%
South Korea	11.7	3.1%
USA	0.8	1.8%
	R^2 [3]	**0.123**



[1] Relative overall costs include administrative and maintenance costs (2011) to GDP (billion €) in 2011
[2] Expenditure on R&D in the business enterprise sector (BERD) (% of GDP) (2011)
[3] Linear regression: coefficient of determination
[4] Costs for a European patent validated in 6 countries (DE, FR, IT, NL, CH and UK)
[5] Costs for an European patent validated in 13 countries (DE, FR, IT, NL, CH, UK, AT, BE, DK, FI, IE, ES and SE)

Note 1: Only patent offices with available data (costs and BERD) are shown
Note 2: Administrative costs for 6 European countries and 13 European countries patents are pre-grant and designation fees charged by the EPO plus validation fees charged by NPOs. Maintenance fees are the sum of maintenance fees charged by each NPO. GDP value used to calculate relative costs for European 6 and 13 countries aggregates is the sum of the GDPs of the countries where the patent is validated

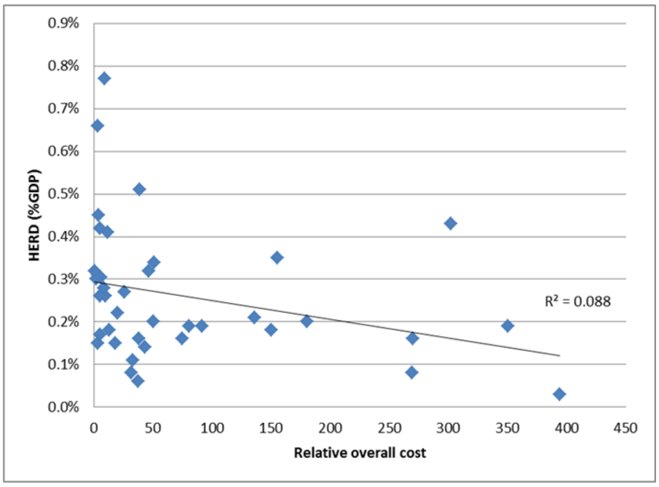
Sources: NPOs costs, Eurostat 2011 except for Canada, Israel, Japan and South Korea (OECD 2011) and Switzerland (OECD 2012)

According to the available data, the enterprise investment on R&D is not constrained or influenced by patent costs to a significant extent. That is, the linear regression curve does not accurately represent how the variation on overall patent costs affects the variation on BERD.

The final analysis of this item deals with the relationship between patent costs and the HERD (Expenditure on R&D performed in the higher education sector).

Figure 17 - HERD vs Relative overall patent costs (2011)

Patent Office	Relative Overall Costs (administrative+ maintenance) [1]	HERD [2]
Austria	43.3	0.14%
Belgium	12.7	0.18%
Bulgaria	180.7	0.20%
Croatia	136.0	0.21%
Cyprus	269.1	0.08%
Czech Republic	46.6	0.32%
Denmark	37.4	0.06%
Estonia	350.4	0.19%
Finland	51.2	0.34%
France	3.2	0.31%
Germany	5.3	0.42%
Greece	38.0	0.16%
Hungary	91.4	0.19%
Ireland	31.8	0.08%
Italy	5.4	0.17%
Latvia	270.1	0.16%
Lithuania	150.0	0.18%
Luxembourg	74.6	0.16%
Malta	394.3	0.03%
Netherlands	20.0	0.22%
Poland	10.1	0.26%
Portugal	33.2	0.11%
Romania	50.3	0.20%
Slovakia	80.6	0.19%
Slovenia	155.0	0.35%
Spain	5.4	0.26%
Sweden	18.5	0.15%
UK	3.1	0.15%
6 European countries [4]	5.8	0.30%
13 European countries [5]	8.8	0.28%
Iceland	301.8	0.43%
Norway	25.8	0.27%
Switzerland	8.8	0.77%
Canada	3.6	0.66%
China	1.8	0.30%
Israel	38.7	0.51%
Japan	3.8	0.45%
South Korea	11.7	0.41%
USA	0.8	0.32%
	R^2 [3]	**0.088**



[1] Relative overall costs include administrative and maintenance costs (2011) to GDP (billion €) in 2011
[2] Expenditure on R&D performed in the higher education sector (HERD) (% of GDP) (2011)
[3] Linear regression: coefficient of determination
[4] Costs for a European patent validated in 6 countries (DE, FR, IT, NL, CH and UK)
[5] Costs for an European patent validated in 13 countries (DE, FR, IT, NL, CH, UK, AT, BE, DK, FI, IE, ES and SE)

Note 1: Only patent offices with available data (costs and HERD) are shown
Note 2: Administrative costs for 6 European countries and 13 European countries patents are pre-grant and designation fees charged by the EPO plus validation fees charged by NPOs. Maintenance fees are the sum of maintenance fees charged by each NPO. GDP value used to calculate relative costs for European 6 and 13 countries aggregates is the sum of the GDPs of the countries where the patent is validated

Sources: NPOs, Eurostat 2011 except for Luxembourg, Canada, Israel, Japan, South Korea (OECD 2011) and Switzerland (OECD 2010)

Like in the previous cases, the determination coefficient is very low. Again, the linear regression does not represent accurately the relationship between HERD and patent costs. In our opinion, HERD is conditioned by the R&D policy of higher education institutions and does not seem to be constrained by the costs of patenting. Moreover, patenting is more likely the consequence of research activities rather than the driver of such activities.

4.3.4 Impact of patent costs on a number of different aspects

The final results of the everis survey 2013 consisted of the **414** respondents which completed the survey comprehensively (the design of the sample is detailed in Section 4.4). Out of these, all non-cost-related answers were considered valid *as is*. **Cost-related answers** (related to questions around the concept of a 'representative European patent') **underwent a filtering process** with the objective of discarding those which were considered unreasonable. This process consisted of the following steps:

First, if the **administrative cost** was deemed unreasonable, it was assumed that, because of the fact that administrative costs cannot vary wildly, the respondent's cost-related answers were not sufficiently reliable. Therefore, all his/her cost figures were disregarded.

Administrative costs were deemed unreasonable if they were 100% below or 300% above a figure representing a relatively low-cost administrative fee of a European patent at current prices: 4,520 € (i.e. costs outside the range 2,260 € to 18,080 € were considered unreasonable). The amount 4,520 € was derived from the sum of the following elements:

- Filing fee - EP direct - online: 120 €.
- Fee for a European search - Applications filed on/after 01.07.2005: 1,285 €.
- Designation fee - For all contracting States designated for applications filed on/after 01.04.2009: 580 €.
- Examination fee - For applications filed on/after 01.07.2005: 1,620 €.
- Fee for grant and printing (not more than 35 pages) or fee for grant including fee for publication: 915 €.

Second, if the **process cost** was deemed unreasonable, it was assumed that the respondent's cost-related answers were not sufficiently reliable. Therefore, all his/her cost figures were disregarded.

Process costs were deemed unreasonable if they were 300% above the reference process cost extracted from the Roland Berger study: 11,443 € (i.e. the figure calculated in 2004, 9,840 €, and updated using the average inflation rate of the OECD countries published by the World Bank). Process costs below this figure were not judged as these can be considered by patentees as low as zero if this activity is undertaken in-house.

Third, if the **maintenance cost** was deemed unreasonable, it was assumed that the respondent's cost-related answers were not sufficiently reliable. Therefore, all his/her cost figures were disregarded.

Maintenance costs were deemed unreasonable if they were below the minimum fee of a European patent at current prices: 465 € (amount corresponding to the 3rd year renewal fee).

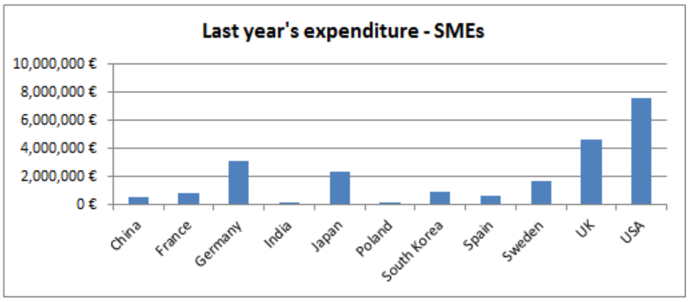
And fourth, **translation costs**, if the answer to the question "Has your entity used patent translation services during 2012?" was "No" and the value of the next question ("Approximately, what costs in Euros has your entity incurred in these services?") was anything bigger than 0 €, this cost was deemed unreliable and was discarded.

After applying this filtering process, the following fields were eliminated: 44% administrative costs; 36% process costs, 49% maintenance costs and 40% translation costs. Due to the high uncertainty related to the cost-related data stemming from the survey (including the data which passed the above-mentioned filtering process), the usage of all cost-related information (linked to the everis survey) in the different analysis included in the current report has been **discarded**, as this data does **not** provide **sufficient reliability**.

R&D investments by SMEs: Research intensity

Table 18 - R&D investments by SMEs: Research intensity

Country of origin	Interviews	Last year's expenditure [1]
China	13	531,538 €
France	16	772,643 €
Germany	11	3,070,000 €
India	6	156,517 €
Japan	19	2,321,396 €
Poland	6	183,667 €
South Korea	7	906,600 €
Spain	26	607,306 €
Sweden	19	1,712,059 €
UK	14	4,667,857 €
USA	15	7,629,924 €



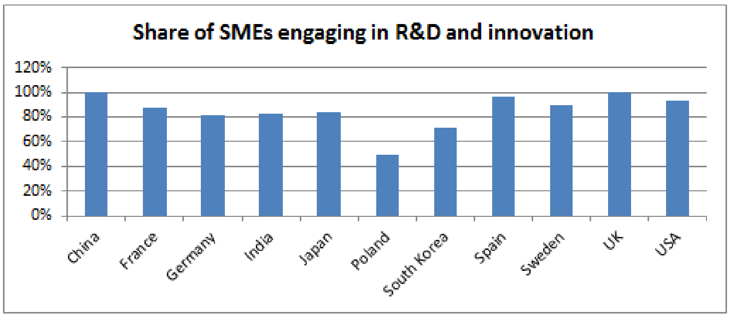
[1] Arithmetic mean of last year's expenditure on R&D ("Approximately, what has been your last year's expenditure on R&D?")

Source: everis survey 2013

R&D investments by SMEs: SMEs engaging in R&D and innovation

Table 19 - R&D investments by SMEs: SMEs engaging in in-house R&D and innovation

Country of origin	Interviews	Share of SMEs [1]
China	13	100%
France	16	88%
Germany	11	82%
India	6	83%
Japan	19	84%
Poland	6	50%
South Korea	7	71%
Spain	26	96%
Sweden	19	89%
UK	14	100%
USA	15	93%



[1] Share of SMEs that spent more than 0 € on R&D last year ("Approximately, what has been your last year's expenditure on R&D?")

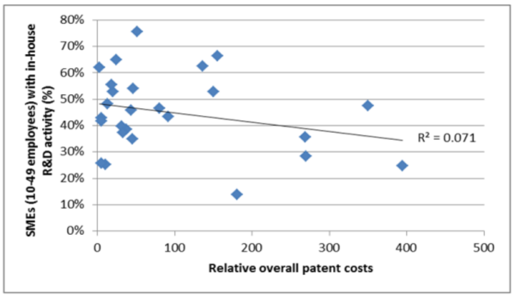
Source: everis survey 2013

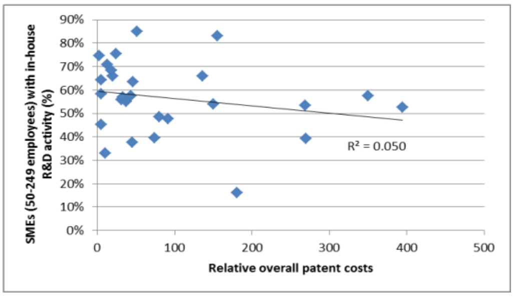
According to the survey, the USA, the UK, Germany, Japan and Sweden are among the countries with the highest R&D Investment and R&D share of innovative SMEs. At the European level this is not surprising, since, according to the European Innovation Scoreboard 2014[38], these countries are leading innovators. Again, as mentioned in 'Item A' above, patent costs are not a constraint to innovation in countries with a long track record in innovation, in this case at SME level.

Using data from the Eurostat Community Innovation Survey 2010, a relation between patent costs and the percentage of SMEs engaged in in-house R&D activities can be explored.

Table 20 - SMEs with in-house R&D activities vs Relative overall patent costs (2011)

	Enterprises, engaged in in-house R&D activities		
	Relative overall costs (administrative + maintenance) to GDP (billion €) [1]	Firm Size	
Patent office		From 10 to 49 [2]	From 50 to 249 [3]
Austria	43.3	46%	57%
Belgium	12.7	48%	71%
Bulgaria	180.7	14%	16%
Croatia	136.0	62%	66%
Cyprus	269.1	36%	53%
Czech Republic	46.6	54%	64%
Denmark	37.4	38%	55%
Estonia	350.4	48%	58%
Finland	51.2	76%	85%
France	3.0	62%	75%
Germany	5.3	43%	58%
Hungary	91.4	43%	48%
Ireland	31.8	40%	56%
Italy	5.4	42%	64%
Latvia	270.1	28%	39%
Lithuania	150.0	53%	54%
Luxembourg	74.6		40%
Malta	394.3	25%	52%
Netherlands	20.0	53%	66%
Poland	10.1	25%	33%
Portugal	33.2	37%	57%
Romania	45.8	35%	38%
Slovakia	80.6	47%	49%
Slovenia	155.0	66%	83%
Spain	5.4	26%	45%
Sweden	18.5	56%	68%
Norway	24.6	65%	76%
	R^2 [4]	0.071	0.050





[1] Relative overall patent costs for SMEs (administrative + maintenance 20 years) to GDP (billion €) in 2011
[2] % of SMEs (10-49 employees) engaged in-house R&D activities
[3] % of SMEs (50-249 employees) engaged in-house R&D activities
[4] Linear regression: coefficient of determination

Note1: only countries with available data
Note 2: Administrative costs for 6 European countries and 13 European countries patents are pre-grant and designation fees charged by the EPO plus validation fees charged by NPOs. Maintenance fees are the sum of maintenance fees charged by each NPO. GDP value used to calculate relative costs for European 6 and 13 countries aggregates is the sum of the GDPs of the countries where the patent is validated

Sources: NPOs, Eurostat

[38] http://ec.europa.eu/enterprise/policies/innovation/policy/innovation-scoreboard/index_en.htm

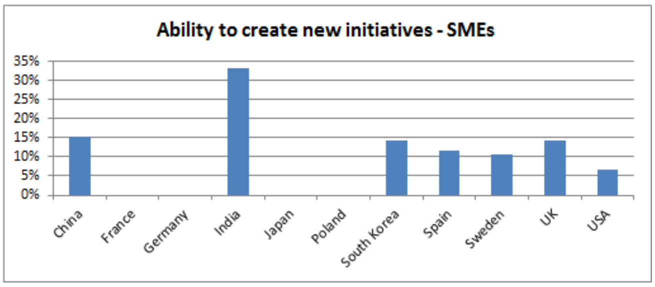
The linear regression of the results do not allow to infer a potential relation between overall patent costs and the percentage of SMEs engaged in R&D activities independently of their size in terms of employees.

Entrepreneurial activity (new initiatives)

Table 21 - Creation of new initiatives

SMEs

Country of origin	Interviews	Ability to create new initiatives [1]
China	13	15%
France	16	0%
Germany	11	0%
India	6	33%
Japan	19	0%
Poland	6	0%
South Korea	7	14%
Spain	26	12%
Sweden	19	11%
UK	14	14%
USA	15	7%



[1] "In what measure have patent costs influenced your entity in the following matters? Ability to create new initiatives" (percentage of respondents that consider patent costs have a high impact)

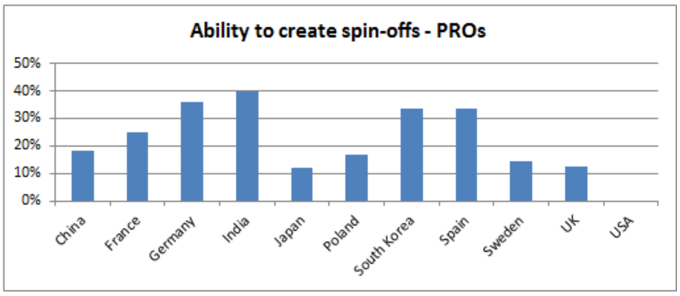
Source: everis survey 2013

Entrepreneurial activity (new spin-offs)

Table 22 - PROs' and Universities' ability to create spin-offs

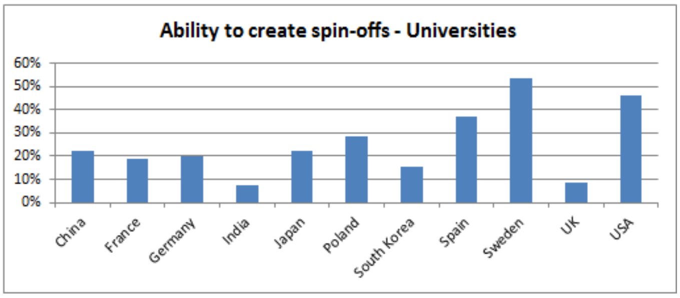
PROs

Country of origin	Interviews	Ability to create spin-offs [1]
China	11	18%
France	12	25%
Germany	14	36%
India	5	40%
Japan	17	12%
Poland	6	17%
South Korea	6	33%
Spain	9	33%
Sweden	7	14%
UK	8	13%
USA	1	0%



Universities

Country of origin	Interviews	Ability to create spin-offs [1]
China	18	22%
France	16	19%
Germany	10	20%
India	14	7%
Japan	18	22%
Poland	7	29%
South Korea	13	15%
Spain	19	37%
Sweden	15	53%
UK	23	9%
USA	13	46%



[1] "In what measure have patent costs influenced your entity in the following matters? Ability to create spin-offs" (percentage of respondents that consider patent costs have a high impact)

Source: everis survey 2013

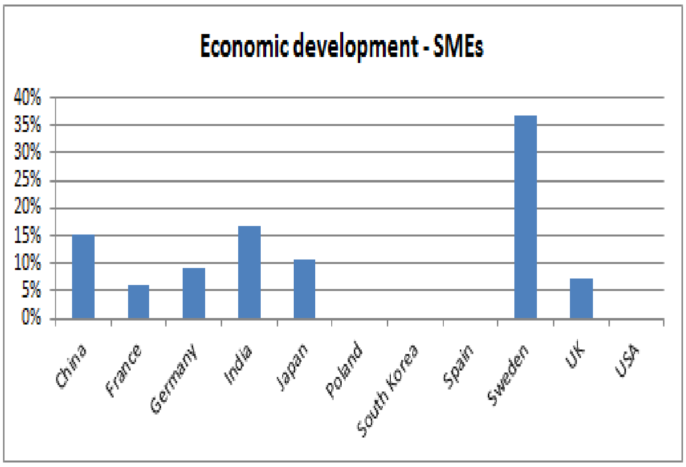
Regarding the relation between entrepreneurial activity (creation of initiatives/spin-offs) and patent costs, the survey does not display clear evidence. With the exception of Indian SMEs, less than 9% of the respondents on average report that the creation of new firms may be influenced by patent costs. At the PRO/University level, interviewees that report that patent costs may influence the creation of spin-offs are nearly three times higher than in the case of SMEs (24% and 25% for PROS and SMEs respectively). This may be explained by the fact that spin-off creation is a usual Technology Transfer alternative promoted by TTOs. Overall, and considering the reduced number of answers in some cases, it seems that entrepreneurial projects are, up to some extent, affected by the overall patent costs, but the impact for SMEs does not seem important. It must be noted that, at the time the survey was conducted, India, France, Japan and the USA have reduced fees for SMEs, PROS and Universities.

Entrepreneurship seen at the SME level (creation of new initiatives) and PRO & University level (spin-off creation) is thought as being a phenomenon based on the strategic value of concrete technologies / envisaged projects, and is therefore very dependent on the specific sample of entities surveyed in this case.

Growth of SMEs

Table 23 - Growth of SMEs

Country of origin	Interviews	Economic development [1]
China	13	15%
France	16	6%
Germany	11	9%
India	6	17%
Japan	19	11%
Poland	6	0%
South Korea	7	0%
Spain	26	0%
Sweden	19	37%
UK	14	7%
USA	15	0%



[1] "In what measure have patent costs influenced your entity in the following matters? Economic development" (percentage of respondents that consider patent costs have a high impact)

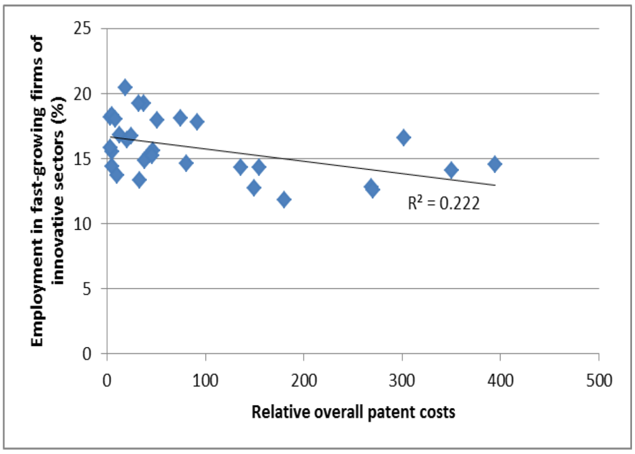
Source: everis survey 2013

In order to identify links between patent costs and the growth of SMEs, a potential relation between fast growing SMEs and overall patent costs has been explored. The Innovation Output Scoreboard and the Innovation Output Indicator both provide an indicator for fast growing SMEs. The indicator shows the degree of innovativeness of successful entrepreneurial activities. It captures the capacity of a country to transform its economy rapidly to take advantage of emerging demand.

Fast-growing enterprises are defined as firms with average annual growth in employees of more than 10% a year, over a three-year period, and with 10 or more employees at the beginning of the observation period. The sum of sectorial results for the employment in fast-growing enterprises by economic sector is then multiplied by the innovation coefficients of these sectors and finally, the result is divided by the total employment in fast-growing enterprises in the business economy (without financial sector).

Table 24 – Employment in fast growing SMEs vs Relative overall patent costs (2011)

Patent office	Relative overall costs (administrative + maintenance) to GDP (billion €) [1]	Employment in fast-growing firms of innovative sectors [2]
Austria	43.3	15.3
Belgium	12.7	16.8
Bulgaria	180.7	11.8
Croatia	136.0	14.3
Cyprus	269.1	12.8
Czech Republic	46.6	15.6
Denmark	37.4	19.2
Estonia	350.4	14.1
Finland	51.2	17.9
France	3.0	18.2
Germany	5.3	18.3
Greece	38.0	14.8
Hungary	91.4	17.8
Ireland	31.8	19.2
Italy	5.4	14.4
Latvia	270.1	12.6
Lithuania	150.0	12.7
Luxembourg	74.6	18.1
Malta	394.3	14.5
Netherlands	20.0	16.4
Poland	10.1	13.7
Portugal	33.2	13.3
Romania	45.8	15.2
Slovakia	80.6	14.6
Slovenia	155.0	14.3
Spain	5.4	15.5
Sweden	18.5	20.4
UK	3.1	15.8
Iceland	301.8	16.6
Norway	24.6	16.7
Switzerland	8.8	18
	R^2 [3]	0.222



[1] Relative overall patent costs for SMEs (administrative + maintenance 20 years) to GDP (billion €) in 2011
[2] Employment in fast-growing firms (2011) of innovative sectors as calculated for the Innovation Union Scoreboard
[3] Linear regression: coefficient of determination

Note 1: only countries with available data
Note 2: Administrative costs for 6 European countries and 13 European countries patents are pre-grant and designation fees charged by the EPO plus validation fees charged by NPOs. Maintenance fees are the sum of maintenance fees charged by each NPO. GDP value used to calculate relative costs for European 6 and 13 countries aggregates is the sum of the GDPs of the countries where the patent is validated

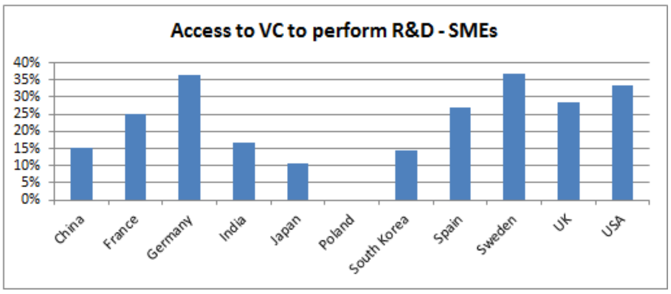
The low value of the determination coefficient does not allow establishing a linear relationship between the employment rate of fast growing firms and patent costs.

Access to venture capital for SMEs to perform R&D

Venture capital has increased its importance in the development of early stage innovative firms. Many reasons may explain the growth of venture capital as a way of obtaining funding. The most important ones are the creation of legal frameworks that support VC investors, the implementation of financial markets like NASDAQ in the USA or the "Neuer Markt" in Germany which are especially suited for the floatation of young companies or the development of myriad of ICT start-ups with attractive growth rates for investors.

Table 25 - Access to venture capital for SMEs to perform R&D

Country of origin	Interviews	Access to VC to perform R&D [1]
China	13	15%
France	16	25%
Germany	11	36%
India	6	17%
Japan	19	11%
Poland	6	0%
South Korea	7	14%
Spain	26	27%
Sweden	19	37%
UK	14	29%
USA	15	33%



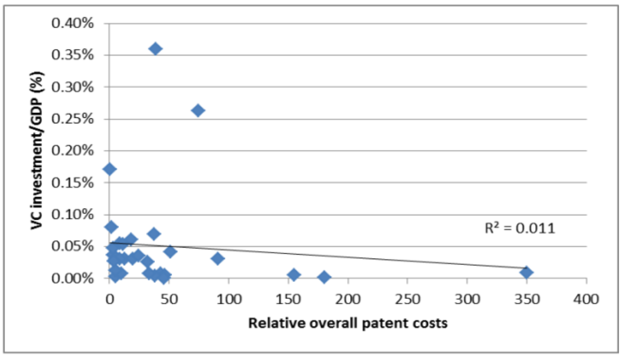
[1] "In what measure have patent costs influenced your entity in the following matters? Access to venture capital to perform R&D" (percentage of respondents that consider patent costs have a high impact)

Source: everis survey 2013

In order to explore any potential relationship between patent costs for SMEs (the ones more likely to receive VC funding at an early stage) and VC investment, data of VC investment as of GDP for the countries covered in the research has been collected and they are shown below:

Table 26 – Venture capital investment/GDP vs Relative overall patent costs (2011)

Patent office	Relative overall costs (administrative + maintenance) to GDP (billion €) [1]	VC investment/GDP (%) [2]
Austria	43.3	0.008%
Belgium	12.7	0.031%
Bulgaria	180.7	0.001%
Czech Republic	46.6	0.005%
Denmark	37.4	0.069%
Estonia	350.4	0.008%
Finland	51.2	0.041%
France	3.0	0.036%
Germany	5.3	0.030%
Greece	38.0	0.004%
Hungary	91.4	0.031%
Ireland	31.8	0.025%
Italy	5.4	0.003%
Luxembourg	74.6	0.263%
Netherlands	20.0	0.031%
Poland	10.1	0.007%
Portugal	33.2	0.008%
Romania	45.8	0.000%
Slovenia	155.0	0.005%
Spain	5.4	0.012%
Sweden	18.5	0.061%
UK	3.1	0.047%
6 European countries [4]	5.8	0.031%
13 European countries [5]	8.8	0.031%
Norway	24.6	0.035%
Switzerland	8.8	0.055%
Canada	1.8	0.080%
Israel	38.7	0.360%
Japan	3.5	0.026%
South Korea	11.7	0.054%
USA	0.4	0.171%
	R^2 [3]	0.011



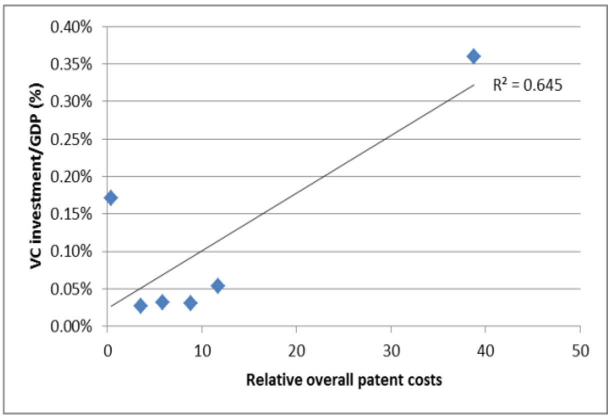
[1] Relative overall patent costs for SMEs (administrative + maintenance 20 years) to GDP (billion €) in 2011
[2] VC investment in early stage (seed and start-up) and later stage as of GDP (%) for 2011 except Israel, South Korea and USA (2012)
[3] Linear regression: coefficient of determination
[4] Costs for a European patent validated in 6 countries (DE, FR, IT, NL, CH and UK)
[5] Costs for an European patent validated in 13 countries (DE, FR, IT, NL, CH, UK, AT, BE, DK, FI, IE, ES and SE)

Note 1: only countries with available data
Note 2: Administrative costs for 6 European countries and 13 European countries patents are pre-grant and designation fees charged by the EPO plus validation fees charged by NPOs. Maintenance fees are the sum of maintenance fees charged by each NPO. GDP value used to calculate relative costs for European 6 and 13 countries aggregates is the sum of the GDPs of the countries where the patent is validated

Source: NPOs, World Bank, Eurostat and OECD (EE, SI, IL, CA, JP, KR and USA)

Table 27 – Venture capital investment/GDP vs Relative overall patent costs for selected NPOs (2011)

Patent office	Relative overall costs (administrative + maintenance) to GDP (billion €) [1]	VC investment / GDP (%) [2]
6 European countries [4]	5.8	0.031%
13 European countries [5]	8.8	0.031%
Israel	38.7	0.360%
Japan	3.5	0.026%
South Korea	11.7	0.054%
USA	0.4	0.171%
	R^2 [3]	0.645



[1] Relative overall patent costs (administrative + maintenance 20 years) to GDP (billion €) in 2011
[2] VC investment in early stage (seed and start-up) and later stage as of GDP (%) for 2011 except Israel, South Korea and USA (2012)
[3] Linear regression: coefficient of determination
[4] Costs for a European Patent validated in 6 countries (DE, FR, IT, NL, CH and UK)
[5] Costs for an European Patent validated in 13 countries (DE, FR, IT, NL, CH, UK, AT, BE, DK, FI, IE, ES and SE)

Note 1: data for China not available
Note 2: Administrative costs for 6 European countries and 13 European countries patents are pre-grant and designation fees charged by the EPO plus validation fees charged by NPOs. Maintenance fees are the sum of maintenance fees charged by each NPO. GDP value used to calculate relative costs for European 6 and 13 countries aggregates is the sum of the GDPs of the countries where the patent is validated

Source: NPOs, World Bank, Eurostat and OECD (IL, JP, KR and USA)

The low determination coefficient for the first case does not allow inferring any potential relation between the two variables. Regarding the case where only data for selected countries/group of countries is shown (6 European countries patent, 13 European countries patent, Israel, Japan, South Korea and the USA), the potential positive correlation of VC investment and patent costs needs to be interpreted cautiously due to the low determination coefficient and the small sample. Several hypotheses may explain the lack of conclusive findings:

- Different degrees of development of VC industry in each country: Countries such as the USA or Israel have a well establish network of investors with VCs that can manage funds of hundreds or even thousands million dollars that are able to provide seed stage funding as well as later stage rounds. In other countries VCs and angel investors are mostly focused on seed or early stage rounds which amount for a fraction of the volume of investment of developed markets for VC.

- Cross-border flows of start-ups: start-ups that seek later stage rounds of funding migrate to VC attraction poles such as the Silicon Valley, Massachusetts or London in Europe, where it is possible to obtain advanced funding rounds.

- Importance of IP protection in innovative start-ups: some ICT start-ups which account for an important number of VC deals do not always rely on patents since they innovate in their business model. This does not preclude that when young start-ups reach later stages of development they may protect any IP they generate.

The relation between patents, innovation and VC funding has been studied in the literature. Engel and Keilbach[39] analysed the impact of venture capital on growth and innovation of young German firms. The authors compared a sample of VC backed firms with a control group and they concluded that VC backed firms have a larger start-up size, a larger and better educated management team and have a **larger number of patents at their foundation date**. Their research also shows that **having one or more patents before their foundation date increases the probability of getting VC funding** in the start-up's first year of activity.

Based on a matching procedure aimed at minimizing the statistical bias due to systematic selection of firms, the authors find evidence that venture funded firms display higher growth rates compared

[39] Firm Level Implications of Early Stage Venture Capital Investment – An empirical investigation. Dirk Engel, Max Keilbach (2007).

to non VC backed firms. The number of patent applications of VC funded firms is also higher than non VC funded firms (weakly significant when considered overall but not significant for industry aggregates) but this was also the case before the engagement of VCs. The probability of applying for at least one additional is higher for VC funded firms but the difference is insignificant. Therefore, the authors conclude that there is weak evidence supporting the idea that firms funded by VCs have a different patenting behaviour.

Hirukawa and Ueda[40] continued the work carried by Kortum and Lerner (KL) (2000) regarding the impact of VC contributing positively to patent counts at industry level in the period ranging from 1988 to 1992. The authors extend the period of time considered to 2001 and find that the impact of VC in patent counts increases in the period 1968-2001 compared with the period 1968-1992. Therefore VC effect on patent counts increased in the 1990s.

Additionally, the authors also consider other innovation metrics different than patent counts like the Total Factor Productivity and labour productivity. In the case of Total Factor Productivity no conclusive results support a positive impact of VC investment. Labour productivity is affected positively by VC investment however this effect may be explained by the technology substitution input factors away from labour.

Other interesting findings and discussions in this paper are related with the reasons why VC increases the patent propensity of the industry:

- Established firms are found to increase the originality of their patents to compete with non-public firms when VC investment increases. This finding contradicts previous research that suggested that established firms should file blocking patents leading to a deterioration of patent quality.
- Start-ups tend to use patents as a way to appropriate returns on innovation. This is due to the fact that start-ups cannot use other appropriation methods, such as secrecy, since most of them do not own their manufacturing and marketing capacities.
- Start-ups increase their patent propensity because patents are considered as a mean to obtain funding. Engel and Keilbach also consider patents as a way to increase the probability to obtain funding since patents are supposed to prove the innovative performance.
- Start-ups are considered to use patents as a way to reduce the risk of VCs expropriating their inventions.

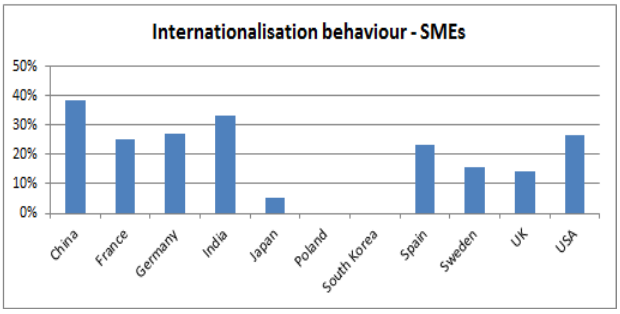
Summing up these findings and comments, patents can be considered a prerequisite to obtain funding. Most early stage start-ups have no income and funding constraints, therefore patent cost may become a burden for patenting. Incentives for start-ups, in the form of price reductions for SMEs, may increase the chances of survival for these firms in their early stages.

Internationalisation behaviour of SMEs

Patents can be used as an indicator of the internationalisation of companies. Companies willing to enter a certain market may decide to protect their inventions in that specific market and patent costs may represent an obstacle for this.

Table 28 - Internationalisation behaviour of SMEs

Country of origin	Interviews	Internationalisation behaviour [1]
China	13	38%
France	16	25%
Germany	11	27%
India	6	33%
Japan	19	5%
Poland	6	0%
South Korea	7	0%
Spain	26	23%
Sweden	19	16%
UK	14	14%
USA	15	27%



[1] "In what measure have patent costs influenced your entity in the following matters? Internationalisation behaviour" (percentage of respondents that consider patent costs have a high impact)

Source: everis survey 2013

[40] Venture capital and industrial "Innovation" Masayuki Hirukawa, Masako Ueda 2013

Despite the relative small sample for each of the countries surveyed, the influence of patent cost as a barrier for internationalisation among the SMEs can be considered to be low.

SMEs from China and India are the two countries surveyed that most frequently report patent costs as a barrier to internationalise their IP. Chinese SMEs must incur into translation costs to file a patent at the EPO and, like Indian companies, face the ratio of fees/GDP per capita of the 11 countries surveyed.

27% of German SMEs surveyed also report that patent costs are a burden for the internationalisation of their IP. This can be explained by the comparatively high relative costs of patenting outside Germany in other countries except for the UK and France (and indeed the same can be said for these two countries).

USA's SMEs may consider costs relevant since the relative overall costs in their home market are the lowest of all the countries covered in this study. Besides the higher relative validation and maintenance costs required to file a European patent in the most relevant countries, the potential higher process costs arising from a more thorough examination process may act as deterrent for American applicants.

Only 1 out the 19 Japanese SMEs (approx. 5%) surveyed report patent costs as a barrier for the internationalisation of IP. However, fees can be considered more accessible for Japanese SMEs compared with other Asian countries since Japan's GDP per capita is nearly 8 times bigger than China's or 30 times higher than India's. The same can be said about Swedish SMEs taking into account that its GDP per capita is the highest of all the countries surveyed.

In order to further explore the impact of patent costs on the internationalisation of companies, the share of high tech exports[41], which are the ones that most frequently rely on patents, over total exports[42] has been calculated (data breakdown according to the size of the company is not available). The ratio has been represented against the overall cost in the following figures:

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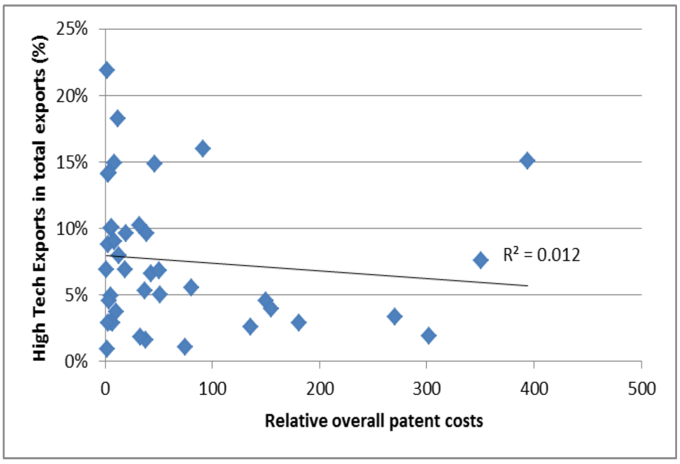
[41] http://data.worldbank.org/indicator/TX.VAL.TECH.CD

[42] http://data.worldbank.org/indicator/NE.EXP.GNFS.CD

Table 29 – Share of high tech exports in total exports vs Relative overall patent costs (2011)

Patent office	Relative overall costs (administrative + maintenance) to GDP (billion €) [1]	Percentage of High Tech exports/ Total exports [2]
Austria	43.3	6.6%
Belgium	12.7	7.9%
Bulgaria	180.7	2.9%
Croatia	136.0	2.6%
Czech Republic	46.6	14.8%
Denmark	37.4	5.3%
Estonia	350.4	7.5%
Finland	51.2	5.0%
France	3.2	14.0%
Germany	5.3	10.0%
Greece	38.0	1.6%
Hungary	91.4	16.0%
Ireland	31.8	10.2%
Italy	5.4	4.9%
Latvia	270.1	3.3%
Lithuania	150.0	4.6%
Luxembourg	74.6	1.1%
Malta	394.3	15.0%
Netherlands	20.0	9.6%
Poland	10.1	3.7%
Portugal	33.2	1.8%
Romania	50.3	6.8%
Slovakia	80.6	5.5%
Slovenia	155.0	3.9%
Spain	5.4	3.0%
Sweden	18.5	6.9%
UK	3.1	8.8%
6 European countries [4]	5.8	10.04%
13 European countries [5]	8.8	9.02%
Iceland	301.8	1.9%
Switzerland	8.8	14.9%
Brazil	6.7	2.9%
Canada	3.6	4.6%
China	1.8	21.9%
India	2.5	2.9%
Israel	38.7	9.6%
Japan	3.8	14.2%
Russia	1.9	0.9%
South Korea	11.7	18.2%
USA	0.8	6.9%
	R^2 [3]	0.012



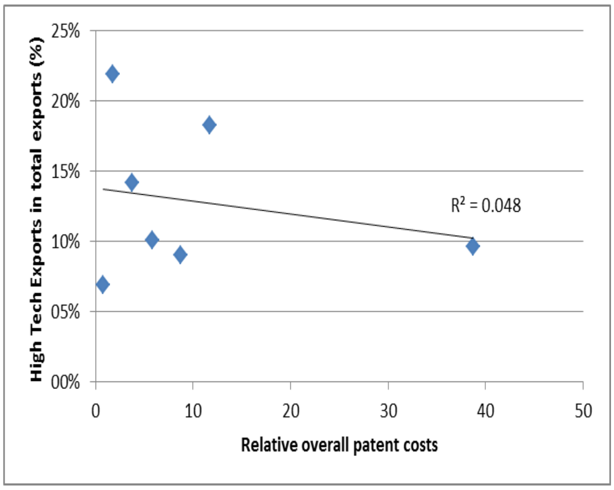
[1] Relative overall patent costs (administrative + maintenance 20 years) to GDP (billion €) in 2011
[2] High tech exports over total exports of manufactured goods in 2011 except for Norway (2010)
[3] Linear regression: coefficient of determination
[4] Costs for a European patent validated in 6 countries (DE, FR, IT, NL, CH and UK)
[5] Costs for an European patent validated in 13 countries (DE, FR, IT, NL, CH, UK, AT, BE, DK, FI, IE, ES and SE)

Note 1: only countries with available data
Note 2: Administrative costs for 6 European countries and 13 European countries patents are pre-grant and designation fees charged by the EPO plus validation fees charged by NPOs. Maintenance fees are the sum of maintenance fees charged by each NPO. GDP value used to calculate relative costs for European 6 and 13 countries aggregates is the sum of the GDPs of the countries where the patent is validated

Sources: NPOs, World Bank

Table 30 – Share of high tech exports in total exports vs Relative overall patent costs for selected countries (2011)

Patent office	Relative overall costs (administrative + maintenance) to GDP (billion €) [1]	Porcentage of High Tech exports/ Total exports [2]
6 European countries [4]	5.8	10.0%
13 European countries [5]	8.8	9.0%
China	1.8	21.9%
Israel	38.7	9.6%
Japan	3.8	14.2%
South Korea	11.7	18.2%
USA	0.8	6.9%
	R^2 [3]	0.048



[1] Relative overall patent costs (administrative + maintenance 20 years) to GDP (billion €) in 2011
[2] High tech exports over total exports of manufactured goods in 2011
[3] Linear regression: coefficient of determination
[4] Costs for a European patent validated in 6 countries (DE, FR, IT, NL, CH and UK)
[5] Costs for an European patent validated in 13 countries (DE, FR, IT, NL, CH, UK, AT, BE, DK, FI, IE, ES and SE)

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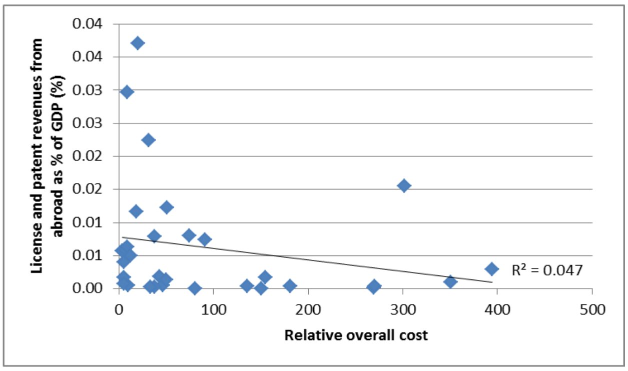
Sources: NPOs, World Bank

Low determination coefficients for both sets of countries are too low to infer any potential relation between the share of high tech exports and the overall patent costs.

Internationalisation of technology can be seen from the perspective of revenues and patent revenues coming from abroad too. This indicator is calculated in the Innovation Union Scoreboard with the reported data shown below and potential relations with relative patent costs have been explored.

Table 31 – Licenses and patent revenues from abroad as % of GDP vs Relative overall patent costs (2011)

Patent office	Relative overall costs (administrative + maintenance) to GDP (billion €) [1]	License and patent revenues from abroad as % of GDP [2]
Austria	43.3	0.19%
Belgium	12.7	0.50%
Bulgaria	180.7	0.03%
Croatia	136.0	0.04%
Cyprus	269.1	0.01%
Czech Republic	46.6	0.05%
Denmark	37.4	0.79%
Estonia	350.4	0.10%
Finland	51.2	1.23%
France	3.2	0.56%
Germany	5.3	0.40%
Greece	38.0	0.02%
Hungary	91.4	0.74%
Ireland	31.8	2.24%
Italy	5.4	0.17%
Latvia	270.1	0.04%
Lithuania	150.0	0.00%
Luxembourg	74.6	0.80%
Malta	394.3	0.30%
Netherlands	20.0	3.70%
Poland	10.1	0.05%
Portugal	33.2	0.03%
Romania	50.3	0.13%
Slovakia	80.6	0.00%
Slovenia	155.0	0.17%
Spain	5.4	0.07%
Sweden	18.5	1.16%
UK	3.1	0.58%
6 European countries [4]	5.8	0.60%
13 European countries [5]	8.8	0.63%
Iceland	301.8	1.55%
Switzerland	8.8	2.96%
	R^2 [3]	0.0475



[1] Relative overall patent costs (administrative + maintenance 20 years) to GDP (billion €) in 2011
[2] License and patent revenues from abroad as % of GDP for 2011
[3] Linear regression: coefficient of determination
[4] Costs for a European patent validated in 6 countries (DE, FR, IT, NL, CH and UK)
[5] Costs for an European patent validated in 13 countries (DE, FR, IT, NL, CH, UK, AT, BE, DK, FI, IE, ES and SE)

Note 1: only countries with available data
Note 2: Administrative costs for 6 European countries and 13 European countries patents are pre-grant and designation fees charged by the EPO plus validation fees charged by NPOs. Maintenance fees are the sum of maintenance fees charged by each NPO. GDP value used to calculate relative costs for European 6 and 13 countries aggregates is the sum of the GDPs of the countries where the patent is validated

Sources: NPOs, World Bank and EC (Innovation Union Scoreboard database 2014)

Like in the previous case, the determination coefficient is too low to infer any potential relation between licenses and patent revenues and overall patent costs.

Internationalisation of technology measured by patent validation flows has been studied in the literature. Harhoff, Hoisl, Reichl and van Pottelsberghe[43] used a gravity model to identify the major factors affecting the validation behaviour of European Patents. The factors identified by the authors were:

- Wealth (GDP per capita) and size (number of inhabitants) the applicant country.
- Wealth and size of the targeted validation country.
- Distance between capital cities.
- EPC member duration.
- Patent costs which are divided into validation fees, maintenance fees (from years 4-6) and translation costs.

From the above mentioned factors, wealth and size of the applicant country are more important than the same parameters of the destination country. An increase of 1% of the GDP in the applicant country increases the validation flows 1.5% while 1% increase of the GDP of the

[43] Patent validation at the country level - The role of fees and translation costs. Dietmar Harhoff, Karin Hoisl, Bettina Reichl and Bruno van Pottelsberghe de la Potterie. (2009).

validation country accounts for an increase of 0.7%. An increase of 1% of the population of the applicant country increases patent validation flows 0.9% (0.35% for the validation country).

Distance between capital cities is found to affect negatively validation flows. An increase of 1% of the distance reduces patent flows 0.5%.

EPC membership duration is found to be correlated to the wealth of the validation country and can be considered as proxy for the attractiveness of the validation country.

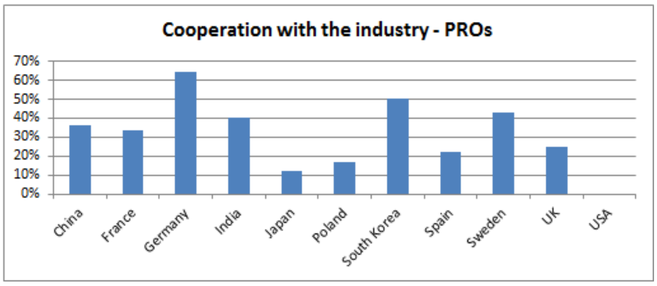
Validation and maintenance fees are significant with elasticities of -0.1 and -0.4 respectively. When factored together the elasticity is -0.5.

Research cooperation between SMEs, UNIs and PROs

Table 32 - Research cooperation between SMEs, UNIs and PROs

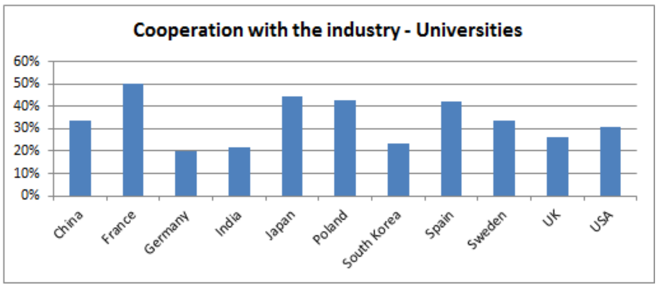
PROs

Country of origin	Interviews	Cooperation with the industry [1]
China	11	36%
France	12	33%
Germany	14	64%
India	5	40%
Japan	17	12%
Poland	6	17%
South Korea	6	50%
Spain	9	22%
Sweden	7	43%
UK	8	25%
USA	1	0%



Universities

Country of origin	Interviews	Cooperation with the industry [1]
China	18	33%
France	16	50%
Germany	10	20%
India	14	21%
Japan	18	44%
Poland	7	43%
South Korea	13	23%
Spain	19	42%
Sweden	15	33%
UK	23	26%
USA	13	31%



[1] "In what measure have patent costs influenced your entity in the following matters? Cooperation with the industry" (percentage of respondents that consider patent costs have a high impact)

Source: everis survey 2013

These tables show an interesting behaviour. In countries with a significant industrialisation degree the amount of "technology centres" (a special type of PRO) is high. These organisations usually act as a kind of liaison between more basic research (stemming from universities) and the needs of the industry. As can be seen, the cooperation with universities in South Korea and Germany is much lower than the cooperation with PROs.

4.4 Patenting costs investment & internationalisation impacts, barriers and burdens

The everis survey 2013 has been used to analyse the perception of the surveyed organisations on investment & internationalisation impacts, barriers and burdens regarding patenting process' costs. As mentioned in the previous section, this analysis has been carried out upon the information provided by the 414 respondents which completed the survey comprehensively.

The design of the sample (detailed below), which amounted originally to 413 participants (even though at the end of the survey 414 responses were obtained), was undertaken using stratified sampling based on an equilibrium influenced by the level of IP-growth and the R&D intensity of the countries and adjusted based on everis' knowledge of the marketplace.

EU country	Sample size
Spain	40
France	45
UK	45
Germany	30
Sweden	45
Poland	18
TOTAL	**223**

Non-EU country	Sample size
USA	45
Japan	45
China	40
South Korea	30
India	30
TOTAL	**190**

R&D Investments by SMEs and impact of patent costs

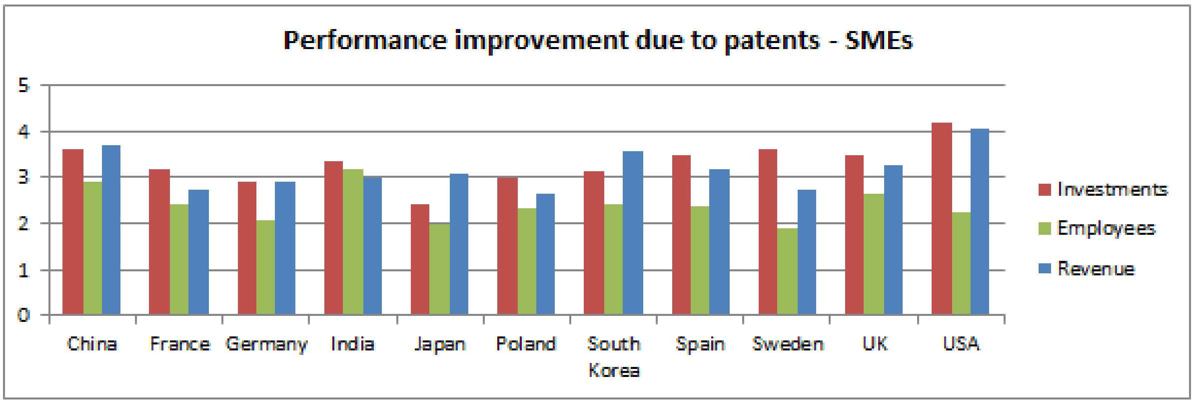
Table 33 - R&D Investments by SMEs and impact of patent costs

R&D Investments by SMEs

Country of origin	Revenue [1]	Expenditure on R&D [2]	Employees [3]
China	6,347,295 €	531,538 €	95
France	7,335,385 €	772,643 €	45
Germany	8,500,000 €	3,070,000 €	42
India	1,091,649 €	156,517 €	121
Japan	5,643,276 €	2,321,396 €	89
Poland	300,000 €	183,667 €	57
South Korea	21,205,400 €	906,600 €	109
Spain	3,968,260 €	607,306 €	36
Sweden	923,417 €	1,712,059 €	17
UK	8,047,500 €	4,667,857 €	43
USA	2,374,964 €	7,629,924 €	30

Impact of patent costs: improvement of performance due to patents (SMEs)

Country of origin	Revenue [4]	Investments [5]	Employees [6]
China	3.7	3.6	2.9
France	2.8	3.2	2.4
Germany	2.9	2.9	2.1
India	3.0	3.3	3.2
Japan	3.1	2.4	2.0
Poland	2.7	3.0	2.3
South Korea	3.6	3.1	2.4
Spain	3.2	3.5	2.4
Sweden	2.7	3.6	1.9
UK	3.3	3.5	2.6
USA	4.1	4.2	2.3



[1] "Approximately, what has been your company's last year revenue in Euros?" (Arithmetic mean of last year's revenue on R&D in euros)
[2] "Approximately, what has been your last year's expenditure on R&D?" (Arithmetic mean of last year's expenditure on R&D in euros)
[3] "What is the number of employees in your company?" (Arithmetic mean of the number of employees)
[4] "Does holding patents improve your performance in the following contexts? Revenue" (Arithmetic mean of the improvement of the companies' performance (1 - Completely disagree; 2 - Disagree; 3 - Partially agree; 4 - Agree; 5 - Completely agree))
[5] "Does holding patents improve your performance in the following contexts? Investments" (Arithmetic mean of the improvement of the companies' performance (1 - Completely disagree; 2 - Disagree; 3 - Partially agree; 4 - Agree; 5 - Completely agree))
[6] "Does holding patents improve your performance in the following contexts? Number of employees" (Arithmetic mean of the improvement of the companies' performance (1 - Completely disagree; 2 - Disagree; 3 - Partially agree; 4 - Agree; 5 - Completely agree))

Source: everis survey 2013

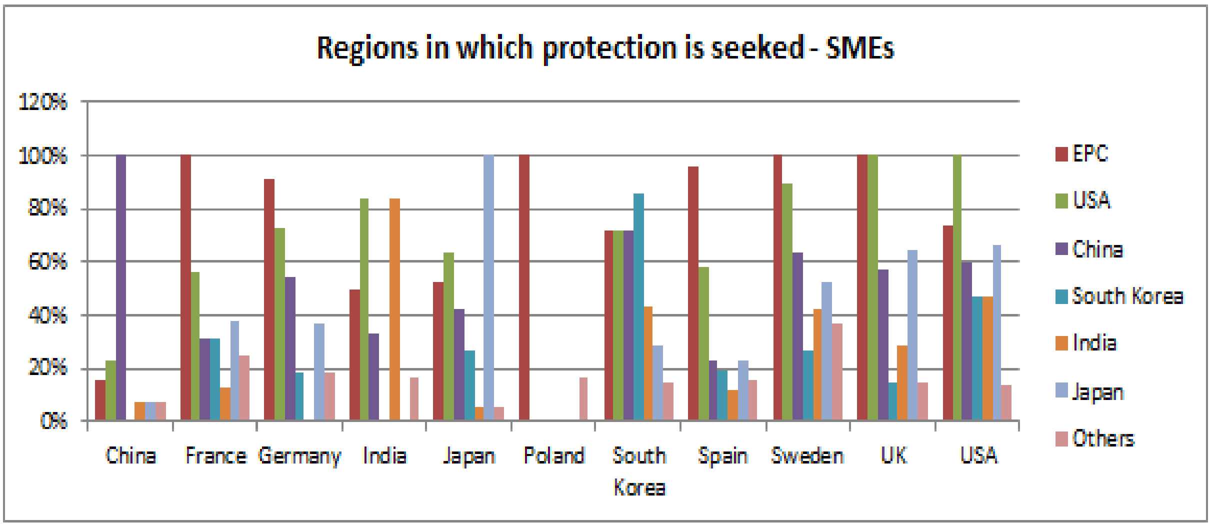
Regarding investment policy, revenues and employees growth of SMEs, it is important to point out that patents are seen as assets by SMEs and are developed and filed following strategic reasons, with a long-term return on investment and, therefore are not affected by short/mid-term actions undertaken by SMEs following business considerations.

International portfolio of SMEs, PROs and Universities

Table 34 - International portfolio of SMEs, PROs and Universities

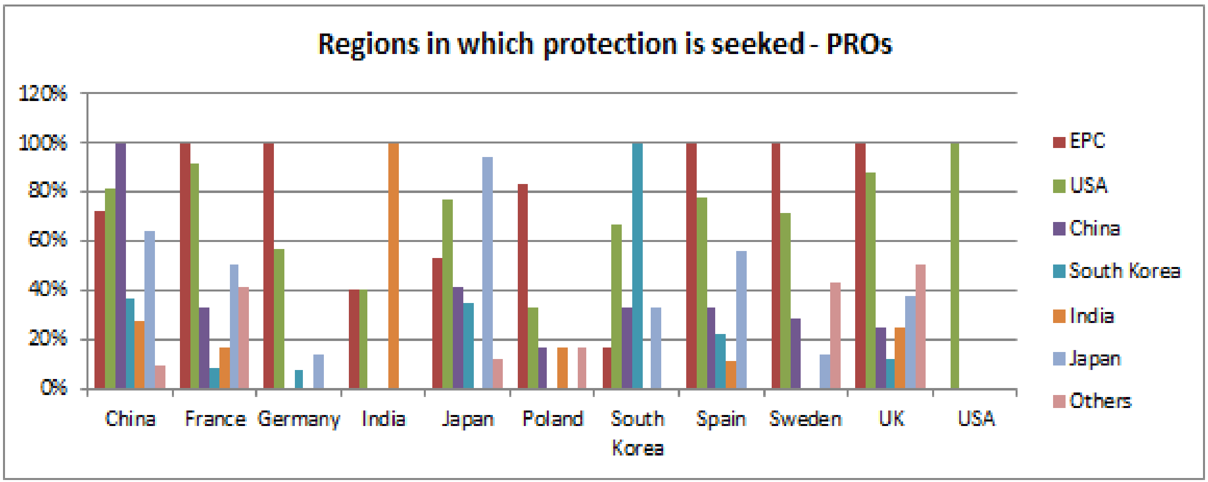
SMEs

	Regions [1]						
Country of origin	EPC	USA	China	South Korea	India	Japan	Others
China	15%	23%	100%	0%	8%	8%	8%
France	100%	56%	31%	31%	13%	38%	25%
Germany	91%	73%	55%	18%	0%	36%	18%
India	50%	83%	33%	0%	83%	0%	17%
Japan	53%	63%	42%	26%	5%	100%	5%
Poland	100%	0%	0%	0%	0%	0%	17%
South Korea	71%	71%	71%	86%	43%	29%	14%
Spain	96%	58%	23%	19%	12%	23%	15%
Sweden	100%	89%	63%	26%	42%	53%	37%
UK	100%	100%	57%	14%	29%	64%	14%
USA	73%	100%	60%	47%	47%	67%	13%



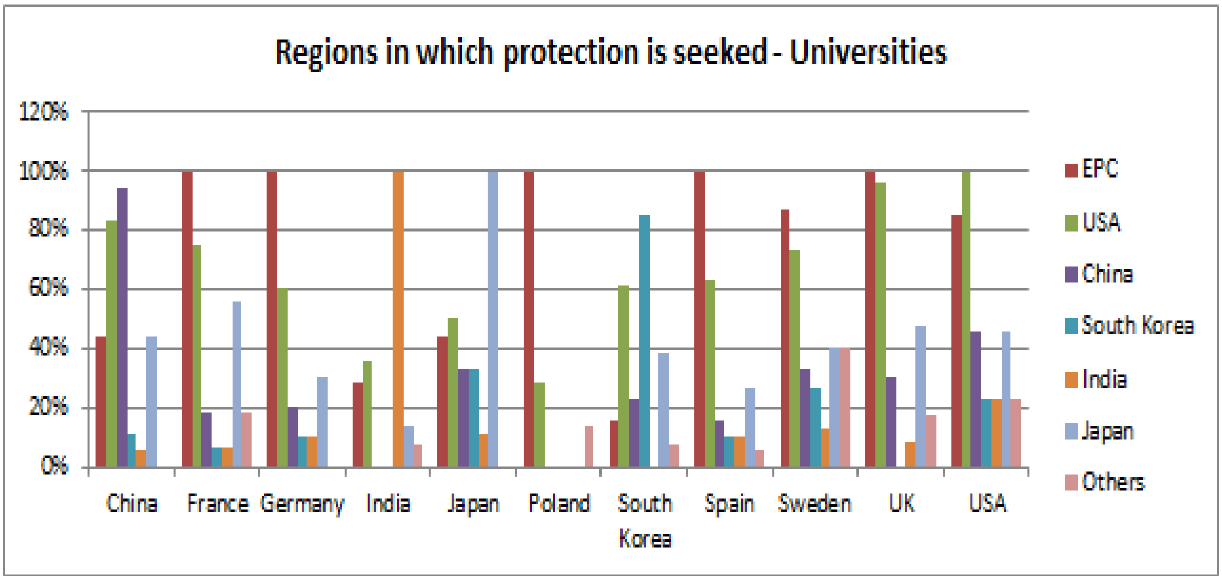
PROs

	Regions [1]						
Country of origin	EPC	USA	China	South Korea	India	Japan	Others
China	73%	82%	100%	36%	27%	64%	9%
France	100%	92%	33%	8%	17%	50%	42%
Germany	100%	57%	0%	7%	0%	14%	0%
India	40%	40%	0%	0%	100%	0%	0%
Japan	53%	76%	41%	35%	0%	94%	12%
Poland	83%	33%	17%	0%	17%	0%	17%
South Korea	17%	67%	33%	100%	0%	33%	0%
Spain	100%	78%	33%	22%	11%	56%	0%
Sweden	100%	71%	29%	0%	0%	14%	43%
UK	100%	88%	25%	13%	25%	38%	50%
USA	0%	100%	0%	0%	0%	0%	0%



Universities

	Regions [1]						
Country of origin	EPC	USA	China	South Korea	India	Japan	Others
China	44%	83%	94%	11%	6%	44%	0%
France	100%	75%	19%	6%	6%	56%	19%
Germany	100%	60%	20%	10%	10%	30%	0%
India	29%	36%	0%	0%	100%	14%	7%
Japan	44%	50%	33%	33%	11%	100%	0%
Poland	100%	29%	0%	0%	0%	0%	14%
South Korea	15%	62%	23%	85%	0%	38%	8%
Spain	100%	63%	16%	11%	11%	26%	5%
Sweden	87%	73%	33%	27%	13%	40%	40%
UK	100%	96%	30%	0%	9%	48%	17%
USA	85%	100%	46%	23%	23%	46%	23%



[1] "What regions does your entity usually seek protection in? Regions in which the entities usually seek protection in" (percentage of respondents that seek protection in each region)

Source: everis survey 2013

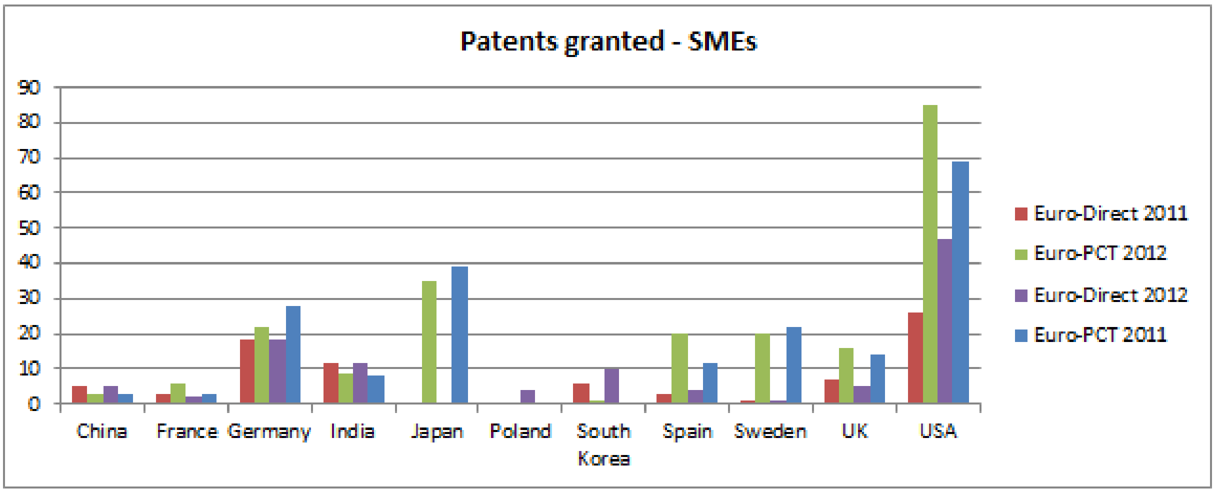
There is a clear homogeneity between the destination regions of the surveyed SMEs, PROs and Universities: all of them look for international protection in the EPC region, the USA and Japan, having the two first regions a mean value close to 70% of the surveyed entities. However, regarding SMEs there is a remarkable difference: SMEs would rather protect their technology in China (close to 50% of the cases) than Japan (40%) which is a clear indication of the increasing importance of China as a global economic player.

Granted patents of SMEs, PROs and Universities (2011, 2012)

Table 35 - Granted patents of SMEs, PROs and Universities (2011, 2012)

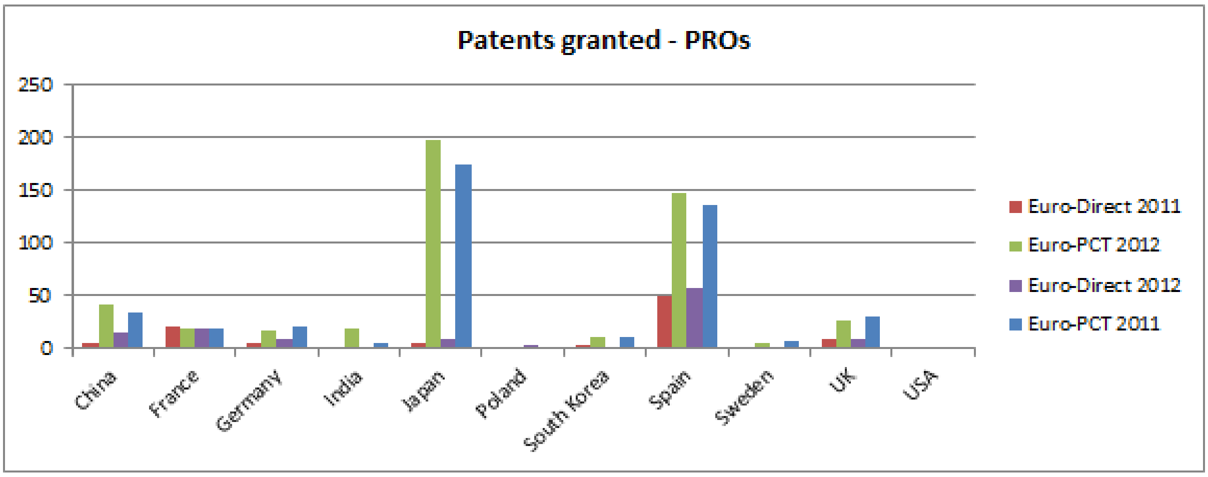
SMEs

	Patents granted			
	2011		2012	
Country of origin	Euro-PCT [1]	Euro-Direct [2]	Euro-PCT [3]	Euro-Direct [4]
China	3	5	3	5
France	3	3	6	2
Germany	28	18	22	18
India	8	12	9	12
Japan	39	0	35	0
Poland	0	0	0	4
South Korea	0	6	1	10
Spain	12	3	20	4
Sweden	22	1	20	1
UK	14	7	16	5
USA	69	26	85	47



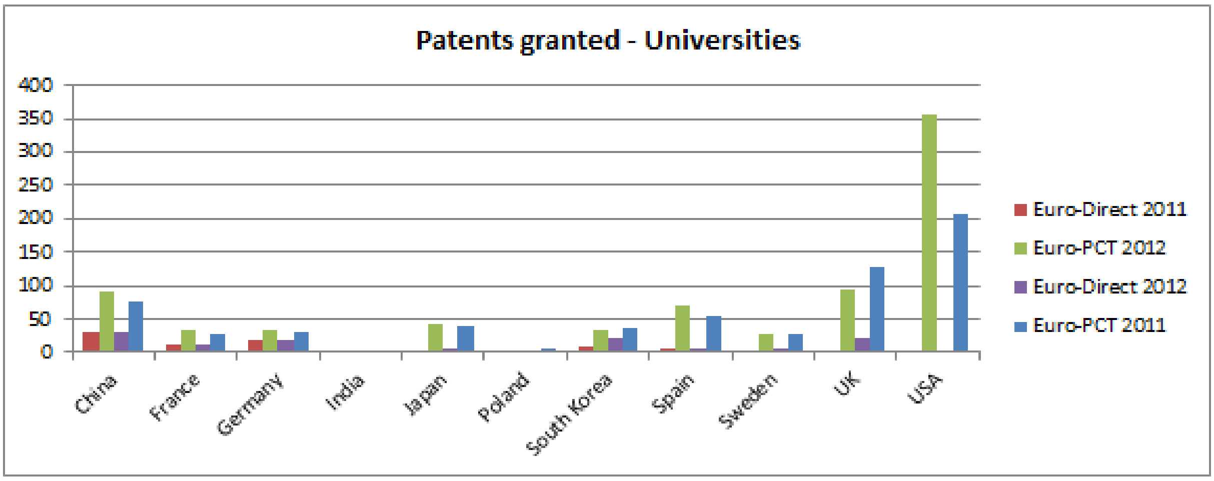
PROs

	Patents granted			
	2011		2012	
Country of origin	Euro-PCT [1]	Euro-Direct [2]	Euro-PCT [3]	Euro-Direct [4]
China	35	5	43	15
France	20	22	19	20
Germany	22	5	17	9
India	5	0	20	0
Japan	174	6	197	10
Poland	0	1	0	3
South Korea	12	3	12	1
Spain	136	50	147	57
Sweden	7	0	6	0
UK	30	10	26	10
USA	1	0	0	0



Universities

	Patents granted			
	2011		2012	
Country of origin	Euro-PCT [1]	Euro-Direct [2]	Euro-PCT [3]	Euro-Direct [4]
China	77	31	91	31
France	28	12	33	13
Germany	30	19	33	18
India	3	1	2	0
Japan	40	4	43	5
Poland	5	2	4	2
South Korea	35	9	34	20
Spain	55	5	69	5
Sweden	26	4	26	7
UK	128	3	94	22
USA	206	0	356	0



[1] Number of patents granted through Euro-PCT route in 2011
[2] Number of patents granted through Euro-Direct route in 2011
[3] Number of patents granted through Euro-PCT route in 2012
[4] Number of patents granted through Euro-Direct route in 2012

Source: everis survey 2013

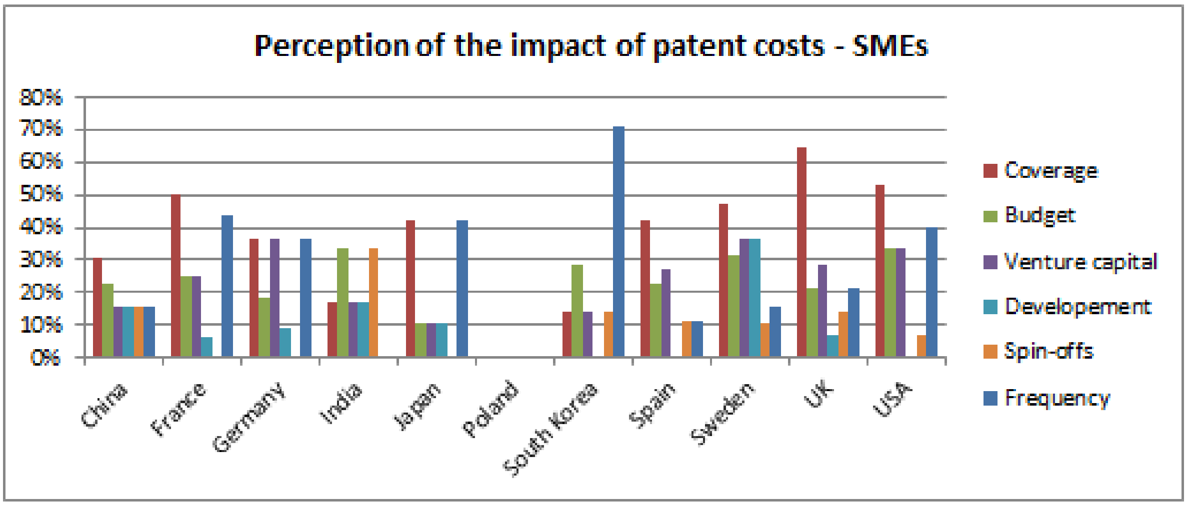
The data available from the survey makes it difficult to obtain a set of global conclusions. However, looking at the three large economies of Germany, the USA and Japan and focusing at the SME level, some comments can be made: (1) these countries display a clear leadership position in terms of patents granted; (2) Japan and the USA clearly rely more on the Euro-PCT route than the Euro-Direct, and (3) a large European economy like Germany displays a very close amount of patents granted following the two considered routes, which is a clear sign of the German bet on innovation and, therefore, patenting as the basis of the competitiveness of its world-class SMEs.

SME, PRO and Universities' perception of the impact of patent costs

Table 36 - SME, PRO and Universities' perception of the impact of patent costs

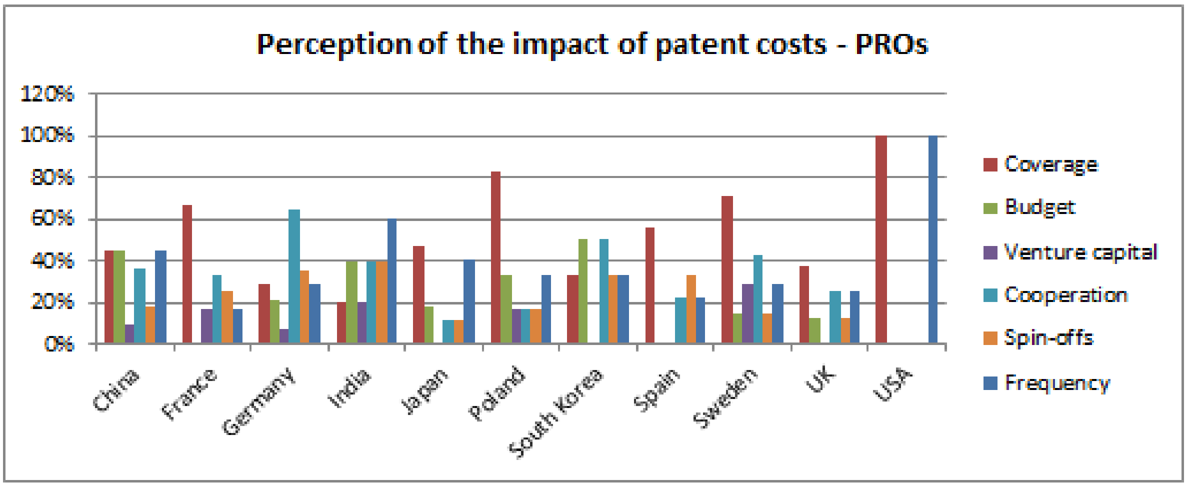
SMEs

	Perception of the impact of patent costs					
Country of origin	Frequency [1]	Coverage [2]	Budget [3]	VC [4]	Develop. [5]	Spin-offs [6]
China	15%	31%	23%	15%	15%	15%
France	44%	50%	25%	25%	6%	0%
Germany	36%	36%	18%	36%	9%	0%
India	0%	17%	33%	17%	17%	33%
Japan	42%	42%	11%	11%	11%	0%
Poland	0%	0%	0%	0%	0%	0%
South Korea	71%	14%	29%	14%	0%	14%
Spain	12%	42%	23%	27%	0%	12%
Sweden	16%	47%	32%	37%	37%	11%
UK	21%	64%	21%	29%	7%	14%
USA	40%	53%	33%	33%	0%	7%



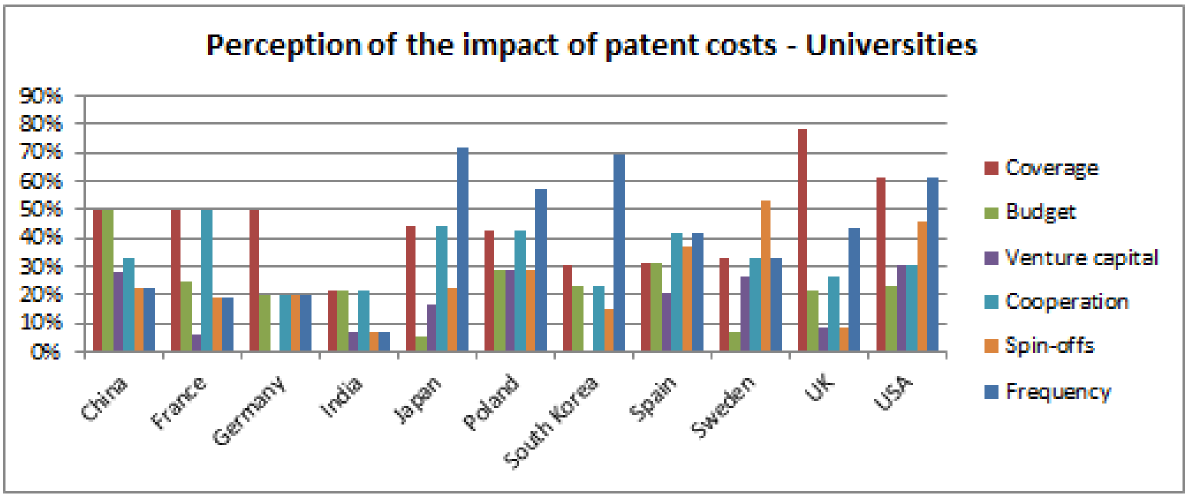
PROs

	Perception of the impact of patent costs					
Country of origin	Frequency [1]	Coverage [2]	Budget [3]	VC [4]	Cooper. [7]	Spin-offs [6]
China	45%	45%	45%	9%	36%	18%
France	17%	67%	0%	17%	33%	25%
Germany	29%	29%	21%	7%	64%	36%
India	60%	20%	40%	20%	40%	40%
Japan	41%	47%	18%	0%	12%	12%
Poland	33%	83%	33%	17%	17%	17%
South Korea	33%	33%	50%	0%	50%	33%
Spain	22%	56%	0%	0%	22%	33%
Sweden	29%	71%	14%	29%	43%	14%
UK	25%	38%	13%	0%	25%	13%
USA	100%	100%	0%	0%	0%	0%



Universities

	Perception of the impact of patent costs					
Country of origin	Frequency [1]	Coverage [2]	Budget [3]	VC [4]	Cooper. [7]	Spin-offs [6]
China	22%	50%	50%	28%	33%	22%
France	19%	50%	25%	6%	50%	19%
Germany	20%	50%	20%	0%	20%	20%
India	7%	21%	21%	7%	21%	7%
Japan	72%	44%	6%	17%	44%	22%
Poland	57%	43%	29%	29%	43%	29%
South Korea	69%	31%	23%	0%	23%	15%
Spain	42%	32%	32%	21%	42%	37%
Sweden	33%	33%	7%	27%	33%	53%
UK	43%	78%	22%	9%	26%	9%
USA	62%	62%	23%	31%	31%	46%



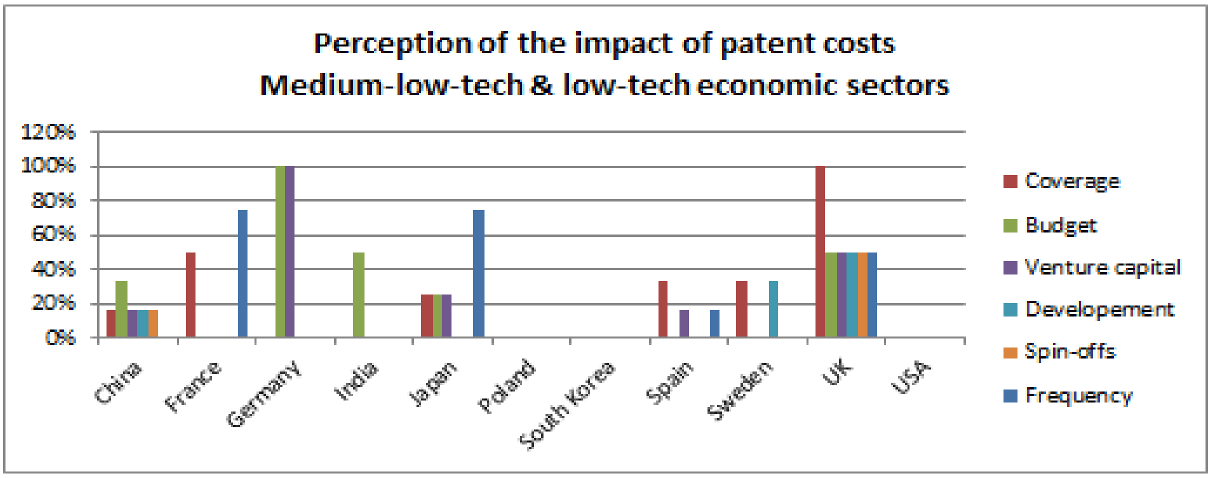
[1] "In what measure have patent costs influenced your entity in the following matters? Frequency of patent filings" (percentage of respondents that consider patent costs have a high impact)
[2] "In what measure have patent costs influenced your entity in the following matters? Geographical coverage of patents" (percentage of respondents that consider patent costs have a high impact)
[3] "In what measure have patent costs influenced your entity in the following matters? R&D budget" (percentage of respondents that consider patent costs have a high impact)
[4] "In what measure have patent costs influenced your entity in the following matters? Access to venture capital to perform R&D" (percentage of respondents that consider patent costs have a high impact)
[5] "In what measure have patent costs influenced your entity in the following matters? Economic development" (percentage of respondents that consider patent costs have a high impact)
[6] "In what measure have patent costs influenced your entity in the following matters? Ability to create spin-offs" (percentage of respondents that consider patent costs have a high impact)
[7] "In what measure have patent costs influenced your entity in the following matters? Cooperation with the industry" (percentage of respondents that consider patent costs have a high impact)

Source: everis survey 2013

SMEs' perception of the impact of patent costs, low/high tech economic sectors

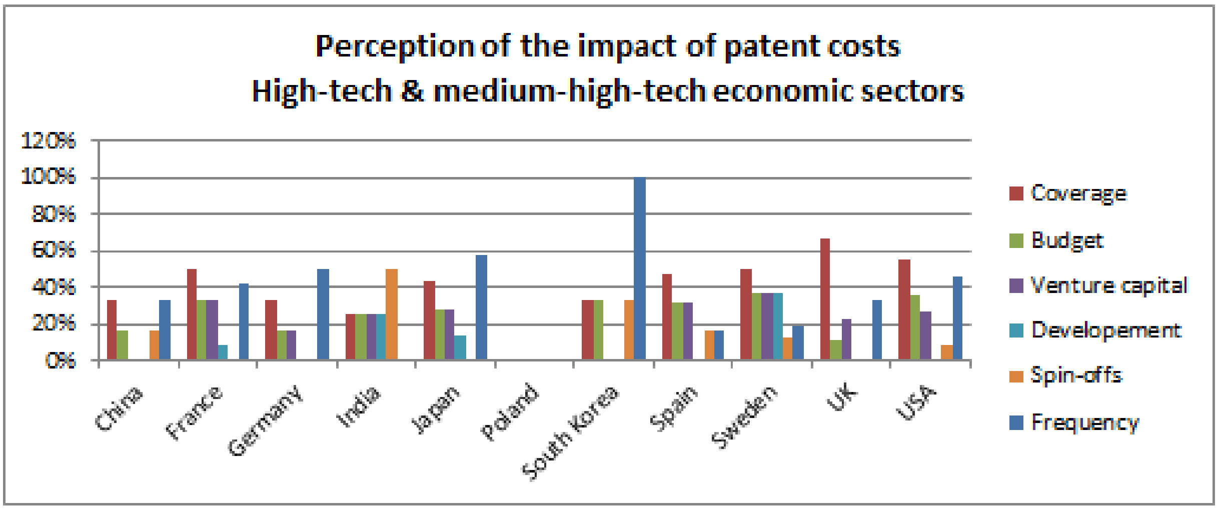
Table 37 - SMEs' perception of the impact of patent costs, low/high tech economic sectors. Medium-low-tech and low-tech economic sectors

	Perception of the impact of patent costs					
Country of origin	Frequency [1]	Coverage [2]	Budget [3]	VC [4]	Develop. [5]	Spin-offs [6]
China	0%	17%	33%	17%	17%	17%
France	75%	50%	0%	0%	0%	0%
Germany	0%	0%	100%	100%	0%	0%
India	0%	0%	50%	0%	0%	0%
Japan	75%	25%	25%	25%	0%	0%
Poland	0%	0%	0%	0%	0%	0%
South Korea	0%	0%	0%	0%	0%	0%
Spain	17%	33%	0%	17%	0%	0%
Sweden	0%	33%	0%	0%	33%	0%
UK	50%	100%	50%	50%	50%	50%
USA	0%	0%	0%	0%	0%	0%



High-tech and medium-high-tech economic sectors

	Perception of the impact of patent costs					
Country of origin	Frequency [1]	Coverage [2]	Budget [3]	VC [4]	Develop. [5]	Spin-offs [6]
China	33%	33%	17%	0%	0%	17%
France	42%	50%	33%	33%	8%	0%
Germany	50%	33%	17%	17%	0%	0%
India	0%	25%	25%	25%	25%	50%
Japan	57%	43%	29%	29%	14%	0%
Poland	0%	0%	0%	0%	0%	0%
South Korea	100%	33%	33%	0%	0%	33%
Spain	16%	47%	32%	32%	0%	16%
Sweden	19%	50%	38%	38%	38%	13%
UK	33%	67%	11%	22%	0%	0%
USA	45%	55%	36%	27%	0%	9%



[1] "In what measure have patent costs influenced your entity in the following matters? Frequency of patent filings" (percentage of respondents that consider patent costs have a high impact)

[2] "In what measure have patent costs influenced your entity in the following matters? Geographical coverage of patents" (percentage of respondents that consider patent costs have a high impact)

[3] "In what measure have patent costs influenced your entity in the following matters? R&D budget" (percentage of respondents that consider patent costs have a high impact)

[4] "In what measure have patent costs influenced your entity in the following matters? Access to venture capital to perform R&D" (percentage of respondents that consider patent costs have a high impact)

[5] "In what measure have patent costs influenced your entity in the following matters? Economic development" (percentage of respondents that consider patent costs have a high impact)

[6] "In what measure have patent costs influenced your entity in the following matters? Ability to create spin-offs" (percentage of respondents that consider patent costs have a high impact)

Source: everis survey 2013

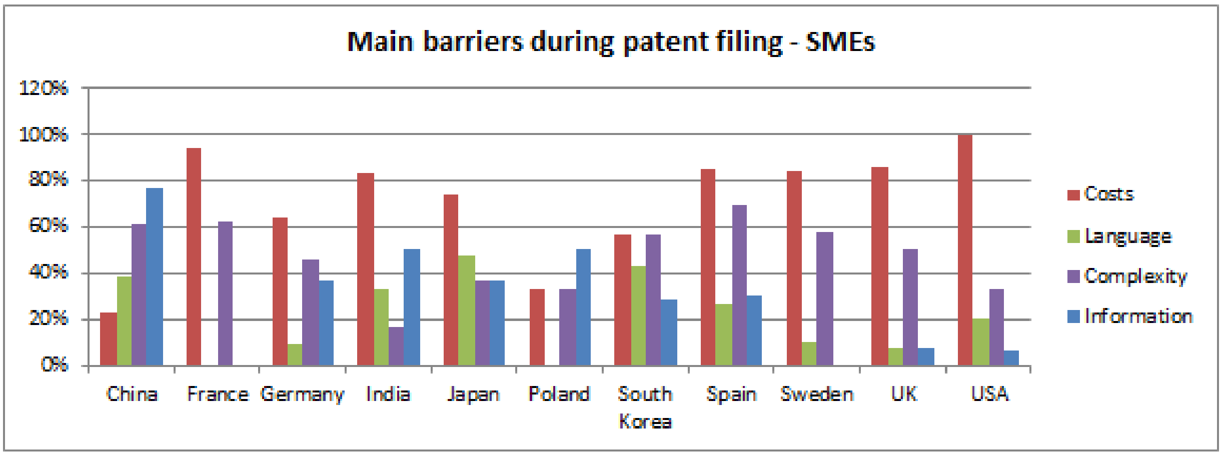
Regarding this point, the limited amount of responses makes it difficult to carry out an accurate analysis. The only remarkable fact is the impact on frequency of patenting that South Korea displays for high-tech and medium-high-tech economic sectors. Apart from this, no relevant conclusions can be drawn as far as the impact of patent costs is concerned.

Main barriers for patenting for SMEs, PROs and Universities

Table 38 - Main barriers for patenting for SMEs, PROs and Universities

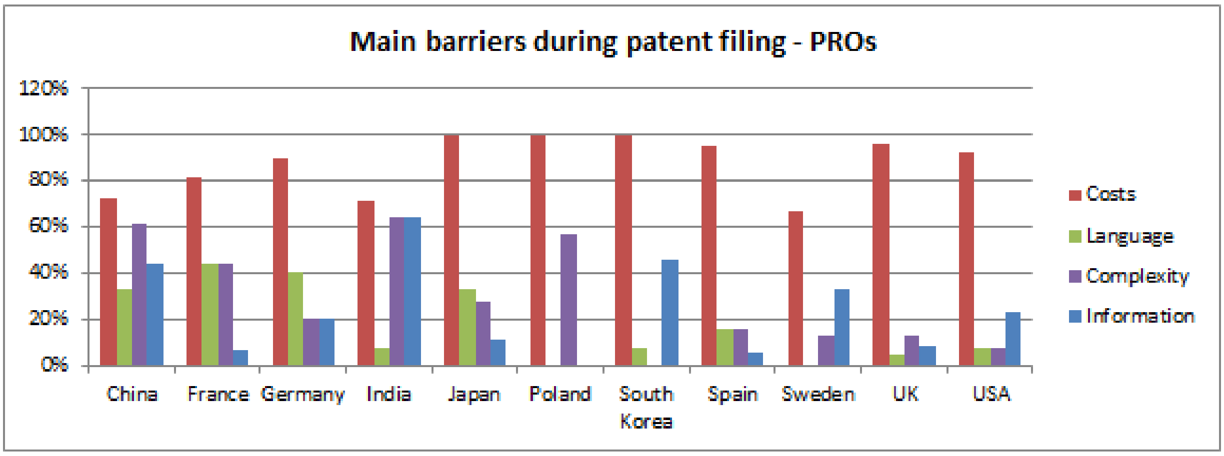
SMEs

	Main barriers found during the process of patent filing			
Country of origin	Information [1]	Costs [2]	Language [3]	Complexity [4]
China	77%	23%	38%	62%
France	0%	94%	0%	63%
Germany	36%	64%	9%	45%
India	50%	83%	33%	17%
Japan	37%	74%	47%	37%
Poland	50%	33%	0%	33%
South Korea	29%	57%	43%	57%
Spain	31%	85%	27%	69%
Sweden	0%	84%	11%	58%
UK	7%	86%	7%	50%
USA	7%	100%	20%	33%



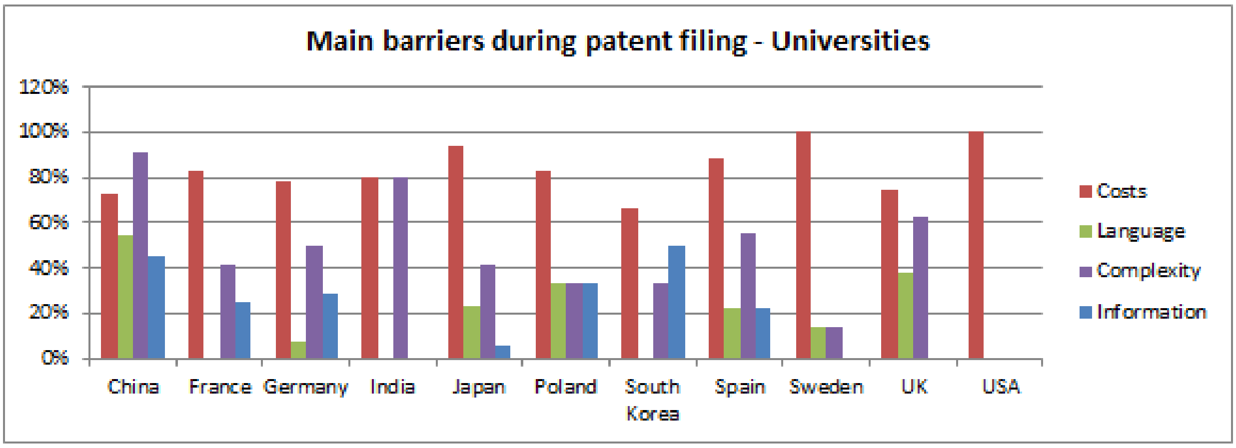
PROs

	Main barriers found during the process of patent filing			
Country of origin	Information [1]	Costs [2]	Language [3]	Complexity [4]
China	44%	72%	33%	61%
France	6%	81%	44%	44%
Germany	20%	90%	40%	20%
India	64%	71%	7%	64%
Japan	11%	100%	33%	28%
Poland	0%	100%	0%	57%
South Korea	46%	100%	8%	0%
Spain	5%	95%	16%	16%
Sweden	33%	67%	0%	13%
UK	9%	96%	4%	13%
USA	23%	92%	8%	8%



Universities

	Main barriers found during the process of patent filing			
Country of origin	Information [1]	Costs [2]	Language [3]	Complexity [4]
China	45%	73%	55%	91%
France	25%	83%	0%	42%
Germany	29%	79%	7%	50%
India	0%	80%	0%	80%
Japan	6%	94%	24%	41%
Poland	33%	83%	33%	33%
South Korea	50%	67%	0%	33%
Spain	22%	89%	22%	56%
Sweden	0%	100%	14%	14%
UK	0%	75%	38%	63%
USA	0%	100%	0%	0%



[1] "What were the main barriers found by your entity during the process of patent filing? Lack of information" (percentage of respondents that agree)
[2] "What were the main barriers found by your entity during the process of patent filing? Costs" (percentage of respondents that agree)
[3] "What were the main barriers found by your entity during the process of patent filing? Language barriers" (percentage of respondents that agree)
[4] "What were the main barriers found by your entity during the process of patent filing? Complexity of the patent system" (percentage of respondents that agree)

Source: everis survey 2013

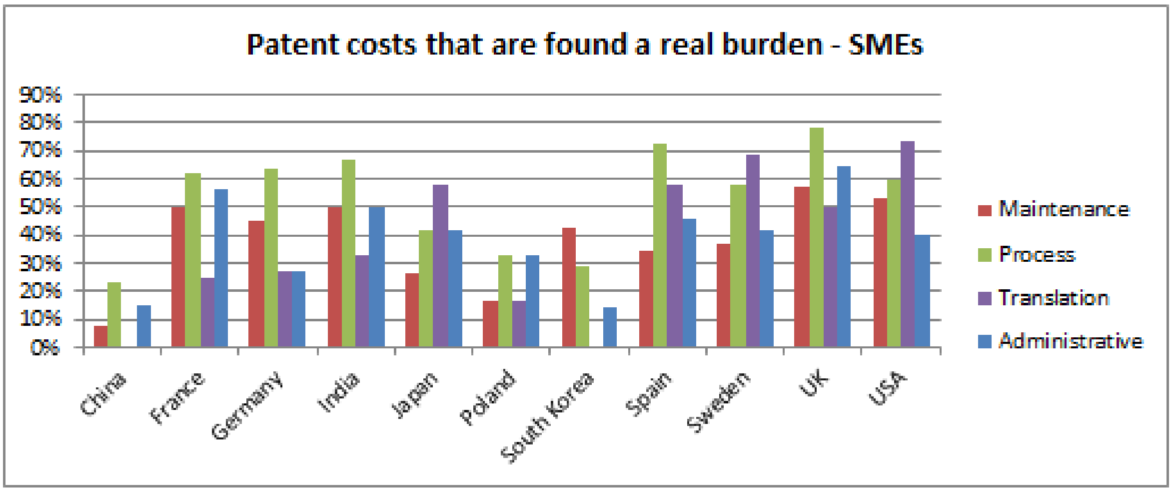
Regarding barriers for patenting there is a consensus among SMEs, PROs and Universities: all of them consider patent cost as the main barrier for patenting, with a clear difference with the second ranked barriers. The only remarkable exception to this pattern is China. In this country, “information” is the leading factor for SMEs and significantly high for PROs and Universities. This fact could be associated with the increasing interest in IP rights in China and the need to create a business culture around this topic.

Type of costs that are found a real burden by SMEs, PROs and Universities

Table 39 - Type of costs that are found a real burden by SMEs, PROs and Universities

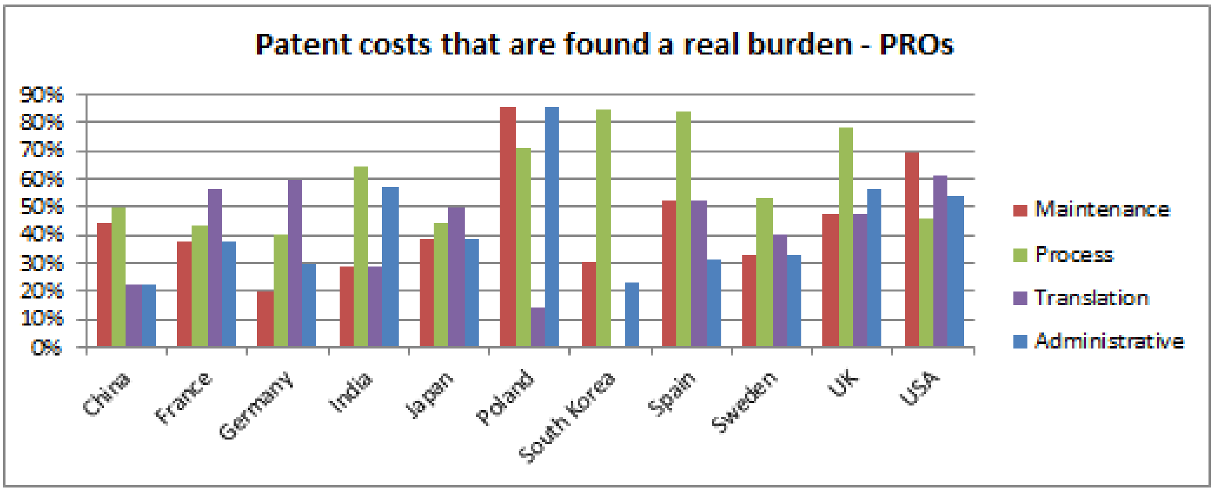
SMEs

	Patent costs that are found a real burden			
Country of origin	Administrative [1]	Maintenance [2]	Process [3]	Translation [4]
China	15%	8%	23%	0%
France	56%	50%	63%	25%
Germany	27%	45%	64%	27%
India	50%	50%	67%	33%
Japan	42%	26%	42%	58%
Poland	33%	17%	33%	17%
South Korea	14%	43%	29%	0%
Spain	46%	35%	73%	58%
Sweden	42%	37%	58%	68%
UK	64%	57%	79%	50%
USA	40%	53%	60%	73%



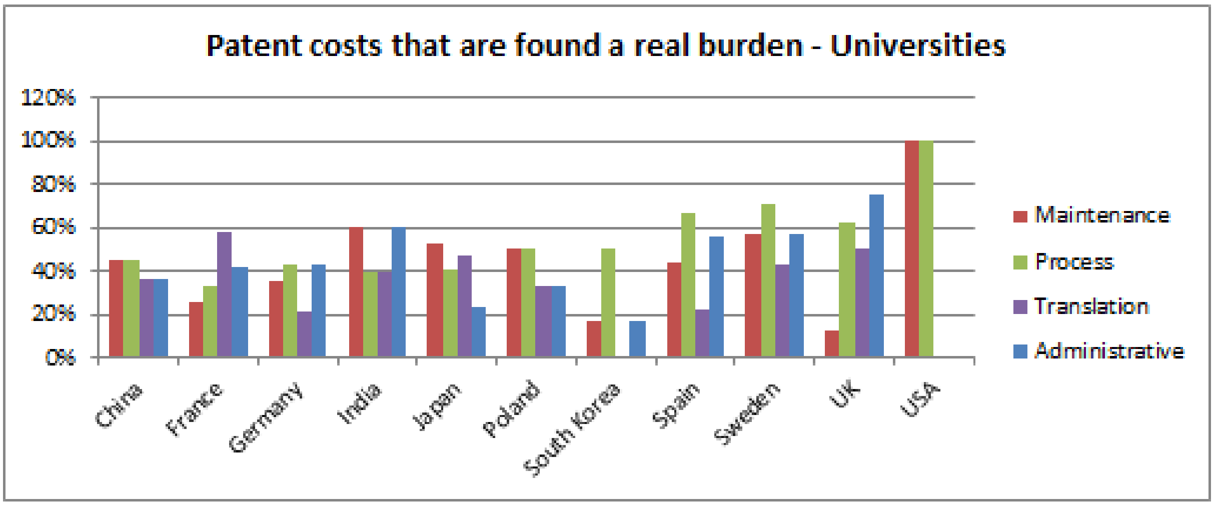
PROs

	Patent costs that are found a real burden			
Country of origin	Administrative [1]	Maintenance [2]	Process [3]	Translation [4]
China	22%	44%	50%	22%
France	38%	38%	44%	56%
Germany	30%	20%	40%	60%
India	57%	29%	64%	29%
Japan	39%	39%	44%	50%
Poland	86%	86%	71%	14%
South Korea	23%	31%	85%	0%
Spain	32%	53%	84%	53%
Sweden	33%	33%	53%	40%
UK	57%	48%	78%	48%
USA	54%	69%	46%	62%



Universities

	Patent costs that are found a real burden			
Country of origin	Administrative [1]	Maintenance [2]	Process [3]	Translation [4]
China	36%	45%	45%	36%
France	42%	25%	33%	58%
Germany	43%	36%	43%	21%
India	60%	60%	40%	40%
Japan	24%	53%	41%	47%
Poland	33%	50%	50%	33%
South Korea	17%	17%	50%	0%
Spain	56%	44%	67%	22%
Sweden	57%	57%	71%	43%
UK	75%	13%	63%	50%
USA	0%	100%	100%	0%



[1] "What type of costs do you find a real burden? Administrative fees" (percentage of respondents that agree)
[2] "What type of costs do you find a real burden? Maintenance cost" (percentage of respondents that agree)
[3] "What type of costs do you find a real burden? Process costs" (percentage of respondents that agree)
[4] "What type of costs do you find a real burden? Translation costs" (percentage of respondents that agree)

Source: everis survey 2013

In this case, there is a clear consensus between the different types of organisations (SMEs, PROs and Universities) about considering process costs as a real burden for patenting. This cost is indeed variable, and depends heavily on the complexity of technology itself and the (geographical) target level of protection. In this case, it makes sense that entities willing to patent their innovations might consider this erratic component of the total costs of patenting as a real barrier.

5. DISCUSSION

The project pursues the goal to analyse to what extent the costs of patenting impacts the R&D activity and, subsequently, the innovation carried out by SMEs, Universities and PROs and how it is being influenced by such costs.

This analysis is indeed complex since there is no single data source able to provide a complete and simultaneous snapshot of the behaviour of the mentioned entities in terms of patenting. Therefore, different databases and sources of information have been used throughout the project. As described in section 3, the main sources of information used have been the following:

- 40 NPOs have been consulted to gather data regarding overall patent costs (according to the OECD they can be split into administrative, process, translation and maintenance costs).
- EPO databases PATSTAT and INPADOC have been extensively used as they are a comprehensive repository of worldwide patent statistics, including information on patent life and validated countries for European patents (this information is provided by INPADOC). In addition, PATSTAT also integrates information stemming from NPOs which deliver this data according to individual policies, which makes difficult the "simultaneous" view mentioned before.
- These sources of data have been complemented by a survey (everis survey 2013) conducted in 11 countries, encompassing 6 European countries, 4 from Asia and the USA. A final set of 414 responses were collected providing valuable information on the motivations, costs, impacts and perceptions regarding patenting for two routes: "Direct National" (standard applications at the NPO level) and "Direct European" (applications directly filed at the EPO). Additional data sources like the "PatVal EU-II survey" and macroeconomic data obtained from Eurostat regarding the expenditure on R&D have also been used.

As a general remark, the lack of available data in some cases at NPO level, the lagging of data integration in PATSTAT and INPADOC (specifically the information delivered by NPOs), the intrinsic complexity of measuring the average patent life and the limited detail of the survey for some required elements of analysis have indeed been challenges that have been tackled during the execution of the project.

Regarding **NPO level costs** as a source for a comprehensive analysis of the patent costs behaviour, an important remark must be raised. The information is far from being homogeneous. I.e. each NPO has its own definitions and criteria on what constitutes its different fees. This implies that one has to spend a great deal of effort finding out what these definitions and criteria are, as they are not normally defined in detail in the documents which are made available to the public. This fact makes it close to impossible to obtain precise information if the sample is as big as 40 NPOs. We can conclude therefore that **a future study should focus on a reduce sample of NPOs and for a shorter period of time** (reduced amount of years to be taken into account)**.**

On the other hand, PATSTAT provides a complete and fairly accurate source of information regarding direct national and European applications, as well as international applications (PCT). Although the lagging of data integration in PATSTAT and INPADOC (specifically the information delivered by NPOs) is still a problem, both databases can be considered a reliable data source. It makes us consider that an extensive and deeper analysis of PATSTAT, from a "big-data" approach, could have provided additional insights regarding patenting behaviour. Therefore, we recommend **exploiting PATSTAT's datasets from a wider perspective** within the framework of a new project.

Another possible discussion could treat the **economic indicators** analysis and the effort to find out relationships between certain macroeconomic parameters (GERD, BERD and HERD) and NPOs patent costs, or between such costs and motivations for patenting or the economic value of patents. This "quasi-empirical" way of working may lead to working hypotheses supported by, for example, a linear regression model. However, if such positive relationship is not seen, what should be done to overcome such a situation? In most cases, the answer is clear: the expected behaviour is not present in the data but this does not necessarily mean that the opposite behaviour is true.

The deadlock described above is a consequence of the data and the analysis method used. A different approach could have been to **build a simple model prior to analysing the data trying to describe some expected behaviour in certain cases** and then, using the data gathered (if possible, with a higher degree of accuracy), validate such model. This approach, that can be called build-measure-learn (build a model, measure -validate- vs data and learn -extract validated knowledge), is very close to standard scientific methods and should be explored as a reasonable strategy in future developments on this topic.

The final issue to be addressed refers to the **survey design and results**. As mentioned above, the survey targeted 11 different countries, 3 different entity types (SMEs, PROs and Universities) and an extremely wide scope of topics and questions. Although a significant effort was given to simplify the survey, the resulting questionnaire was still complex and difficult to apply in such a big sample (the USA, four Asian countries and six EU Member States). There was no time to try with a beta version of the survey, make changes, try again and so on, until a final best-of-breed version was produced. Now, when all the information has been gathered and only a limited part of the survey is providing real value to the project, it is when some improvements are obvious, both from the **usability (less questions and topics) and execution (greater schedule and sample)**. This experience should be a relevant input in any future attempt to carry out similar surveys.

6. Conclusions and open questions

6.1 Conclusions

The present study on patent costs and impact on innovation has been carried out considering three main data sources: 40 NPOs from which patent-related information was gathered, PATSTAT (and INPADOC) from which data from direct European and national patents was obtained, and the everis survey which was conducted in 11 countries which covered topics such as patent costs, motivations, burdens and benefits of patenting. Additional data sources such as the PatVal-EU II survey and Eurostat GERD, BERD and HERD data was also used to provide, respectively, a complementary view on motivation, economic value and utilisation rate of patents, as well as macroeconomic data regarding expenditure on R&D.

All the above mentioned data sources have been analysed and a selection of the most relevant results has been displayed in section 3, addressing four different topics: patent costs at NPO level, profile of patents filed in NPOs and the EPO (including an EPO patent validated in 6 and 13 countries), economic indicators and their relationship with patent costs and, finally, investment & internationalisation impacts, barriers and burdens regarding patenting costs. For each of these topics, the corresponding interpretation of the data has been included, as well as some "working hypotheses" (not tested) when it has been appropriate. Following this approach, a selection of the most relevant insights are summarised as a set of preliminary conclusions. This pursues two goals: on one hand, provide the reader with an easy-to-read briefing and, on the other hand, set the basis for a future debate and discussion on the impacts of patent costs.

Firstly, we can draw our attention to the costs structure at the NPO level. Basically, different countries display different cost behaviours. Germany is the leading European market in terms of patents filed but also has the highest absolute costs. This may be explained by the importance in terms of market size and dynamism, and the medium-high technology intensity of the companies that operate in the German market, which may force companies to prioritise protecting their inventions in Germany. Despite this, high costs may still be a barrier for some SMEs with low IP protection budgets.

However, patent costs expressed just in absolute terms do not take into account the attractiveness of each market. Considering relative costs (i.e. those obtained dividing costs expressed in Euros by the GDP of each country in billion Euros) an interesting behaviour appears: relative overall costs for the model patent (28 pages and 13 claims) filed at the EPO[44] and validated in 6 and 13 countries are now lower than most of the NPOs considered and, in absolute terms, these European patents are more competitive than a bundle of national patents when translation costs and the simplified procedure are considered.

Other important countries in terms of economic size such as the USA, China or Japan have different cost structures. Despite this, relative overall costs for filing a 6 European countries model patent is 7.3 times higher than the same patent filed at the USPTO and 1.5 times higher than in the JPO. Maintenance costs charged on behalf of NPOs account for most of the difference in relative costs between the model Europe (6 and 13 countries) patent and the USPTO and JPO. Relative maintenance costs of the 6 European countries patent are 10.6 and 1.5 times higher than the costs in the USA and Japan respectively.

In addition, our investigation has analysed the cost reductions applied by different NPOs to SMEs in order to boost the innovation developed by these entities. They are indeed significant in many countries; however we have not found any quantitative evidence on the positive impact of such special pricing on patenting activity. This could be based on the fact that most NPOs (with the exception of the USA, Brazil and Canada) offer reductions that only affect pre-grant fees and, in some cases, the first years of the renewal fees. Although this special pricing may be an incentive, it must be stressed that maintenance costs are the most relevant ones for SMEs and may not be fully incurred if the economic value of the patent does not compensate for them. This is reasonable for organisations where patenting for defensive purposes is not common and the real value of a patent cannot be determined accurately at the time of the application.

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44 Although filed at the EPO, not all costs are set by the EPO. Validation fees (in some countries) and maintenance costs are charged on behalf of the NPOs.

We have also described five different clusters of countries in item 4.1.2 with similar relative overall patent costs components (administrative and maintenance costs). Since relative costs are used, the final displayed behaviours for the different clusters make sense. For example, cluster A is comprised of the low relative overall costs countries. Countries in cluster A range from big economies (in terms of population, GDP per capita or both) such as Japan, the USA, China or India, to medium-sized economies like Switzerland and Poland, which have lower absolute patent costs. On the other hand, clusters B and C account respectively for medium/small economies with medium/high overall costs and four small economies from Eastern Europe and the Baltic countries. Finally, clusters D and E correspond to very small countries, with the biggest of them in terms of population (Latvia), having slightly more than 2 million inhabitants. Their economies are small measured by their GDP and, as a consequence, their relative costs are very high. In other words, it can be remarked that large economies or medium sized economies with low overall costs within the scope of this study can be placed in the same group of countries when relative patents costs are considered.

Secondly, special attention has been paid to litigation costs. According to the data gathered, patent litigation in various jurisdictions can be unaffordable for SMEs or individuals due to the fragmented nature of the patent litigation system in Europe. Costs for litigation in four European jurisdictions may be twice as high as the total fees for validating and maintaining a European patent in 13 countries. In addition, patent trolls[45] have drawn the attention of innovators due to their increasing activity. Since patent trolls' victims are those who are not willing or able to fight a patent infringement case through an invalidity trial (SMEs or individuals are the most vulnerable), a fast, low cost patent litigation system with a broad geographical coverage and with cost recovery mechanisms may deter trolls from acting.

Thirdly, the SME's share in the patents granted mix has been investigated. Unfortunately, the lack of available data at the NPO level and the intrinsic complexity of identifying SMEs make it impossible to reach a conclusion regarding the SME's participation in the granted patents mix. Additional effort should be carried out to foster efficient registration of the applicant type (company, university, individual, etc.) at the NPO level to obtain in the future a better view of the patenting behaviour in Europe. However, using data from the Eurostat Community Innovation Survey 2010, the relation between patent costs and the percentage of SMEs engaged in in-house R&D activities has been explored. In this particular case, the linear regression of the results do not allow to infer a potential relation between overall patent costs and the percentage of SMEs engaged in R&D activities independently of their size in terms of employees.

Fourthly, average patent life has been analysed thanks to PATSTAT and INPADOC. Some interesting pattern has been found: the patents with the longest life correspond to the technology fields of micro-structural and nano-technology, ICT (information and communication technology), bio-science (biotechnology and pharma), medical technology and chemistry (particularly food and organic fine chemistry). Likewise, the analysis of patents with the highest number of validated countries shows similar results with respect to micro, nano, bio, medical and chemistry related technologies, which leads to the hypothesis that these require intensive investment on R&D and can be easily copied if they do not have adequate IP protection mechanisms. In addition, the return on investment is only achieved after a long period due to the high investments carried out during the development phase. In this context patents become assets and therefore their lives tend to be longer. In the case of ICT related patents however, their life period is long but the average number of countries in which they are validated in is average. This fact is likely to be related to the dynamics of this industry rather than initial high investments.

Another insight can be obtained if the average patent lives per validated country indicator is considered. As expected, Europe's largest economies display the longest lives, with the notable exception of Italy in which patents reach a mean of almost 16 years, well ahead of the second country in line, Germany, with just over 13 years. This corresponds with the hypothesis that low and flat maintenance fee structure such as Italy's is an incentive for longer living patents. Germany's maintenance fees sharply increase towards the end of the 20 year patent lifespan thus incentivising patent holders to drop lower values and unlocking the IP which is beneficial for the system.

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[45]Harhoff defines patent trolls as companies that acquire patents of failed companies or independent innovators and use these to threaten suit against infringing companies without having the intention of using the patent they assert

Fifthly, the present study also deals with additional economic indicators. Correlation analyses were carried out to investigate the relationship between maintenance costs (at the NPO level) and the utilisation of patents, their economic value and the motivations for patenting (PatVal-EU II). No significant correlation was found associated with the above mentioned indicators.

Correlation analysis has also been applied to find out possible relationships between patent costs at the NPO level and the GERD, BERD and HERD. We have not found any significant relationship between patent costs and these economic indicators, with determination coefficients lower than 0.2.

Other indicators have been taken into account regarding patenting behaviour of SMEs, such as the percentage of in-house R&D, employment in fast-growing firms (those supposed to be linked to innovative activities) and venture capital funding. In all cases, there is no observed relationship between relative patent costs and these indicators. If all type of companies are considered and we focus on the internationalisation behaviour, measured as the share of high tech exports in total exports, there is no relationship between relative patent costs and this type of exports.

Finally, regarding entrepreneurial activity and patent costs, the everis survey 2013 has been taken into account, although it does not display significantly conclusive data. Entrepreneurship, both at the SME level (creation of new firms) or PRO/University level (spin-off creation) seems to be a phenomenon based on the strategic value of the technology or envisaged project, rather than a process led by the overall patent costs. Moreover, the survey shows no relationship between patent costs and growth, access to VCs and internationalisation of SMEs.

6.2 Open questions: the basis for future work

The results shown in this report and the conclusions in the previous section do not provide a definite answer to the main question which was the foundation for this study: are patent costs a barrier for innovation?

As mentioned, there is no strong evidence suggesting that patent costs can be a constraint for patenting. The everis survey 2013 indicates that respondents consider patent costs a burden, but it does not mean that lower fees will increase the issuing of high quality patents. Following this comment, one question that could be answered in future studies could be: **what is the right balance between patent costs and patent application quality**?

Another open area could deal with the pendency times and grants per examiner. This comparison, carried out in section 4.1.4, highlights the differences between the processes of the different patent offices. In general terms, the EPO has lower granted claims per examiner ratios, which could suggest that the time required for the examination process is higher than in its Japanese and USA counterparts. In this regard, **literature gives several arguments showing that the EPO process is very strict.** The answer to this question is relevant: patent offices should be sustainable; increasing the number of examiners to reduce backlogs would automatically yield an increase in the operational expenditure. Therefore, new ways to act on backlogs are required in order to cope with the increase of patent filings while maintaining the quality of the examination process.

Throughout the study a hypothesis has been taken for granted: patents are a relevant factor for innovation. Indeed patents and, more precisely, patent offices are devoted to support innovation providing a framework in which inventors' discoveries can be made available for the public while, at the same time, providing exclusive rights for the exploitation of the inventions. However, some highly dynamic sectors are moving beyond patents as they rely on the innovation in business models or accelerated innovation in which technology is a mean and the stiffness and timing of the patent system are not aligned with the objectives of these innovators.

Regarding economic indicators and, more specifically, GERD, BERD & HERD and patents costs at the NPO level, some **additional analysis should be carried out to cope with the fact that a fraction of national applications come from foreign countries**: these countries are not affected by the local (national) R&D expenditure. In the case of R&D intensity in the business sector, an issue to be explored is the possibility that business growth and profitability are spurring innovation in a highly competitive and globalised market, while patents are always valuable despite their costs when the returns on investments are clear. Fast growth-technology intensive SMEs are probably the most sensitive users and the priority targets for further research. In the case of higher education R&D expenditure, ownership of inventions, rewards for inventors and technology transfer practices should be analysed in depth to identify specific behaviours across countries.

Another related topic is the “economic value of patents”. PatVal-EU II made an attempt to measure this parameter by asking inventors. Actually, the inventors were asked for their perceptions of the economic value of their patents. **Could it be possible to move forward from these results and provide a complementary view of the economic value of patents?** Indeed it is a complicated topic but the final return-on-investment for a patent is, for sure, a fundamental reason for issuing a patent application.

Finally, the everis survey carried out pursued very ambitious goals, targeting SMEs, PROs and Universities in 11 different countries with strong differences between some of them. The questions conducted in the survey covered a wide scope of topics. All these factors have led to the outcome that only a limited fraction can be exploited**.** A new survey focused on a reduced set of topics and with a greater sample could be undertaken to clarify some of the open issues raised after this work and improve the knowledge regarding patenting motivations. This will allow a **better understanding of the reasons behind patenting for different organisations and countries.**

7. ANNEXES

7.1 Countries and group of countries

Wherever applicable throughout the document, data and indicators are provided for the following countries and groups of countries:

Table 40 - Analysed countries and group of countries

EU-28
Austria
Belgium
Bulgaria
Cyprus
Czech Republic
Germany
Denmark
Estonia
Spain
Finland
France
UK
Greece
Croatia
Hungary
Ireland
Italy
Lithuania
Luxembourg
Latvia
Malta
Netherlands
Poland
Portugal
Romania
Sweden
Slovenia
Slovakia

EFTA countries
Switzerland
Iceland
Norway

Other countries
Brazil
Canada
China
Israel
India
Japan
South Korea
Russia
USA

7.2 IPC - Technology field concordance table

Table 41 - IPC - Technology field concordance table

Field of Technology		International patent classification (IPC) symbols
I: Electrical engineering		
1	Electrical machinery, apparatus, energy	F21#, H01B, H01C, H01F, H01G, H01H, H01J, H01K, H01M, H01R, H01T, H02#, H05B, H05C, H05F, H99Z
2	Audio-visual technology	G09F, G09G, G11B, H04N-003, H04N-005, H04N-009, H04N-013, H04N-015, H04N-017, H04R, H04S, H05K
3	Telecommunications	G08C, H01P, H01Q, H04B, H04H, H04J, H04K, H04M, H04N-001, H04N-007, H04N-011, H04Q
4	Digital communication	H04L
5	Basic communication processes	H03#
6	Computer technology	(G06# not G06Q), G11C, G10L
7	IT methods for management	G06Q
8	Semiconductors	H01L
II: Instruments		
9	Optics	G02#, G03B, G03C, G03D, G03F, G03G, G03H, H01S
10	Measurement	G01B, G01C, G01D, G01F, G01G, G01H, G01J, G01K, G01L, G01M, (G01N not G01N-033), G01P, G01R, G01S, G01V, G01W, G04#, G12B, G99Z
11	Analysis of biological materials	G01N-033
12	Control	G05B, G05D, G05F, G07#, G08B, G08G, G09B, G09C, G09D
13	Medical technology	A61B, A61C, A61D, A61F, A61G, A61H, A61J, A61L, A61M, A61N, H05G

Source: WIPO (2012).

Field of Technology		International patent classification (IPC) symbols
III: Chemistry		
14	Organic fine chemistry	(C07B, C07C, C07D, C07F, C07H, C07J, C40B) not A61K, A61K-008, A61Q
15	Biotechnology	(C07G, C07K, C12M, C12N, C12P, C12Q, C12R, C12S) not A61K
16	Pharmaceuticals	A61KnotA61K-008
17	Macromolecular chemistry, polymers	C08B, C08C, C08F, C08G, C08H, C08K, C08L
18	Food chemistry	A01H, A21D, A23B, A23C, A23D, A23F, A23G, A23J, A23K, A23L, C12C, C12F, C12G,C12H, C12J, C13D, C13F, C13J, C13K
19	Basic materials chemistry	A01N, A01P, C05#, C06#, C09B, C09C, C09F, C09G, C09H, C09K, C09D, C09J, C10B, C10C,C10F, C10G, C10H, C10J, C10K, C10L, C10M, C10N,C11B, C11C, C11D, C99Z
20	Materials, metallurgy	C01#, C03C, C04#, C21#, C22#, B22#
21	Surface technology, coating	B05C, B05D, B32#, C23#, C25#, C30#
22	Micro-structural and nano-technology	B81#, B82#
23	Chemical engineering	B01B, B01D-000#, B01D-01##, B01D-02##, B01D-03##, B01D-041, B01D-043, B01D-057, B01D-059, B01D-06##, B01D-07##, B01F, BOU, B01L, B02C, B03#, B04#, B05B,B06B, B07#, B08#, D06B, D06C, D06L, F25J, F26#, C14C, H05H
24	Environmental technology	A62D, B01D-045, B01D-046, B01D-047, B01D-049, B01D-050, B01D-051, B01D-052,B01D-053, B09#, B65F, C02#, F01N, F23G, F23J, G01T, E01F-008, A62C
IV: Mechanical engineering		
25	Handling	B25J, B65B, B65C, B65D, B65G, B65H, B66#, B67#
26	Machine tools	B21#, B23#, B24#, B26D, B26F, B27#, B30#, B25B, B25C, B25D, B25F, B25G, B25H, B26B
27	Engines, pumps, turbines	F01B, F01C, F01D, F01K, F01L, F01M, F01P, F02#, F03#, F04#, F23R, G21#, F99Z
28	Textile and paper machines	A41H, A43D, A46D, C14B, D01#, D02#, D03#, D04B, D04C, D04G, D04H, D05#, D06G, D06H, D06J, D06M, D06P, D06Q, D99Z, B31#, D21#, B41#
29	Other special machines	A01B, A01C, A01D, A01F, A01G, A01J, A01K, A01L, A01M, A21B, A21C, A22#, A23N, A23P, B02B, C12L, C13C, C13G, C13H, B28#, B29#, C03B, C08J, B99Z, F41#, F42#
30	Thermal processes and	F22#, F23B, F23C, F23D, F23H, F23K, F23L, F23M, F23N,

Field of Technology		International patent classification (IPC) symbols
	apparatus	F23Q, F24#, F25B, F25C, F27#, F28#
31	Mechanical elements	F15#, F16#, F17#, G05G
32	Transport	B60#, B61#, B62#, B63B, B63C, B63G, B63H, B63J, B64#
V: Other fields		
33	Furniture, games	A47#, A63#
34	Other consumer goods	A24#, A41B, A41C, A41D, A41F, A41G, A42#, A43B, A43C, A44#, A45#, A46B, A62B, B42#, B43#, D04D, D07#, G10B, G10C, G10D, G10F, G10G, G10H, G10K, B44#, B68#, D06F, D06N, F25D, A99Z
35	Civil engineering	E02#, E01B, E01C, E01D, E01F-001, E01F-003, E01F-005, E01F-007, E01F-009, E01F-01#, E01H, E03#, E04#, E05#, E06#, E21#, E99Z

7.3 IPC - NACE concordance table

In December 2006, NACE Rev. 2 was introduced as a revision of the existing NACE classification (1.1). Shifts and conversions in the NACE classification system imply the need for updating concordance tables between NACE sectors and technology domains, which are used to arrive at patent statistics by industry.

Over the last decade, patent indicators reporting activity by industry relied on the well-known concordance table between industries and technologies developed by Schmoch et al (2003). This concordance scheme was developed and validated by matching IPC classes to industries via an assessment of a representative sample of firm-owned patents, resulting in an allocation of IPC codes to NACE categories.

In 2013-2014, Eurostat produced an updated IPC-NACE concordance[46]. The update relies on two sources: (1) the existing concordance between 44 technology sectors of the Fraunhofer classification with corresponding IPC classes and NACE 1.1 industries, and (2) the official conversion table NACE 1.1 to NACE Rev. 2, edited and published by Eurostat. IPC codes have been re-allocated to NACE Rev.2 industries based on content analysis, co-occurrence/co-citation analysis and industry membership of main applicants. The resulting concordance table has been validated by a team of independently operating experts (Eurostat, EPO and Fraunhofer-Gesellschaft).

This study was carried out before the release of the updated IPC-NACE concordance. Therefore, the concordance IPC-NACE used is shown in Table 42.

Table 42 - IPC - NACE concordance table

NACE Rev. 1.1 code[47]	Corresponding IPC codes
15	A01H, A21D, A23B, A23C, A23D, A23F, A23G, A23J, A23K, A23L, A23P, C12C, C12F, C12G, C12H, C12J, C13F, C13J, C13K
16	A24B, A24D, A24F
17	D04D, D04G, D04H, D06C, D06J, D06M, D06N, D06P, D06Q
18	A41B, A41C, A41D, A41F
19	A43B, A43C, B68B, B68C
20	B27D, B27H, B27M, B27N, E04G
21	B41M, B42D, B42F, B44F, D21C, D21H, D21J
23	C10G, C10L, G01V
24.1	B01J, B09B, B09C, B29B, C01B, C01C, C01D, C01F, C01G, C02F, C05B, C05C, C05D, C05F, C05G, C07B, C07C, C07F, C07G, C08B, C08C, C08F, C08G, C08J, C08K, C08L, C09B, C09C, C09D, C09K, C10B, C10C, C10H, C10J, C10K, C12S, C25B, F17C, F17D, F25J, G21F
24.2	A01N
24.3	B27K
24.4	A61K, A61P, C07D, C07H, C07J, C07K, C12N, C12P, C12Q
24.5	C09F, C11D, D06L
24.6	A62D, C06B, C06C, C06D, C08H, C09G, C09H, C09J, C10M, C11B, C11C, C14C, C23F, C23G, D01C, F42B, F42D, G03C
24.7	D01F
25	A45C, B29C, B29D, B60C, B65D, B67D, E02B, F16L, H02G
26	B24D, B28B, B28C, B32B, C03B, C03C, C04B, E04B, E04C, E04D, E04F, G21B
27	B21C, B21G, B22D, C21B, C21C, C21D, C22B, C22C, C22F, C25C, C25F, C30B, D07B, E03F, E04H, F27D, H01B

46 https://circabc.europa.eu/d/d/workspace/SpacesStore/d1475596-1568-408a-9191-426629047e31/2014-10-16-Final%20IPC_NACE2_2014.pdf.

47 See the Annex '*Economic sectors*'.

NACE Rev. 1.1 code[47]	Corresponding IPC codes
28	A01L, A44B, A47H, A47K, B21K, B21L, B22F, B25B, B25C, B25F, B25G, B25H, B26B, B27G, B44C, B65F, B82B, C23D, C25D, E01D, E01F, E02C, E03B, E03C, E03D, E05B, E05C, E05D, E05F, E05G, E06B, F01K, F15D, F16B, F16P, F16S, F16T, F17B, F22B, F22G, F24J, G21H
29.1	B23F, F01B, F01C, F01D, F03B, F03C, F03D, F03G, F04B, F04C, F04D, F15B, F16C, F16D, F16F, F16H, F16K, F16M, F23R
29.2	A62C, B01D, B04C, B05B, B61B, B65G, B66B, B66C, B66D, B66F, C10F, C12L, F16G, F22D, F23B, F23C, F23D, F23G, F23H, F23J, F23K, F23L, F23M, F24F, F24H, F25B, F27B, F28B, F28C, F28D, F28F, F28G, G01G, H05F
29.3	A01B, A01C, A01D, A01F, A01G, A01J, A01K, A01M, B27L
29.4	B21D, B21F, B21H, B21J, B23B, B23C, B23D, B23G, B23H, B23K, B23P, B23Q, B24B, B24C, B25D, B25J, B26F, B27B, B27C, B27F, B27J, B28D, B30B, E21C
29.5	A21C, A22B, A22C, A23N, A24C, A41H, A42C, A43D, B01F, B02B, B02C, B03B, B03C, B03D, B05C, B05D, B06B, B07B, B07C, B08B, B21B, B22C, B26D, B31B, B31C, B31D, B31F, B41B, B41C, B41D, B41F, B41G, B41L, B41N, B42B, B42C, B44B, B65B, B65C, B65H, B67B, B67C, B68F, C13C, C13D, C13G, C13H, C14B, C23C, D01B, D01D, D01G, D01H, D02G, D02H, D02J, D03C, D03D, D03J, D04B,D04C, D05B, D05C, D06B, D06G, D06H, D21B, D21D, D21F, D21G, E01C, E02D, E02F, E21B, E21D, E21F, F04F, F16N, F26B, H05H
29.6	B63G, F41A, F41B, F41C, F41F, F41G, F41H, F41J, F42C, G21J
29.7	A21B, A45D, A47G, A47J, A47L, B01B, D06F, E06C, F23N, F24B, F24C, F24D, F25C, F25D, H05B
30	B41J, B41K, B43M, G02F, G03G, G05F, G06C, G06D, G06E, G06F, G06G, G06J, G06K, G06M, G06N, G06T, G07B, G07C, G07D, G07F, G07G, G09D, G09G, G10L, G11B, H03K, H03L
31.1	H02K, H02N, H02P
31.2	H01H, H01R, H02B
31.4	H01M
31.5	F21H, F21K, F21L, F21M, F21S, F21V, H01K
31.6	B60M, B61L, F21P, F21Q, G08B, G08G, G10K, G21C, G21D, H01T, H02H, H02M, H05C
32.1	B81B, B81C, G11C, H01C, H01F, H01G, H01J, H01L
32.2	G09B, G09C, H01P, H01Q, H01S, H02J, H03B, H03C, H03D, H03F, H03G, H03H, H03M, H04B, H04J, H04K, H04L, H04M, H04Q, H05K
32.3	G03H, H03J, H04H, H04N, H04R, H04S
33.1	A61B, A61C, A61D, A61F, A61G, A61H, A61J, A61L, A61M, A61N, A62B, B01L, B04B, C12M, G01T, G21G, G21K, H05G
33.2	F15C, G01B, G01C, G01D, G01F, G01H, G01J, G01M, G01N, G01R, G01S, G01W, G12B
33.3	G01K, G01L, G05B, G08C
33.4	G02B, G02C, G03B, G03D, G03F, G09F
33.5	G04B, G04C, G04D, G04F, G04G
34	B60B, B60D, B60G, B60H, B60J, B60K, B60L, B60N, B60P, B60Q, B60R, B60S, B60T, B62D, E01H, F01L, F01M, F01N, F01P, F02B, F02D, F02F, F02G, F02M, F02N, F02P, F16J, G01P, G05D, G05G
35	B60F, B60V, B61C, B61D, B61F, B61G, B61H, B61J, B61K, B62C, B62H, B62J, B62K, B62L, B62M, B63B, B63C, B63H, B63J, B64B, B64C, B64D, B64F, B64G, E01B, F02C, F02K, F03H
36	A41G, A42B, A44C, A45B, A45F, A46B, A46D, A47B, A47C, A47D, A47F, A63B, A63C, A63D, A63F, A63G, A63H, A63J, A63K, B43K, B43L, B44D, B62B, B68G, C06F, F23Q, G10B, G10C, G10D, G10F, G10G, G10H

Source: "Linking Technology Areas to Industrial Sectors - Report for the European Commission, DG Research", Fraunhofer Institute for Systems and Innovation Research, Observatoire des Sciences et des Techniques, University of Sussex, Science and Policy Research Unit (11/2003).

7.4 Economic sectors

The IPC - NACE concordance table shown above (which can be considered as the most reliable source at present in terms of IPC - NACE concordance studies) references the following NACE Rev. 1.1 codes (Eurostat, 2002):

Table 43 - Relevant NACE Rev. 1.1 codes

NACE Rev. 1.1 code	Description
15	Food, beverages
16	Tobacco products
17	Textiles
18	Wearing apparel
19	Leather articles
20	Wood products
21	Paper
23	Petroleum products, nuclear fuel
24.1	Basic chemical
24.2	Pesticides, agro-chemical products
24.3	Paints, varnishes
24.4	Pharmaceuticals
24.5	Soaps, detergents, toilet preparations
24.6	Other chemicals
24.7	Man-made fibres
25	Rubber and plastics products
26	Non-metallic mineral products
27	Basic metals
28	Fabricated metal products
29.1	Energy machinery
29.2	Non-specific purpose machinery
29.3	Agricultural and forestry machinery
29.4	Machine-tools
29.5	Special purpose machinery
29.6	Weapons and ammunition
29.7	Domestic appliances

NACE Rev. 1.1 code	Description
30	Office machinery and computers
31.1	Electric motors, generators, transformers
31.2	Electric distribution, control, wire, cable
31.4	Accumulators, battery
31.5	Lightening equipment
31.6	Other electrical components
32.1	Electronic components
32.2	Signal transmission, telecommunications
32.3	Television and radio receivers, audio-visual electronics
33.1	Medical equipment
33.2	Measuring equipment
33.3	Industrial process control equipment
33.4	Optical instruments
33.5	Watches, clocks
34	Motor vehicles
35	Other transport equipment
36	Furniture, consumer goods

The project's survey however takes advantage of referencing the newer version of this standard: NACE Rev. 2 (Eurostat, 2008):

Table 44 - NACE Rev. 2 sections

Section	Description
A	Agriculture, forestry and fishing
B	Mining and quarrying
C	Manufacturing
D	Electricity, gas, steam and air conditioning supply
E	Water supply; sewerage, waste management and remediation activities
F	Construction
G	Wholesale and retail trade; repair of motor vehicles and motorcycles
H	Transportation and storage
I	Accommodation and food service activities
J	Information and communication
K	Financial and insurance activities
L	Real estate activities
M	Professional, scientific and technical activities
N	Administrative and support service activities
O	Public administration and defence; compulsory social security
P	Education
Q	Human health and social work activities
R	Arts, entertainment and recreation
S	Other service activities
T	Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
U	Activities of extraterritorial organisations and bodies

7.5 N° of patents by technology field and economic sector per type of applicant

The present annex shows the number of distinct patents filed in 1991 and 2001 by technology field and economic sector per type of applicant, taking into account patents:

- which have a patent life that can be calculated (with high certainty).
- that have been validated in at least one country.

Figure 18 - Patents filed in 1991 which have a patent life that can be calculated (with high certainty), per type of applicant for each technology field

	Number of patents [1]				
Technology Field	Company	Government	Hospitals	Individual	University
Electrical machinery, apparatus, energy	2.545	33		112	11
Audio-visual technology	3.322	19	1	81	13
Telecommunications	2.639	27	1	39	13
Digital communication	629	5		4	1
Basic communication processes	975	6		14	6
Computer technology	2.384	16	2	41	9
IT methods for management	71			6	
Semiconductors	1.605	30		11	11
Optics	2.852	38		51	18
Measurement	2.872	121	2	154	94
Analysis of biological materials	1.172	77	2	54	75
Control	1.093	7		87	4
Medical technology	1.754	31	3	318	48
Organic fine chemistry	4.209	194	13	130	165
Biotechnology	1.319	146	11	57	138
Pharmaceuticals	2.269	134	12	123	142
Macromolecular chemistry, polymers	2.584	38	1	19	21
Food chemistry	625	17		43	5
Basic materials chemistry	2.716	67		61	21
Materials, metallurgy	1.660	55		51	19
Surface technology, coating	1.505	33		54	8
Micro-structural and nano-technology	15			2	2
Chemical engineering	1.853	49		198	23
Environmental technology	1.322	45		189	21
Handling	1.992	10		220	4
Machine tools	1.581	15		203	5
Engines, pumps, turbines	1.419	19		100	5
Textile and paper machines	2.336	8		81	6
Other special machines	2.467	43		228	17
Thermal processes and apparatus	737	12		86	3
Mechanical elements	2.030	9		184	5
Transport	2.063	13		194	3
Furniture, games	678	1		160	2
Other consumer goods	864	10		130	3
Civil engineering	1.324	28		319	1

[1] Number of distinct patents (filed in 1991) for which patent life can be calculated (with high certainty)

Note 1: Data available only for European patents
Note 2: Patents can belong to more than one technology field
Note 3: 1991 has been used as the sole reference year for patent life calculation as this is the only year in which standard (non-extensible) patents have had the chance to reach their maximum term

Source: PATSTAT 10-2012, Dataset Gamma

Figure 19 - Patents filed in 1991 which have a patent life that can be calculated (with high certainty), per type of applicant for each economic sector

	Number of patents [1]				
Economic Sector	Company	Government	Hospitals	Individual	University
Food, beverages	628	17		43	5
Tobacco products	44			3	
Textiles	457	7		22	2
Wearing apparel	52	1		8	2
Leather articles	49			16	
Wood products	68	1		39	
Paper	549	1		27	1
Petroleum products, nuclear fuel	340	29		20	2
Basic chemical	6.239	175	1	174	79
Pesticides, agro-chemical products	432	12		9	11
Paints, varnishes	22			3	
Pharmaceuticals	3.730	215	15	136	206
Soaps, detergents, toilet preparations	362	2		3	
Other chemicals	1.151	9		27	5
Man-made fibres	150	2		1	2
Rubber and plastics products	2.256	15		230	2
Non-metallic mineral products	1.590	24		145	8
Basic metals	1.076	32		59	7
Fabricated metal products	1.379	18		242	3
Energy machinery	1.688	6		126	3
Non-specific purpose machinery	2.182	45		245	24
Agricultural and forestry machinery	364	7		95	6
Machine-tools	1.336	14		161	4
Special purpose machinery	3.657	65		339	15
Weapons and ammunition	119	8		7	
Domestic appliances	745	2		102	1
Office machinery and computers	5.091	40	2	87	12
Electric motors, generators, transformers	356	1		19	3
Electric distribution, control, wire, cable	777	3		27	1
Accumulators, battery	197	11		11	1
Lightening equipment	128			15	
Other electrical components	675	10		42	5
Electronic components	2.408	44		25	17
Signal transmission, telecommunications	2.923	41		71	19
Television and radio receivers, audio-visual electronics	1.703	7	1	27	10
Medical equipment	2.001	49	3	336	53
Measuring equipment	2.555	112	2	117	92
Industrial process control equipment	504	6		25	7
Optical instruments	1.626	23		70	14
Watches, clocks	73	1		8	
Motor vehicles	2.738	21		200	8
Other transport equipment	568	7		88	1
Furniture, consumer goods	577	1		152	

[1] Number of distinct patents (filed in 1991) for which patent life can be calculated (with high certainty)

Note 1: Data available only for European patents
Note 2: Patents can belong to more than one economic sector
Note 3: 1991 has been used as the sole reference year for patent life calculation as this is the only year in which standard (non-extensible) patents have had the chance to reach their maximum term

Source: PATSTAT 10-2012, Dataset Gamma

Figure 20 - Patents filed in 2001 that have been validated in at least one country, per type of applicant for each technology field

	Number of patents [1]				
Technology Field	Company	Government	Hospitals	Individual	University
Electrical machinery, apparatus, energy	4.062	73		118	28
Audio-visual technology	3.099	26		95	15
Telecommunications	4.479	37		77	20
Digital communication	2.823	15		31	6
Basic communication processes	1.182	11		12	8
Computer technology	3.349	33	1	84	34
IT methods for management	337	2		18	
Semiconductors	1.624	53		23	33
Optics	2.596	41		59	39
Measurement	3.970	200	12	152	190
Analysis of biological materials	1.703	143	12	84	161
Control	1.610	20		85	6
Medical technology	3.832	48	21	338	125
Organic fine chemistry	5.866	260	33	177	361
Biotechnology	1.973	198	28	105	265
Pharmaceuticals	4.063	173	33	163	301
Macromolecular chemistry, polymers	2.826	47	3	20	32
Food chemistry	791	32		52	26
Basic materials chemistry	3.057	72	1	67	40
Materials, metallurgy	1.960	70		49	28
Surface technology, coating	1.918	48		57	23
Micro-structural and nano-technology	164	17		1	12
Chemical engineering	2.550	74		149	36
Environmental technology	1.828	65		127	22
Handling	2.866	14		219	8
Machine tools	2.383	17		158	7
Engines, pumps, turbines	3.054	33	1	98	6
Textile and paper machines	3.002	27		52	5
Other special machines	3.214	64	6	243	39
Thermal processes and apparatus	1.173	13		89	5
Mechanical elements	3.553	20		194	9
Transport	4.648	15		208	6
Furniture, games	1.187	2		236	7
Other consumer goods	1.600	5		193	4
Civil engineering	1.989	15		343	3

[1] Number of distinct patents (filed in 2001) that have been validated in at least one country

Note 1: Data applicable only for European patents
Note 2: Patents can belong to more than one technology field
Note 3: 2001 has been chosen as the reference year since filing data for 2006 and 2011 was not complete. For further details see 'Methodology overview and sources of information'

Source: PATSTAT 10-2012, Dataset Delta

Figure 21 - Patents filed in 2001 that have been validated in at least one country, per type of applicant for each economic sector

	Number of patents [1]				
Economic Sector	Company	Government	Hospitals	Individual	University
Food, beverages	799	33		52	26
Tobacco products	40			7	
Textiles	564	6		12	2
Wearing apparel	109			23	
Leather articles	99			20	
Wood products	108	3		33	
Paper	746	4		19	1
Petroleum products, nuclear fuel	348	35		11	5
Basic chemical	6.757	209	4	129	138
Pesticides, agro-chemical products	416	13	1	27	22
Paints, varnishes	19			1	
Pharmaceuticals	5.769	301	39	209	415
Soaps, detergents, toilet preparations	474	3		3	4
Other chemicals	1.015	16		17	10
Man-made fibres	150	12		4	
Rubber and plastics products	3.268	23		245	11
Non-metallic mineral products	2.009	43		175	11
Basic metals	1.329	32		69	20
Fabricated metal products	2.158	13		281	13
Energy machinery	3.354	19	1	136	7
Non-specific purpose machinery	3.238	52		220	22
Agricultural and forestry machinery	617	25	4	122	22
Machine-tools	1.980	20		119	7
Special purpose machinery	4.817	89		251	27
Weapons and ammunition	144			20	
Domestic appliances	1.446	11		125	2
Office machinery and computers	5.896	50	1	139	40
Electric motors, generators, transformers	655	8		24	3
Electric distribution, control, wire, cable	1.240	4		19	3
Accumulators, battery	531	35		10	12
Lightening equipment	243	2		20	
Other electrical components	1.018	17		45	7
Electronic components	2.527	81		36	49
Signal transmission, telecommunications	6.564	46		108	36
Television and radio receivers, audio-visu	1.614	17		44	14
Medical equipment	4.294	85	21	361	144
Measuring equipment	3.552	189	12	132	191
Industrial process control equipment	754	16		24	9
Optical instruments	1.927	30		88	30
Watches, clocks	101			7	
Motor vehicles	5.959	27		180	1
Other transport equipment	1.122	9		99	5
Furniture, consumer goods	974	3		218	8

[1] Number of distinct patents (filed in 2001) that have been validated in at least one country

Note 1: Data applicable only for European patents
Note 2: Patents can belong to more than one economic sector
Note 3: 2001 has been chosen as the reference year since filing data for 2006 and 2011 was not complete. For further details see 'Methodology overview and sources of information'

Source: PATSTAT 10-2012, Dataset Delta

7.6 Literature review

In addition to the references cited below, another important source of information is Eurostat's quarterly review of literature on patent statistics. The report consists of an extensive targeted review of the existing and currently developed methodological, analytical and scientific material and of the most recent relevant literature in the following domains: Name harmonisation and gender; Existing information and databases at institutional or company level or business surveys: comparison and possible integration and matching of data for analytical purposes; Development of methods on patent data based on technical fields: biotechnology, nanotechnology, environmental technologies, energy, measurement of climate change, eco-innovation, technological innovation, and other emerging fields; Development of methods for compiling information on patent families and citations; Regionalisation.

The report essentially consists of a collection of articles, working papers and other publications available free of charge. The last available version of this report is available under the Eurostat web dissemination environment.

Link:

https://circabc.europa.eu/sd/a/cb91afc3-2426-487a-a24f-68d1ca58fbce/AR_patents_042013.pdf

The internationalisation of technology analysed with patent data

Authors:

D. Guellec, Bruno van Pottelsberghe (2000)

Abstract:

This paper presents three new patent-based indicators of internationalisation of technology reflecting international cooperation in research and the location of research facilities of multinational firms. They witness both an increasing trend towards the globalisation of technology in the OECD area and large cross-country differences in the extent of internationalisation. An empirical analysis shows that the degree of technological internationalisation is higher for small countries and for countries with low technological intensity. Finally, two countries are more likely to collaborate if they are geographically close to each other, if they have a similar technological specialisation and if they share a common language. Being member of the European Union involves more cross-border ownership but does not entail more research co-operation than it is implied by the above factors. Nordic countries have a particularly high propensity to collaborate together.

Conclusions:

This paper presented and analysed three indicators of internationalisation of technology derived from information available in patent data. In accordance with the existing literature, these indicators witness an increasing trend towards the internationalisation of technology of OECD countries. However, there are large differences in the extent of internationalisation across countries. Internationalisation of a country's technological activities decreases with the level of its GDP and with its R&D intensity. Researchers in larger countries find more easily colleagues for partnering in their own country, and countries with higher technological level do not need as much as others co-operation with foreign researchers since their own knowledge base is large. This partly explains the relative insulation of Japan for instance. On the other end, the UK and the USA seem to be more open than their size and research intensity would lead to predict. Language may be part of the explanation, as suggested in results concerning geographical patterns of international co-operation. Another insight from the study is that the major aim of multinational firms when establishing research facilities abroad is to adapt their products to local conditions rather than to "tap" foreign technology: actually, the major stream of R&D investment abroad come from highly R&D intensive countries to low intensive ones rather than the opposite (as it would be the case if technology sourcing was the dominant objective).

Who co-operates with whom is largely explained by geographical proximity and technological proximity (similar specialisation) of the partnering countries. In addition, sharing a common language fosters bilateral links in technology. Pairs of countries that are both members of the European Union have slightly more cross-border ownership than the average, but not more research co-operation than it is implied by their geographical and technological proximity.

Link:

http://www.oecd.org/sti/inno/40807432.pdf

Role of national patent offices, the European Patent Office, as well as the Japanese and USA patent offices in promoting the patent system

Authors:

IBM

Abstract:

The purpose of the study described in this report was to:

Obtain a clear and detailed picture of the innovation promotion activities currently being undertaken by the national patent offices in the Member States of the European Union, and also by the European Patent Office, Japanese and USA patent offices.

Provide an assessment of the effectiveness of these activities in meeting their intended objectives. Provide an assessment of the scope for possible future activities of national patent offices of the Member States of the European Union.

Identify for each Member State any areas where the needs of – in particular –SMEs, private inventors and academic institutions for patent-related services were not being met. For the purposes of the study, innovation promotion activities are understood to mean the efforts to disseminate/promote the use of patent system information and encourage businesses, academic institutions, other government departments/agencies and the public to use the patent system.

First Objective is met in a rather straightforward way by generating an overview of the activities patent offices currently undertake to promote the patent system. Given the close interrelation of the other objectives, associated findings are presented in a more integrated manner.

Link:

http://ec.europa.eu/internal_market/indprop/docs/patent/studies/offices_en.pdf

Patent renewal fees and self-funding patent offices

Authors:

Joshua S. Gans, Stephen P. King and Ryan Lampe (2004)

Abstract:

A socially optimal structure of application and renewal fees for patents would encourage the maximal number of applications while reducing effective patent length. We find, however, that when patent offices are required to be self-funding, resource constraints can distort this fee structure. Specifically, a financially constrained, but welfare-oriented, patent office will tend to raise initial application fees while lowering renewal fees. This creates two detriments to social welfare as it discourages the filing of some patents while extending the effective life of others.

Conclusions:

Our analysis shows that requiring the patent office to be self-funding can distort patent fees in a way that lowers social welfare. In particular, a self-funding patent office has an incentive to encourage too many patent renewals from a social perspective. Increasing the number of renewals by lowering renewal fees increases inventors' expected profit and this profit can be appropriated by the patent office through initial patent application fees.

It might seem incongruous that a self-funding requirement for the patent office can lead to lower patent renewal fees. However, what the patent office does when faced by a binding self-funding constraint is to rebalance the patent fees. It is this rebalancing by lowering renewal fees but raising application fees that distorts social welfare. In our framework the same number of inventions are patented but from the social perspective too many of these inventions effectively gain a "long" patent.

Our model provides a clear empirical prediction about the implications of introducing a self-funding requirement on a patent office. To the extent that this constraint binds, we would expect to see the patent office rebalance its fees by raising application fees relative to renewal fees. Over time we would expect to see an increased incidence of patent renewals for inventions.

Link:

http://ssrn.com/abstract=515162

How does intellectual property support the creative process of invention?

Authors:

H. Hall et al. (2004)

Abstract:

Invention as a human activity is much older than the notion of intellectual property. People had been inventing new tools, techniques and technologies for thousands of years before legal constructs granted individuals and organizations limited ownership rights for the ideas they produced. Systems of patenting were conceived to motivate and reward people not only for undertaking invention but also for disclosing their ideas to society in order to promote general progress. From the first patent law, in 15th century Venice, to the landmark English patent statute in the 17th century, to the establishment of the United States system of patent protection in the 1790s, to today's international patent structures, such legal conceptions have changed dramatically over time. In addition, patents have evolved along with the larger web of intellectual property that includes forms such as trade secrets and copyrights.

But like any set of laws and practices, these forms of protection sometimes get misinterpreted and misapplied, and they sometimes yield inconsistencies, loopholes, and unintended consequences. Since these rules and laws exist to support and stimulate the human activities that gave rise to them in the first place, we ask these overarching questions: How well does our current system of intellectual property support the creative process of invention? What are the ways it can be improved?

To answer those and related, the Lemelson-MIT Program, in September 2003, convened a distinguished group of experts in the area of intellectual property. Our participants included professors of law, engineering and management, as well as patent attorneys, intellectual property researchers, a university patent office director, a former director of the U.S. Patent &Trademark Office, as well as inventors and entrepreneurs, with many of our participants taking on more than one of these roles over the course of their careers. The goals of this report are to summarize the discussion of the critical aspects of intellectual property and to reach conclusions about how to change the system to better support and stimulate invention.

Conclusions:

The Patent System Provides Support and Incentives for Invention Society as a whole is the customer of the patent system. Evidence suggests that high levels of invention are important to our economic welfare and that the patent system supports invention.

Inventors are motivated by a diverse set of factors, including financial gain, altruism, the intrinsic pleasure of inventing, and professional recognition. Patents serve as an effective incentive for inventors to disclose their knowhow to society in return for limited monopolies to exploit their own inventions. This bargain encourages investment in new technologies, prompts corporations to create new products, and gives entrepreneurs the impetus to get new business underway. Invention is cumulative; many inventions create the opportunity to build on their ideas.

Link:

http://web.mit.edu/invent/n-pressreleases/downloads/ip.pdf

The value of the European patents, evidence from a survey of European inventors

Authors:

A. Gambardella et al. (2005)

Abstract:

The transition of the European Union towards the "knowledge-based economy" is a priority of the agenda of the Lisbon Summit (European Commission, 2003a). The investment in education, research and innovation is crucial to achieve these goals.

This report focuses on a number of ingredients that determine the innovative performance of the European countries and their potentialities for economic growth. It includes key figures concerning the research inputs (such as the characteristics of the inventors, the motivations to innovate, the characteristics of the innovation process), and the innovative performance of six European countries (i.e. the value of the innovations produced by European inventors).

Conclussions

The authors show evidence from a survey of European inventors, where relevant data about the structure and competitiveness of SMEs in Europe can be found.

One of the most relevant findings, most inventors do not change jobs after their invention is patented. The EU6 share of inventors who never moved is 77.52%, with differences across countries. The less mobile inventors are in Spain, Germany and France: 88.80%, 83.14% and 82.28%. Italy and the Netherlands follow with 75.43% and 69.88%. The UK is the country with the smallest share of non-mobile inventors: 65.28%. Most of the inventors who changed job, moved only once. The share of EU6 inventors who moved more than three times is 0.80%. Recent contributions point out that there is a positive correlation between the researchers' productivity and their mobility, and highlight the importance of human capital mobility as a mechanism through which knowledge spillovers take place (Klepper, 2001; Zucker, Darby and Armstrong, 1998). A goal of the research agenda based on the "PatVal-EU" data is to investigate the relationship between the inventors' mobility and their innovative performance

Link:

http://ec.europa.eu/invest-in-research/pdf/download_en/patval_mainreportandannexes.pdf

Study on evaluating the knowledge economy-what are patents actually worth?

Authors:

A. Gambardella, P. Giuri and M. Mariani (2006)

Abstract:

This Report deals with the economic value of European patents and offers a comprehensive analysis of the "state of the art" on this issue. It provides a complete survey of the existing scientific literature in economic and business studies, and it uses original data to present descriptive statistics and elaborations on the value of European patents.

Conclusions

The authors constructed 10 classes for the value of the patents, ranging from those that are worth less than 30,000 EUR, up to patents that are estimated to produce more than 300 million EUR. Consistently with the well-known skewness of the distribution of the patent value (i.e. only few patents produce high economic returns, Harhoff et al. 1999a, 2003, and Scherer and Harhoff 2000 who report on several stochastic model simulations, concluding that the set of profit potentials tapped by innovators is itself skew-distributed and that the number of entrants into innovation races is more likely to be independent of market size than stochastically dependent upon it.) only 7.2% of the patents in their sample are worth more than 10 million EUR, and 16.8% have a value higher than 3 million EUR. A share of 15.4% has a value between 1 and 3 million EUR. However, the largest share of patents falls in the left-end of the distribution. About 68% of all their patents produce less than 1 million EUR, and about 8% have a value lower than 30,000 EUR.

At the country level, Spain, the Netherlands and the UK have a share of high value patents larger than the EU6 share. The share of patents with a value higher than 10 million EUR is 12.79% in Spain, 8.86% in the Netherlands and 11.12% in the UK. Italy follows with 7.68%. Germany and France are in the bottom of the list with 5.19% and 5.58% of patents with a value higher than 10 million EUR. Symmetrically, the share of patents whose value is lower than 1 million EUR is lower in Spain (54.13%), the UK (53.73%) and the Netherlands (61.04%) compared to the EU6 share (67.8%). Italy comes fourth with 67.83%, while Germany (74.95%) and France (74.9%) have the largest share of comparatively lower value patents.

Link:

http://ec.europa.eu/internal_market/indprop/patent/index_en.htm#studies

The cost factor in patent systems

Authors:

B. van Pottelsberghe and D. François (2009)

Abstract:

The objective of this paper is to assess whether and to what extent the cost of patenting affects the demand for patents. The empirical analysis, which focuses on the patent systems of the USA, Japan, and Europe during the year 2003, leads to the following methodological and empirical observations: i) after the grant, the translation, validation and transaction costs induced by an effective protection in several European countries witness a highly fragmented and very expensive European market for intellectual property; ii) for a proper international comparison, the size of the market and the average number of claims must be accounted for; iii) when the cost per claim per capita (the 3C-index) is considered, a negative linear relationship appears between the cost of patenting and the number of claims that are filed; iv) for a patent designating 13 European countries, the 3C-index is about 10 (2) times higher than in the USA (Japanese) system (for process and translation costs up to the grant); v) The European market being more than twice as large as the USA market in terms of inhabitants, the 3C-index suggests that there would be a clear justification for higher nominal examination fees at the EPO, that would ensure a rigorous granting process.

Conclusions:

Contrarily to what could logically be expected, there is no apparent relationship between the market size of a country or region and the number of patent applications it receives each year. Even if the number of claims is taken into account instead of the number of patent filings, being a larger economic area does not translate into the filing of a larger number of claims. The reason underlying this lack of relationship between market size and patent applications is partly due to the cost of patenting, which is not straightforward to measure. We have put forward a method for cost evaluation that consists in taking first the "procedural" costs, which include all official fees up to the grant of a patent and its validation in the desired countries for protection. The second component is related to the translation costs. It occurs exclusively for the EPO, once the patent is granted, and is required in order to be validated in each national patent office. The third component is the most difficult to approximate. It is related to the external services (professional services, attorneys, etc..) that companies can either outsource or bear in-house. The fourth component varies with the duration of the protection. Renewal fees are required to keep the patent in force in each designated country. In this paper the cost of a 10 year and 20 year protection have been computed. In addition, as the cost of a patent applied at the EPO depends on the desired geographical scope for protection, we have computed the average cost for a protection in the three most frequently designated EPC states and for the 13 EPC states that were designated by at least 60% of the patent filing.

The results clearly show that the European patent system is much more expensive than the USA or Japanese patent systems. A European patent that is renewed for 20 years in 3 (13) EPC Member states costs more than EUR 40,000 (120,000), against about EUR 14,500 and EUR17,300 for the USA patent system and the Japanese patent system, respectively. The Japanese patent system is the least expensive for the process costs. For a 20 years protection the USA system is the least expensive. As Japanese patents are composed of much less claims (on average, about 7) than European (18) or American patents (23), we argue that it is more appropriate to analyse the cost per claim. For instance, the process and translation costs of a claim that is granted by the EPO goes from more than EUR 400 for 3 designated states to more than EUR 1,100 for 13 designated states, as compared with EUR 80 and EUR 220 per claim in the USA and Japan, respectively. A European patent designating 13 countries appears to be nearly 11 times more expensive than a U.S. patent if process and translation costs are considered. For the total costs with up to 20 years of protection the European patents would be nearly 9 times more expensive. Japanese patents are less expensive than USA patents at the beginning of the process and become gradually more expensive. If the analysis focuses on the claims, the cost differences increase. One claim, the lowest common denominator of a patent, is 6 to 14 times more expensive in Europe (with "only" 13 designated states) than in the USA, depending on the type of cost considered.

Several attempts to reach a more integrated market are currently tackled by policy makers. A first, although incremental, possibility for improvement would be to harmonize the validation and renewal fees across the EPO Member States. In this respect the 3-C index could be a useful tool. A second and significant potential improvement of the system lies in the current proposals of the European Patent Litigation Agreement (EPLA) and/or the London Protocol. While the former would simplify the complexity and the cost of litigation in Europe (through a centralized court) the latter would substantially reduce the translation requirements, and hence the cost of patenting. Finally, the most important advance in reducing the complexity and the cost of patenting in Europe would be reached through the Community Patent - i.e., a unique gateway for patenting, with an automatic reach of the whole European market, one fee structure and lower translation costs.

Link:

http://www.un-lj.si/files/ULJ/userfiles/ulj/razis_razv_projekti/intelektualna_lastnina/%C5%A0tudija-The%20cost%20factor%20in%20patent%20systems.pdf

When small is beautiful measuring the evolution and consequences of the voluminosity of patent applications at the EPO

Authors:

E. Archontopoulos, D Guellec, N. Steevnsborg, B. van Pottelsberghe and N. van Zeebroeck. (2007)

Abstract:

The joint increase in the number and size of patents filed around the world puts patent systems under pressure. This paper addresses issues in measuring the voluminosity of patent applications and highlights patterns in its evolution. The results, based on a database of 2 million EPO applications, show that the average size of applications has doubled over the past 20 years and that this is mainly associated with PCT applications having a USA priority. Voluminosity indicators are influenced by geographical origins and technological areas and strongly impact the workload of the EPO, justifying the need for regulatory and policy actions.

Conclusions:

Patent voluminosity has become a real issue for patent offices around the world and for the EPO in particular. The objective of this paper was to investigate possible measures of this phenomenon as well as its main potential drivers and broad impact on the patent system. The most appropriate indicators of voluminosity seem to be the number of claims and the number of pages in patent applications. Both figures have experienced a dramatic increase over the past 20 years, and although these two indicators may diverge in their determinants they seem to converge in their consequences. The broad descriptive analysis of these indicators reveals a wide range of potential drivers, from the fee structure to the complexity of inventions. Apparently driven by specific national systems, especially the American one, technological specificities (e.g. biotech and computers), and a growing interest for the internationalization of patenting procedures and markets (e.g. the PCT route), this escalation may be a common result of the accelerating complexity of new technologies and of the harmonization process of international patent laws. More generally, it appears that any voluminosity indicator is influenced by the geographical origin and the technological area of the patent. No matter its roots, not only does the surge in the size of incoming applications rapidly increase the workload of patent offices, which if not mastered will inevitably lead to widened backlogs and delays in grant decisions; it also raises important quality issues. Indeed, one may for instance question whether patent examiners, who are on average supposed to treat each application in the same amount of time, can reasonably provide the same quality in their examination on both small, medium or increasingly larger applications. Yet another open question is whether disruptive strategies, such as creating uncertainty by polluting the technological field or circumventing the disclosure requirement by hiding major inventions (Stevnsborg and van Pottelsberghe, 2007), are the major factor behind this escalation in voluminosity. Alternatively, is the increase in the number of claims actually revealing a better and more systematic use of fallback positions in patent drafting and number of pages a more thorough disclosure of inventions for which protection is being sought? These questions are calling for more formal statistical testing. Such tests are conducted in van Zeebroeck et al. (2006a).

Link:

http://www.sciencedirect.com/science/article/pii/S0167624507000145

Patent validation at the country level - The role of fees and translation costs

Authors:

D. Harhoff et al. (2007)

Abstract:

One feature of the European patent system that is heavily criticized nowadays is related to its fragmentation and the induced cost burden for applicants. Once a patent is granted by the EPO, the assignee must validate (and often translate) it and pay the renewal fees to keep it in force in each country in which protection is sought. The objective of this paper is to assess to what extent validation and renewal fees as well as translation costs affect the validation behaviour of applicants. We rely on a gravity model that aims at explaining patent flows between inventor and target countries within the European patent system. The results show that the size of countries, their wealth and the distance between their capital cities are significant determinants of patent flows. Validation fees and renewal fees further affect the validation behaviour of applicants. Translation costs seem to have an impact as well. The implementation of cost-reducing policy interventions like the London Protocol will, therefore, induce a significant increase in the number of patents validated in each European country.

Conclusions:

Overall, our results show that fees and translation costs do influence the patenting behaviour of firms. It is plausible that this relationship does not only apply to post-grant fees (analysed in this paper) but also to application or examination fees. Consequently, an increase in the application or examination fees charged by the EPO could be used as a policy instrument to influence the volume of **filing fees** which in turn facilitates the examination process and decreases the time to grant. One example for the implementation of a new fee strategy is the increase of the claim-based fees implemented by the EPO as of April 2008. In particular, before 2008, the EPO charged D 45 per claim in excess of 11 claims. From April 1st, 2008, the EPO charges D 200 per claim in excess of 16 claims. An additional increase of the claim-based fees will take place in April 2009.

Link:

http://www.sciencedirect.com/science/article/pii/S0048733309001243

Firm level implications of early stage venture capital investment – An empirical investigation

Authors:

Engel and Keilbach (2007)

Abstract:

The paper analyses the impact of venture capital finance on growth and innovation activities of young German firms. Among other variables, our panel of firm data includes data on venture capital funding and patent applications. With a statistical matching procedure we draw an adequate control group of non-venture funded firms. The analysis gives evidence that innovative firms will be able to close a venture capital deal with higher probability. Once the firms are venture funded, they display higher growth rates but do not differ in their innovative output from otherwise comparable firms. We derive strategic implications.

Conclusions:

In this paper, we investigate the implication of venture capital funding on firms' growth performance and innovative behaviour. This is done using a sample of roughly 50,000 German firms of which roughly 1 per-cent is venture funded. We find evidence that firms with higher innovative output (measured by patent applications, corrected for size) and with a higher educated management have a larger probability of being venture funded. Then we compare venture funded and non-venture funded firms with respect to growth and innovative behaviour. This is done using a statistical matching approach that compares venture funded firms with non-venture funded "twin"-firms. The aim of this approach is to make sure that the results are not biased with respect to firms' characteristics.

Based on this approach we find evidence that venture funded firms display significantly higher growth rates compared to their non-venture funded homologues. On the other hand, there is only very weak evidence for the innovative behaviour of both groups to be different. In our view, these results can be interpreted as follows: venture capital firms screen potential portfolio firms to select out those with the best growth perspectives. The innovative potential (as signalled by patent applications and by the founders' education levels) plays an important role in that respect. This screening process is very selective though successful since venture capital funded firms display indeed higher (twice as large) growth rate as compared to firms of a control group. This stronger growth rate seems to be a result of a commercialization of previous innovations since innovation outputs of venture funded firms do not differ from non-venture funded but otherwise strongly similar group of firms of a control group. A plausible explanation for this finding could be that venture capital investors assist their portfolio firms in this commercialization effort, rather than in further innovation effort, in an attempt to maximize sales, hence value, of their portfolio firms. Commercialization is probably done by financial means but also by means of management assistance. It is also possible that venture investors are more aware of possible commercialization channels.

Link: ftp://ftp.zew.de/pub/zew-docs/dp/dp0282.pdf

Filing international patent applications under the patent cooperation treaty (PCT): Strategies for delaying costs and maximizing the value of your intellectual property worldwide

Authors:

Anne M. Schneiderman (2007)

Abstract:

Obtaining international patent protection for an invention can present a significant financial commitment for an early-stage company, entrepreneurial venture or not-for profit organization with a limited budget for intellectual property management. This chapter examines the use of patent application filings under the Patent Cooperation Treaty (PCT) to delay, consolidate, or minimize the costs of patenting overseas. Using the PCT to file internationally enables a patent applicant to delay, generally for up to 30 months after the first (priority) filing date, strategic decisions about the countries in which to pursue patent protection. The delay offers a significant advantage, since it allows the applicant more time in which to evaluate commercial demand for the invention, the likelihood of its success in overseas marketplaces, and the likelihood of obtaining a patent grant in a particular country, prior to filing national-phase patent applications in the countries in which patent protection is sought.

Conclusions:

Filing a patent application under the PCT enables the applicant to delay strategic decisions about where to pursue patent protection by:

- Consolidating patent prosecution costs: single-application format, language, and set of fees.
- Providing the applicant with preliminary feedback regarding patentability of the invention.
- Providing the applicant with the opportunity to present arguments for patentability, to amend claims, and to strengthen the application prior to filing with national patent offices enabling the applicant to delay filing the application in individual national patent offices for up to 30 months after the first (priority) filing date delaying prosecution costs of filing applications in multiple countries streamlining the process of filing applications in multiple countries.

Delaying international patent prosecution provides more time to determine:

- The value of IP to applicant or owner.
- The strength of commercial demand abroad.
- Which claims in a patent application are likely to be patentable.
- Which countries are most attractive for pursuing patent protection.
- The likelihood of obtaining a patent grant in target countries.

Link:

http://www.iphandbook.org/handbook/chPDFs/ch10/ipHandbook-Ch%2010%2007%20Schneiderman%20PCT%20Filing%20Strategies.pdf

Per un pugno di dollari: A first look at the price elasticity of patents

Authors:

B. van Pottelsberghe and G. de Rassenfosse (2007)

Abstract:

This paper analyses the role of patent filing fees requested by the Member States of the European Patent Convention (EPC). We provide first empirical evidence showing that the fee elasticity of the demand for priority applications is negative and significant. Given the strong variation in absolute fees and in fees per capita across countries, this result witnesses a suboptimal treatment of inventors across European countries and suggests that fees should be considered as an integral part of an IP policy, especially in the current context of worrying backlogs. In addition, we show that the transfer rate of domestic priority filings to the EPO increases with the duration of membership to the EPO and the GDP per capita of a country, suggesting that Member States experience a learning curve within the EPC. The high heterogeneity in the transfer rates casts some doubts on the practice that consists in relying on filings at the EPO or at the USPTO to assess innovative performance of countries.

Conclusions:

There is a strong variation in absolute and relative patent fees across European countries: smaller countries generally display higher fees per capita. It is more expensive to protect a market unit in small countries than in large countries. Second, and contrarily to a common believe, patent filing fees have a significant and negative impact on the number of priority filings. A 10 per cent increase in filing fees would lead to a reduction of about 5 per cent in the demand for patents. Added together, these results witness a suboptimal treatment of inventors across European countries, which in turn substantially affects their filing behaviour.

This "fee" issue is generally not at the forefront of the debates on patent systems. The results presented in this paper however suggest that filing fees could be effectively considered as an integral part of an IP policy. This is especially true in the current context of the boom in patent filings and backlogs of pending applications observed at regional patent offices. Priority applications at the national patent offices of EPC Member States constitute a stepping stone towards subsequent filings at the EPO. Therefore, understanding the determinants of the transfer rate from the former to the latter is an important concern, which has been investigated in the final part of the present paper.

It turns out that there is a high level of cross-country heterogeneity in the transfer rate of domestic priority filings to the EPO and that this heterogeneity can be partly explained. The empirical analysis reveals that two main factors do not have any impact on the number of priority filings but rather significantly affect the transfer rate of national priority filings towards the EPO. These factors are the relative wealth of a country (measured with its GDP per capita) and its age of membership within the EPC.

The wealthier a country is and the older its membership in the EPC, the higher is the share of its priority filings that are transferred to the EPO. These results suggest first that more resources allow bearing the cost of an effective internationalisation of priority filings. Second, the Member States of the EPC go through a learning curve, which predicts a continued increase in the workload of the EPO. As a side effect, the degree of predictability of the transfer rates to the EPO casts some doubts -or calls for a very cautious interpretation- on the practice that consists in relying on second filings (be it at the EPO or at the USPTO) to assess the innovative performance of countries.

Link:

https://dipot.ulb.ac.be/dspace/bitstream/2013/53933/1/RePEc_sol_wpaper_07-022.pdf

Essays on the empirical analysis of patent systems

Authors:

N. van Zeebroeck (2007)

Abstract:

The European patent system has been affected by substantial changes over the past three decades, which have raised vigorous debates at different levels. The main objective of the present dissertation is to contribute to these debates through an exploratory analysis of different changes in patenting practices – in particular the way applications are drafted and filed to patent offices –, their drivers, association with the value of patents, and potential impact on the patent system. The coming essays are therefore empirical in their essence, but are inspired by economic motivations and concerns. Their originality is threefold: it resides in the novelty of the main questions discussed, the comprehensive database specifically built to address them, and the range of statistical methods used for this purpose. The main argument throughout these pages is that patenting practices have significantly evolved in the past decades and that these developments have affected the patent system and could compromise its ability to fulfil its economic purpose. The economic objective of patents is to encourage innovation and its diffusion through the public disclosure of the inventions made. But their exploitation in the knowledge economy has assumed so many different forms that inventors have supposedly developed new patenting and filing strategies to deal with these market conditions or reap the maximum benefits from their patents. The present thesis aims at better understanding the dimensions, determinants, and some potential consequences of these developing practices.

Conclusions:

The potential economic consequences and some policy implications of the findings from the dissertation are discussed in chapter 7. The evolution of patenting practices analysed in these works has some direct consequences for the stakeholders of the patent system. For the EPO, they generate a considerable increase in workload, resulting in growing backlogs and processing lags. For innovative firms, this phenomenon translates into an undesired increase in legal uncertainty, for it complicates the assessment of the limits to each party's rights and hence of the freedom to operate on a market, which is precisely what the so called "patent trolls" and "submariners" may be looking for. Although empirical evidence is lacking, some fear that this may result in underinvestment in research, development or commercialization activities (e.g. Hall and Harhoff, 2004). In addition, legal uncertainty is synonymous with an increased risk of litigation, which may hamper the development of SMEs and reduce the level of entrepreneurship. Finally, for society, we are left with a contrasted picture, which is hard to interpret. The European patent system wishes to maintain high quality standards to reduce business uncertainty around granted patents, but it is overloaded with the volume of applications filed, resulting in growing backlogs which translate into legal uncertainty surrounding pending applications. The filing strategies that contribute to this situation might reflect a legitimate need for more time and flexibility in filing more valuable patents, but they could also easily turn into real abuses of the system, allowing some patentees to obtain and artificially maintain provisional rights conferred by pending applications on inventions that might not meet the patentability requirements. Distinguishing between these two cases goes beyond the scope of the present dissertation, but should they be found abusive, they should be fought for they consume resources and generate uncertainty. And if legitimate, then they should be understood and the system adapted accordingly (e.g. by adjusting fees to discourage some strategies, raising the inventive step, fine-tuning the statutory term in certain technologies, providing more legal tools for patent examiners to reject unpatentable applications, etc.) so as to better serve the need of inventors for legal protection in a more efficient way, and to adapt the patent system to the challenges it is or will be facing.

Link:

http://theses.ulb.ac.be/ETD-db/collection/submitted/ULBetd-02042008-170122/unrestricted/nvz_phd.pdf

The London Agreement and the cost of patenting in Europe

Authors:

B. van Pottelsberghe and M. Mejer (2008)

Abstract:

This paper analyses the consequences for the European Patent System (EPS) of the recently ratified London Agreement (LA), which aims to reduce the translation requirements for patent validation procedures in 15 out of 34 national patent offices. The simulations suggest that the cost of patenting has been reduced by 20 to 30 per cent since the enforcement of the LA. With an average translation cost saving of €3,600 per patent, the total savings for the business sector amount to about €220 millions. The fee elasticity of patents being about -0.4, one may expect an increase in patent filings of eight to 12 per cent. Despite the translation cost savings, the relative cost of a European patent validated in six (thirteen) countries is still at least five (seven) times higher than in the United States.

Conclusions:

In nominal terms, for the average patent which targets six countries for protection, the cost savings are about 3,600 EUR. Given the fact that the EPO grants about 60,000 patents each year, the total saving for the business sector is about €220 million. As well as these substantial cost savings, one may expect an increase in the demand for patents of eight to 12 per cent, everything else being equal.

It is important to keep in mind that translation costs still have to be supported for the claims' section of a patent, and that cumulated (over the number of countries targeted for protection) national validation and renewal fees outperform by far the renewal fees observed elsewhere. Despite the substantial reduction induced by the London Agreement, the relative cost of a European patent is still at least four times higher than in the USA (and any other large national patent office). With a larger geographical scope for protection the relative cost of a patent in Europe could increase up to ten times the cost of a USA patent.

The question that directly pops up when these results are considered is whether these factors affect the behaviour of applicants, and if yes, whether it is good or bad for patent systems. On the first question, the evidence suggests that the propensity to patent is affected, although through a low price elasticity of -0.4. Is this then good for the patent system? A more expensive patent is not particularly bad for an economy, provided it correlates with the quality of the examination process, and provided the costs are not too prohibitive. In Europe the high costs actually constitute a prohibitive barrier to patenting, as witnessed by the relatively small attractiveness of the European market (which has only half the attractiveness of the USA patent system in terms of total applications, including PCT international applications). Given the current backlog issues raised by the heads of the USA, Japanese and European patent offices, one would be tempted to conclude that it is actually good for the economy, as it limits somewhat the number of applications. However, it must be kept in mind that the simulations presented in the present paper all too amply demonstrate that what makes a European patent relatively expensive is to a large extent due to the remaining translation costs and national renewal fees that must be paid in the countries targeted for protection. In other words, the high costs are no reflection on the quality of the patent system, but the managerial complexity and financial burden induced by a highly fragmented patent system.

Link:

http://www.ecares.org/index2.php?option=com_docman&task=doc_view&gid=46&Itemid=20

Venture capital and industrial innovation

Authors:

Ueda and Hirukawa (2008)

Abstract:

For the sample period of 1965-1992, Kortum and Lerner (2000) find that venture capital (VC) investments have a positive impact on patent count at industry level, and this impact is larger than that of R&D expenditures. We confirm that this positive impact continued to be present and became even stronger in late 90s during which VC industry experienced an unprecedented growth. We then proceed to study if this positive impact of VC is also present on productivity growth, which is a measure of innovation alternative to patent count. Unlike the impact on patent count, we do not find that VC investment affects total factor productivity growth. We do find that VC investment is positively associated with labour productivity but this positive impact is originated from the technology substitution from labour to other productive inputs such as energy and material. Therefore, our finding suggests that, at industry level, VC investment increases the patent propensity but may not necessarily improve the productive efficiency. Various interpretations are offered why this may be the case.

Conclusions:

This paper asks the following questions. First, did VC investment continue to be a highly effective driver of patent activities during the explosive VC boom in late 90s? Second, does VC money spur industrial innovations or patents? The answer to our first question is yes. By extending the sample period till 2001, we reconfirm the results of KL. We find that VC investments are more effective than R&D in generating patents and its effect became stronger during the extended period. The answer to our second question is that VC money spurs patents but not necessarily industrial innovation. In particular, we find that VC investments are not significantly related with TFP growth; labour productivity is positively and significantly related with VC investments. Nevertheless, this positive relation is driven by the VC investment's impact on the substitution of energy and non-energy material against labour. This labour saving behaviour in VC intensive industries may be driven by strong corporate governance by venture capitalists or by firms' desire to boost labour productivity and also stock prices. We also speculate that availability of VC may increases the patent propensity of new firms and nor the industry average patent propensity because VC stimulates new firm start-ups. Overall, our results suggest that the impact of VC investment is complex and a further examination is needed to understand what VC investment does to innovations.

Link:

http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1242693

Long live patents: The increasing life expectancy of patent applications and its determinants

Authors:

N. van Zeebroeck (2011)

Abstract:

Relying on a comprehensive dataset including detailed information on all patent applications filed to the EPO from 1980 to 2000 and on the renewal of those of them that were granted, this paper presents the first survival time analysis of the determinants of patent length. The results are twofold: first, they clearly establish that the life expectancy of patent rights has significantly increased over the past decades strategies very strongly influence the overall length of patents, possibly due to induced delays in the examination process. This suggests that such strategies may result in higher and longer lasting legal uncertainty on the markets, with unknown consequences on the dynamic efficiency of the patent system.

Conclusions:

First, the present paper clearly establishes that the length of patent rights in Europe has significantly increased over the eighties and the nineties despite an apparent decline in the average grant rate. This increase may be due to the dilatation of the examination process (significant increase in patent renewals), or both. More work would be needed to disentangle these potential factors, but they readily suggest that monopolistic rents may be extracted over longer periods by patent holders, with unknown consequences on the dynamic efficiency of patents.

Second, these developments were not even across technology fields. In particular, our results suggest that emerging technologies, which also make the most controversial subject matter in today's patent system (i.e. biotechnologies, computers and telecommunications), are associated with the longest patent rights. This may be due to evolving patenting standards in these technological fields, resulting in a smaller predictability of the patentability requirements and hence more complexity in the examination, but also to specificities in competitive processes on these markets that induce a particular focus on IP rights.

Third, it clearly appears that most filing strategies are associated with longer patent rights, but it appears that they may affect the length of patents slightly differently before and after grant, i.e. they may have different impacts on the duration of the examination process and on renewal rates. In particular, although increasingly popular, the filing of divisionals remains an exceptional practice (about 4.5% of applications filed in the late nineties were divisionals), but this practice seems to have a major impact on the length of the patents. This is of great importance, because such strategies are in fact procedures allowed by the European Patent Convention that are actionable by firms, for instance when they deem it in their interest to delay the grant decision on their patents, at the expense of a greater legal uncertainty on the markets.

These results therefore suggest the exclusive rights offered by patents tend to be exploited by the patentees over longer periods, but that this is not only a matter of patents being more important and valuable and therefore renewed for longer periods after grant, but it is largely a matter of filing strategies used by firms with effect to delay the grant decision on their patents. It is hard to imagine why such a growing uncertainty on the market would be beneficial to competition, to the functioning of technology markets, and to society at large. Still, further research would be greatly needed to disentangle the influence of filing strategies on the granting process and on grant and renewal rates and to better understand the motivation of the firms who rely on such strategies.

Link:

http://www.rei.unipg.it/rei/article/view/41

Languages, fees and the international scope of patenting

Authors:

D. Harhoff, K. Hoisl and B. van Pottelsbergue (2009)

Abstract:

This paper analyses firms' choices regarding the geographic scope of patent protection within the European patent system. We develop an econometric model at the patent level to quantify the impact of office fees and translation costs on firms' decision to validate a patent in a particular country once it has been granted by the EPO. These costs have been disregarded in previous studies. The results suggest that both translation costs and fees for validation and renewals have a strong influence on the behaviour of applicants. The estimates are then employed to simulate the impact of the London Protocol, a recent policy reform which reduces translation requirements in the European patent system. National validations of patents granted by the EPO are estimated to increase by 29%.

Conclusions:

The European patent system provides an interesting field for the empirical analysis of patent systems. The variation in our data allows us to investigate to what extent patent applicants are influenced by both the fees and translation costs, as well as by physical distances and market attractiveness (represented by its size, its wealth or the technical position of the validation country relative to the applicant country). Our paper analyses a particularly clear decision- making situation where fees and translation costs are the only remaining expenses that separate applicants from patent protection. The empirical results are applied to assess the impact of an important patent policy reform, the London Protocol, which has had a major impact on the translation costs of European patents.

The empirical analysis essentially aimed at testing the role of languages (i.e., translation costs) and the role of fees for validation and early renewal. A patent-level probit model was used estimate the incidence of patent validation of an EPO-granted patent in a given EPC country. Economic variables such as the size and the wealth of the countries of origin (the country of residence of the applicant) and of the countries of destination where the patent is validated are important determinants of the validation probability. In general, the characteristics of the validation country (where the patent is validated and enforced) have a much stronger impact on validations than the characteristics of the origin country.

Technological specificities and geographical distance were included as additional explanatory variables. These characteristics are important factors affecting the probability of validation of a patent in a given country. The world may have become more globalized, but it certainly has not become "completely flat". Physical distance still matters, and so does the distance in culture and languages. The empirical analysis also shows that translation costs have a negative impact on validations. Furthermore, our results show that early renewal fees and validation fees substantially reduce the likelihood of validating a patent in a given country. The unique and rich dataset which exploits the institutional detail of the European patent system also permits us to make predictions regarding the number of additional validations that EPC Member States may expect in the future. A simulation of the validation decision under London Protocol translation regulation shows that the countries that ratified the London Protocol face an increasing probability of validations. In particular, we predict that the number of additional validated patents will increase between 29%. Should all EPC Member States ratify the London Protocol, the increase could reach 59.3% of the validations performed in 2003. Our estimates only capture the impact of the marginal cost of patenting on validation.It is highly likely that the cost reduction coming with the implementation of the London Protocol will affect the overall number of filings at the EPO, and hence the number of grants which are then subject to the validation decision studied here.33 We plan to investigate the overall impact of current reforms and reform proposals in future work building on the econometric results described in this paper.

Link:

http://epub.ub.uni-muenchen.de/10456/

Economic cost-benefit analysis of a unified and integrated European patent litigation system

Authors:

D. Harhoff (2009)

Abstract:

The patent system in Europe is still incomplete. Appropriating returns from patented technology is impaired by the fact that patent-holders may have to enforce their patent rights in multiple courts. Moreover, third parties interested in showing that particular patent rights have been granted erroneously are disadvantaged by having to initiate revocation proceedings in multiple jurisdictions.

Given that the successful pursuit of these two objectives can generate welfare gains for the European economy, a unified European patent litigation system has immediate appeal. The current study seeks to provide approximate cost and benefit calculations in order to inform policy-makers in Europe about the choices they face in this important field of public policy. The study groups cost and benefit effects into the following categories: (i) effects from avoiding duplication of litigation; (ii) effects from changes in the demand for litigation, induced by changes in the cost structure; (iii) effects from changed incentives for patenting. Towards performing an assessment of the first two effects, the report collects data from a variety of sources in order to support the estimates and to test the plausibility of a number of necessary assumptions. Given that no official data on the incidence, outcomes and cost of patent litigation exist, an effort is made to triangulate data and estimates in order to demonstrate that the approximations are justified.

Conclusions:

The following results are particularly important. Avoiding duplication of infringement and revocation cases is likely to generate large benefits for the European economy. The results obtained here suggest that currently, between 146 and 311 infringement cases are being duplicated annually in the EU Member States. By 2013, this number is likely to increase to between 202 and 431 duplicated cases. Total private savings from having access to a unified Patent Court in 2013 would span the interval between EUR 148 and 289 million. An assessment of the operating costs of the proposed Patent Court is obviously subject to a large number of caveats. Based on data from earlier efforts (in particular the Working Party on Litigation set up under the auspices of the European Patent Organisation), an upper-bound estimate for the operating costs of a court with a capacity of 940 cases indicates that the Court would cause operating costs of EUR 27.5 million.

Hence, the cost-benefit assessment focusing on avoided duplication leads to a highly positive evaluation of the proposal. Even if the low estimate of savings (EUR 148 million) is taken, the new system would create substantial benefits and reach a benefit-cost ratio of 5.4. However, this view may be unduly conservative, and the benefit-cost ratio could be as high as 10.5. Additional benefits could flow in case of additional litigation activity, be it in terms of infringement or revocation actions. The availability of a low-cost litigation path offered by a unified Patent Court is likely to lead to additional activity from parties in countries which currently do not use the European patent system extensively. Moreover, the cost level of litigation in the unified Patent Court system is likely to be below the cost levels currently observed in some Member States and parties in these Member States are also likely to engage in more litigation activity in the medium-run. These effects will also contribute to generate private and public benefits.

The above estimates and considerations are based on the assumption that the unified Patent Court will offer litigation at roughly the same cost level as the three largest low-cost national systems. In a robustness check, the report explores to what extent the gains from saved duplication would be dissipated if the cost level were higher. The computations show that even with a substantial average cost increase, benefit-cost ratios remain above one, and for most scenarios considerably above one.

It is more difficult to predict cost-induced changes in the demand for litigation. The relevance of such changes will depend on the level and type of costs imposed on users of the new system. These will be mostly determined by the private costs for legal support and advice, but also by the fees levied by the Court itself. Measures to contain the private costs to parties in litigation are important, and the Presidency's proposal includes a number of such measures which are discussed in the report with respect to their impact. A particularly promising measure is to admit representation of parties by specialized European Patent Attorneys. Another measure of importance is the contribution from the Community budget and from States which are not EU Member States to the Court's budget, in order to keep fees at low levels.

The report also discusses – in a qualitative manner – effects which emerge from changes in patenting and litigation incentives. It is argued that effects will be beneficial if the unified patent litigation system puts emphasis on fast and low-cost proceedings, high quality judgement, and a fair balance between the legitimate interests of patent holders and alleged infringers. It is emphasized that particularly strong positive welfare contributions can be expected if an effective and rapid, low-cost revocation procedure is available. The latter feature should provide an effective means against strategic and (possibly) frivolous litigation activity which could be mounted in the future by "patent trolls". The report also comments on particular design choices in the Presidency's proposal.

To summarize, this report recommends strongly that the Presidency should proceed in its efforts to establish a unified and integrated patent litigation system for European patents and future Community patents. For conservative estimates of the relevant parameters, the economic benefits from such a system are likely to exceed the costs of the establishment and operation of the new court by a large multiple of between 5.4 and 10.5. Moreover, with prudent design choices it should be possible to implement a litigation system that will be balanced and supportive of overall efforts to improve the quality of patents in Europe.

Link:

http://ec.europa.eu/internal_market/indprop/patent/index_en.htm#studies)

Economic Incongruities in the European Patent System

Authors:

M.Mejer and B. van Pottelsberghe (2009)

Abstract:

This paper argues that the consequences of the "fragmentation" of the European patent system are more dramatic than the mere prohibitive costs of maintaining a patent in force in many jurisdictions. First, detailed analysis of judicial systems in several European countries and four case studies provide evidence suggesting that heterogeneous national litigation costs, practices and outcome induce a high level of uncertainty. Second, a high degree of managerial complexity results from systemic incongruities due to easier "parallel imports", possible "time paradoxes" and the de facto paradox of having EU-level competition policy and granting authority ultimately facing national jurisdictional primacy on patent issues. These high degrees of uncertainty and complexity contribute to reduce the effectiveness of the European patent system and provide additional arguments in favour of the Community patent and a centralized litigation in Europe.

Conclusions:

Litigation costs vary significantly across jurisdictions, including within Europe. While absolute litigation costs are somewhat lower in continental Europe than in the USA or the UK, relative costs are much higher in the UK and in smaller countries like the Netherlands. The multiplicity of small markets (as compared to the USA) increases the already prohibitive costs of managing and enforcing patents in Europe, especially when multiple parallel litigation occurs.

Furthermore, as legal procedures differ across jurisdictions, there is a clear possibility of substantially different judgements occurring on the same subject matter. Despite the efforts to harmonize the enforcement of intellectual property rights (including patent rights) at the European level disparities will still prevail. But the current architecture of the European patent system generates even more complexity and uncertainty for patentees. The lack of a single market for innovations, where the industrial property rights are generally enforced in a few countries, together with the supremacy of national jurisdictions in patent issues, entails three related economic incongruities: an EU wide competition policy but national patent rights; intra-EU "parallel" trade and patent protection; and a time paradox. Four case studies illustrate these incongruities and their implications for managers. There is no Europe-wide market for technology, and even the supposedly centralised procedure, the substantive examination performed by the EPO, is actually not really "centralised" or "European": it is possible for a national court to invalidate a patent granted by the EPO, or to grant a patent that has not been granted by the EPO. And such decisions may occur in up to 34 countries. These "incongruities" and the prohibitive costs of enforcement or litigation in Europe generate both a high level of uncertainty regarding the validity of a patent (and its market reach) and considerable managerial complexity which clearly reduces the effectiveness and the attractiveness of the European patent system in terms of stimulating innovation. Resolving these incongruities would require the implementation of a Community patent together with a centralised jurisdiction mechanism. The national patent offices of the European Union are de facto deliberately blocking the implementation of a truly European patent system, thereby hindering the speed of internationalisation of their own small and medium-sized firms. Special tax incentives may help, but they will certainly not alleviate the problem of the cost, complexity and diversity of practice which generate a lack of confidence in the system.

Link:

http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1345668

A policy insight into the R&D-patent relationship

Authors:

G. de Rassenfosse and B. van Pottelsberghe (2009)

Abstract:

Contrary to an accepted wisdom, this paper shows that cross-country variations in the number of patents per researcher do not only reflect differences in the propensity to patent but also signals differences in research productivity. We put forward and test an empirical model that formally accounts for the productivity and the propensity component of the R&D–patent relationship. The two components play an important role, as witnessed by the impact of several policies, including education, intellectual property and science and technology policies. Indicators based on domestic priority filings reflect research efforts and are primarily affected by varying propensities to patent. In contrast, international filings, especially triadic patents, rather capture variations in research productivity.

Conclusions:

Three policy implications may be drawn from the present results. First, the simultaneous impact of several policy tools (IP, S&T and education policies) calls for a more coordinated approach, especially between the policies that directly influence the researchers' productivity and their propensity to patent. Second, the negative and highly significant impact of fees suggests that the demand for patents is partly influenced by their price. Against the current background of high numbers of applications and the resulting backlogs at the main patent offices, the results suggest that national patent offices might use fees as policy leverage. Such a move would need to think about a potential lowering of fees for SMEs as it exists in the USA and other countries. Finally, even though priority filings are appealing for obvious reasons — and the wider diffusion of the Patstat database may contribute to their popularity — they are highly influenced by the propensity component. In this respect, the triadic patent statistics produced by the OECD remain the least biased indicator of innovation performances, at least regarding international comparison. Policy makers should look more closely at this readily available source of information.

Link:

http://www.sciencedirect.com/science/article/pii/S0048733308002977

Patent fees for sustainable EU community patent

Authors:

B. van Pottelsberghe and J.Danguy (2010)

Abstract:

The objective of this report is to suggest a sustainable fee structure for the EU patent, also known as Community patent and abbreviated as "COMPAT" in the remainder of this document. In particular, the following dimensions are investigated:

- Focus on pre-grant and post-grant (or renewal) fees.
- Illustrate the differences between Euro-Direct applications and PCT applications.
- Perform a break-even analysis based on unit-costs provided by the EPO.
- Suggest and simulate the effects of a cost reduction schedule for SMEs.

Conclusions:

The research analises EPO and PCT fee structure and its impact on the sustainability of the EPO. The key findings are:

- About 30% of the total patent applications filed at the EPO contribute to compensate for the net cumulated losses generated by the remaining 70% of patent applications.
- With the current EPO pre-grant fee schedule and 50% of the NPOs' post-grant renewal fees, the EPO actually loses nearly 800 EUR per Euro-Direct patent application
- With the current fee schedule the EPO loses about 1,700 EUR per PCT-international application. To some extent, Euro-Direct applications reduce (or compensate for) the losses associated with PCT applications.
- High fees (pre- and post-grant) have the advantage of improving self-selection mechanisms, ensure sustainability of the system, and provide an effective correction mechanism. However, they might constitute a barrier to entry for small entities.

The authors study the impact of the VCOM (200+) fee structure suggested by Danguy and van Pottelsberghe (2009), starting at 600 EUR on year 6 and adding 200 EUR each year. From year 15 onwards an exponential trend is adopted. The key aspects of the proposed fee structure for the COMPAT are:

- VCOM(200+) renewal fee structure for the COMPAT has the advantage of 1) being compatible with the economic literature, 2) being globally competitive in relative terms, 3) ensuring a financial sustainability for the system, and 4) matching what the business sector is paying in the current system.
- With the new fee schedule put forward in this report, the net cumulated income of the COMPAT becomes positive, and is even higher for PCT applications than for Euro-Direct.
- With the new fee schedule put forward in this report, the absolute cost (cumulated fees for 10 years of protection) would be similar than in the current system, but the relative cost (cost per million capita) would drive the European patent system towards a much more competitive position, thanks to a large market composed of 500 million inhabitants.
- A 50% fee reduction for SMEs could be set for entry fees, with an eventual pay-back process if the patents are sold, licensed, or maintained for more than 6 years.

The new fee schedule proposed in this report would make the European patent system more attractive with lower costs for the EU patent relative to the current European patent covering only 6 Member States. At the same time, the new schedule provides a financially sustainable model for the system by preserving relatively high absolute fees but allowing for possibilities of fee reductions for SMEs/young innovative companies and public research organisations to facilitate entry to the patent system.

Link:

http://ec.europa.eu/internal_market/indprop/docs/patent/patent_fees_report_en.pdf

Cost-Benefit Analysis of the Community Patent

Authors:

B. van Pottelsberghe and J.Danguy (2009)

Abstract:

For more than 40 years, governments and professional associations have acted, voted or lobbied against the implementation of the Community Patent (COMPAT). The econometric results and simulations presented in this paper suggest that, thanks to its attractiveness in terms of market size and a sound renewal fee structure, the COMPAT would drastically reduce the relative patenting costs for applicants while generating more income for the European Patent Office and most national patent offices. The loss of economic rents (€400 million would be lost by patent attorneys, translators and lawyers) and the drop of controlling power by national patent offices elucidate further the observed resistance to the Community Patent.

Conclusions:

The present paper contributes to the economic literature on the patenting behaviour of applicants. An econometric model explaining the observed maintenance rates of European patents in 17 countries over the past 20 years shows that five main factors play a significant role: the GDP size of a country, the age of the patent, the level of renewal fees, the strength of a country's patent system, and the length of time that a country has been a member of the European Patent Convention. The estimated impacts of these five variables allow in turn to derive the maintenance rate of the COMPAT and hence the renewal fees income it would generate for patent offices.

The simulations show that the EPO and most NPOs would actually gain from each patent granted under the COMPAT if an 'appropriate' fee schedule is adopted. This is mainly due to a price effect (higher absolute fees) combined with a size effect (a new market for technology of about 500 million inhabitants) which would lead to a longer duration of patents. The main office that might see a significant drop in its renewal fees income is the German Patent Office, which has historically benefited from its 'largest economy' status in Europe and hence generates above the expected validation and maintenance rates.

The new centralized system would sharply reduce translation and intermediation costs, and the costs induced by parallel litigations with heterogeneous outcomes. Under the very conservative assumption of 50,000 patents granted each and the VCOM(200+) renewal fee schedule put forward in this paper, the COMPAT would result in total financial surpluses of €250 million for the business sector, €43 million for the EPO and €78 million for NPOs, compared to total losses of €270 million for patent attorneys and translators and at least €121 million for lawyers, due to a sharp fall in parallel litigations.

The simulations were indeed performed under the constraints of the current patent system and under the conditions set by political negotiations related to fees and translations. One important condition relates to the 50/50 split between national patent offices and the EPO. Nothing, however, precludes the reader to dream of an alternative redistribution scheme of the EPO 'surplus'.

The COMPAT would drastically simplify the system, reduce the uncertainty currently associated with the fragmented system and make it attractive for companies (domestic and foreign), and less incongruous for SMEs and universities; it would give some motion to the invisible hand, with undoubtedly large benefits for the business sector in general, and high-tech entrepreneurs in particular.

The Role of Fees in Patent Systems: Theory and Evidence

Authors:

B. van Pottelsberghe and G. de Rassenfosse (2010)

Abstract:

This paper reviews the economic literature on the role of fees in patent systems. Two main research questions are usually addressed: the impact of patent fees on the behaviour of applicants and the question of optimal fees. Studies in the former group confirm that a range of fees affect the behaviour of applicants and suggest that patents have low elasticity. Studies in the latter group provide grounds for both low and high application (or pre-grant) fees and renewal (or post-grant) fees, depending on the structural context and on the policy objectives. The paper also presents new stylized facts on patent fees of thirty patent offices worldwide. It is shown that application fees are generally lower than renewal fees, and renewal fees increase more than proportionally with patent age (to the notable exception of Switzerland and the U.S.).

Conclusions:

In the current context of an apparent decline in the quality of patents and of congested patent offices due to a record number of applications, it is worth looking at the tools available to policymakers to fix the patent system. One such tool is the fee policy, which has received increasing attention over the past ten years. The paper starts by presenting key statistics on patent fees across thirty patent offices. Two key findings must be emphasized. First, relative fees at the USPTO have been decreasing for 200 years. Over the years, U.S. patents have become more and more affordable. Second, comparisons of patent fees across a large number of patent offices show that yearly application fees are by and large lower than yearly renewal fees, and renewal fees increase more than proportionally with patent age. Switzerland and the U.S. are among the rare countries where yearly renewal fees are lower than yearly pre-grant fees.

As a rule of thumb, the optimal structure of fees is one where (i) application fees are sufficiently high to deter the filing of patents with low marginal value (especially in the current context of highly congested patent offices) and (ii) renewal fees increase more than proportionally with patent age in order to make sure that only the commercially valuable patents are held in force. However, one should not forget that fees are only one policy leverage among others. The quality of the examination process, the coverage of patent rights or the process put in place to challenge a patent are as many dimensions that also impact the good functioning of the patent system. They should be taken into account when policy action is considered.

Link:

http://onlinelibrary.wiley.com/doi/10.1111/j.1467-6419.2011.00712.x/abstract

Digital Opportunity. A review of intellectual property and growth

Authors:

I.Hargreaves (2011)

Abstract:

In advanced economies like the UK's, innovation is crucial to competitive edge. That makes Intellectual Property (IP) policy an increasingly important tool for stimulating economic growth. Every year in the last decade, investment by UK business in intangible assets has outstripped investment in tangible assets: by £137 billion to £104 billion in 2008. Global trade in IP licences alone is worth more than £600 billion a year: five per cent of world trade and rising. Small and young innovative firms are of crucial importance in terms of growth and jobs but proliferating use of IP rights can push up IP transaction costs and block these new players from entering markets.

Conclusions:

Although recommendations stemming from the study are directed at the British government, most of them can be extended to other countries. According to the author Government should ensure that development of the IP System is driven as far as possible by objective evidence. Policy should balance measurable economic objectives against social goals and potential benefits for rights holders against impacts on consumers and other interests. These concerns will be of particular importance in assessing future claims to extend rights or in determining desirable limits to rights.

Governments should resolutely pursue its international interests in IP, particularly with respect to emerging economies, based upon positions grounded in economic evidence. They should attach the highest immediate priority to achieving a unified EU patent court and EU patent system. They should work to make the Patent Cooperation Treaty a more effective vehicle for international processing of patent applications.

In order to limit the effects of these barriers to innovation, the Government should:

- take a leading role in promoting international efforts to cut backlogs and manage the boom in patent applications by further extending "work sharing" with patent offices in other countries;
- work to ensure patents are not extended into sectors, such as non-technical computer programs and business methods, which they do not currently cover, without clear evidence of benefit;
- investigate ways of limiting adverse consequences of patent thickets, including by working with international partners to establish a patent fee structure set by reference to innovation and growth goals rather than solely by reference to patent office running costs. The structure of patent renewal fees might be adjusted to encourage patentees to assess more carefully the value of maintaining lower value patents, so reducing the density of patent thickets.

NPOs should draw up plans to improve accessibility of the IP system to smaller companies who will benefit from it. This should involve access to lower cost providers of integrated IP legal and commercial advice

Link:

www.ipo.gov.uk

Venture capital and industrial innovation for Europe

Authors:

A.Popov and P. Roosenboom (2011)

Abstract:

We provide the first cross-country evidence of the effect of venture capital investment on industrial innovation. Using a panel of 21 European countries and 10 manufacturing industries covering the period 1991-2005, we study the effect of venture capital, relative to R&D, on the number of granted patents. We address concerns about causality by exploiting variations across countries and over time in private equity fundraising and in the structure of private equity funds. Our estimates imply that while the ratio of venture capital to R&D has averaged around 6% between 1991 and 2005, VC has accounted for 9.7% of industrial innovation during that period. We also find that VC is relatively more successful in fostering innovation in countries with less stringent labour regulations and with higher human capital.

Conclusions:

Our estimates of the impact of a euro of venture capital relative to a euro of industrial R&D are generally positive, but their significance tends to vary depending on the sample partition used, and the implied VC potency is considerably lower than in similar USA studies. For example, the only case when the estimate on VC/RD is significant is in the reduced sample of non-transition economies with good data coverage, with an implied relative VC potency of 2.94. The mean ratio of VC investment to total disbursements (venture capital plus industrial R&D) between 1991 and 2005 in that sample is 3.85%. Using these two values, we calculate that venture capital investment has accounted for around 10.2% of industrial innovation in 15 European countries since the early 1990s. However, taking an average of the estimates implies that VC has accounted for around 8.5% of industrial innovation. While the estimated relative VC potency in our sample is lower than what Kortum and Lerner (2000) estimate using USA data for the 1965-1992 period (a relative VC potency of around 4, when both VC/RD and Log R&D are instrumented), we show that VC.s contribution to innovation in the USA also declined during the 1991-2005 period. Finally, we also demonstrate that part of the reason VC has a lower effect on innovation than in the USA in earlier periods is due to more stringent employment practices and to Europe's still rudimentary knowledge networks.

While the European venture capital industry has developed rapidly in recent years, with some countries surpassing at times the USA in terms of share of the industry's share of GDP, labour market reforms have been slow and the deregulation of investment activity by large institutional investors like pension funds and insurance companies has only recently been enacted. Confounding the problem, the recent global financial crisis has unleashed a wave of regulatory measures which are designed to limit systemic risk, but which could also result in less funds being raised to finance risky innovative enterprises. Our study suggests that the combined effect of slow labour and institutional reforms and of stringent financial regulations can further diminish Europe's innovative potential.

Link: http://www.cepr.org/meets/wkcn/9/981/papers/popov_roosenboom.pdf

The study on the quality of patent systems in Europe

Authors:

G. Scellato (2011)

Abstract:

This study is dedicated to a comprehensive assessment of the quality of the patent system in Europe. An effective system for the protection and enforcement of intellectual property rights represents an essential element for the growth of economies, which are based on the generation and exploitation of new scientific and technological knowledge. The well-known risks of market failures in the private financing of innovation investments call for a continuous effort of policy makers to the improvements of the tools that are expected to guarantee proper private returns from R&D activities while protecting also the interests of consumers and society at large. The increased salience of patents to companies competing in the knowledge economy has raised concerns throughout the world in the past decade about the actual effectiveness of the current patent systems.

The correct functioning of patent systems has been seriously challenged in recent years by different factors, both exogenous and endogenous. Among the exogenous factors, it is worth recalling the emergence of new technological and scientific fields that have posed questions about the extent of patentable subject matter, the increasing complexity of new technologies that makes more difficult and time consuming the assessment of both inventive step and actual scope of each patent, the increased activity in innovation from companies in emerging countries that have started to file an constantly growing number of patent applications with a non-trivial impact on the backlogs of the main patent offices worldwide.

We acknowledge the complexity of patent systems, whose functioning is based on the interaction of a wide array of heterogeneous actors (large firms, SMEs, Patent Offices, International Granting Authorities, patent attorneys, local and international legislators, and judiciary systems, among others) that carry specific interests. Hence, the assessment of quality requires the adoption of an analytical framework that encompasses multiple instruments and the need to clearly state the boundaries of the concept of quality that will be investigated. Taking into consideration these important methodological concerns, the quality of the European patent system will be analysed in this study along two complementary perspectives: the first one relates to the quality of the granted patents per se, in terms of compliance with their fundamental legal requirements, and the second one relates to the quality of patent by a systemic perspective. The assessment of patent quality at systemic level requires the analysis of additional factors beyond the efficacy of the substantive examination process, like the costs for obtaining, managing and enforcing a patent. Understanding such dual nature of quality is necessary to identify complementarities and synergies generated by prospective policy interventions.

Conclusions:

Survey respondents made a clear point on the fact that ex-post enforceability is a key component of the perceived quality of a patent system. The improvement in the enforceability can be achieved along different trajectories:

First, improve the quality of the litigation system through a centralised court exclusively. Second, reduce the costs of access to justice.

Third, reduce the cost and duration of proceedings.

Fourth, limit ex-ante the likelihood of trials due to uncertainty on the patentability of the subject matter.

Fifth, speed up the opposition proceedings in order to avoid uncertainty. The uncertainty during opposition procedure is aggravated if the patent holder enforces the opposed patent in court.

To conclude, the European intergovernmental patent regime allows to retain institutional arrangements within Member States and to prevent any moves to delegate responsibility outside the national sphere. This intergovernmental patent regime is characterised by a fragmented European Patent System of national translation, validation and enforcement. Stakeholders in this study consider some characteristics of fragmentation as failings of the system due to higher costs and uncertainty, and low quality.

How can problems caused by such a fragmentation be solved institutionally? There is no single approach, but at least two options can be constructed.

Make a unitary title and a centralised patent court legitimate for competitiveness of the European single market and for innovation in the knowledge economy. This will provide policy coherence and cohesion by defining what the regime is and what it does in relation to the economy. Agreements will succeed with a conviction of why Europe is lagging behind in terms of innovation and competitiveness in the knowledge economy. Over domestic negotiations, Member States absorb the concern of domestic actors and builds coalitions with them. Allow for parallel regimes when there is a tension between strongly institutionalised differences across Member States, and a desire of policy makers and stakeholders to adapt common rules for mutual advantage in the European Patent System. One way of giving a chance to Member States that support a unitary title and a centralised patent court is by means of enhanced cooperation, which allows those Member States that wish to continue to work more closely together to do so. Parallel regimes and enhanced cooperation are therefore a strategy and not a final outcome. The ultimate goal would create a single institutional architecture by means of a unitary title and a centralised patent court for the single market of the EU provided that patent-related costs were lower and legal certainty raised.

Link:

http://ec.europa.eu/internal_market/indprop/patent/#studies

Patent Backlogs at USPTO and EPO: Systemic failure vs deliberate delays

Authors:

M. Mejer and B. van Pottelbergue

Abstract:

This paper first describes the so-called patent backlogs and assesses the extent to which they might affect the examination process in major patent offices. Second it puts forward that the root causes of these backlogs in Europe and in the USA are different. The backlog at the United States Patent and Trademark Office (USPTO) is three times larger than one at the European Patent Office (EPO) and is essentially due to very low fees and a weak rigor of the examination process. The observed long pendency at the EPO is more due to applicants' strategic filing behaviors that aim at delaying the grant date, as it marks the start of high expenses due to translation requirements and multiple validation or renewal fees. Since the root causes of backlogs diverge between EPO and USPTO, their cure should also be different.

Conclusions:

The paper first shows that backlogs are first and foremost an American issue; Europe suffers less from this disease, as witnessed by a three times smaller number of pending applications at the EPO. In addition, average pendency durations have decreased at the EPO over the past five years, as opposed to the USPTO.

It is argued that the USA backlog finds its origin in the design of its system, whereas pendency at the EPO could be a result of the delay caused by applicants' filing behavior. The backlog in the USA is due to a systemic failure. Its profound causes find their roots in the chosen design of the patent systems regarding four critical elements: (i) the number of patentable subject matters; (ii) the adequacy of the search report; (iii) the rigor of the examination process and (iv) the relatively low patent fees. The evidence presented in this paper suggests that the backlog in the USA is essentially due to the easiness to get a patent granted and to the very low patent fees. In Europe the problem is different; it is related to its fragmentation in many national systems, which have the ultimate power on patent validity and enforcement. Deliberate delays are observed at the EPO, where applicants might rely on lawful drafting practices in order to substantially delay the grant date and hence the sudden occurrence of high costs (due to translations, validation and renewal fees).

Curing the problem of backlogs should not only address the symptoms that are similar across patent offices, but first and foremost tackle their main root causes. Addressing the USA symptoms through the on-going Patent Prosecution Highways (PPH) projects might actually negatively affect the examination process in Europe. Given the structural differences between patent systems, introduction of PPH will result in the situation where examiners at the EPO will need to apply accelerated examination procedure to the patents granted under the system with the lower quality factor leading to the quality deterioration of EPO granted patents.

What Europe needs to cure its own disease is to limit the possibilities to delay the grant date. Gradual steps have been taken with the amendments to procedural practices introduced in December 2007 and the recent revision of the guidelines for examination procedure. The latter included accelerating prosecution and limiting an applicant's ability to file divisional applications. This is a temporary solution, as companies will most probably find other ways to delay the examination process. An alternative and more efficient way would be to suppress the sharp increase in costs once the patent is granted, which might be achieved with the Community (or EU-) patent. The USPTO challenge is to tackle its own backlogs, probably by re-designing its system, with higher fees and the recruitment of more (long term) examiners.

Link:

http://www.sciencedirect.com/science/article/pii/S0172219010001298

The changing face of innovation

Authors:

WIPO (2011)

Abstract:

Understanding these changes is important. In modern market economies, innovation is a key ingredient of sustained economic growth. In high-income countries, studies have estimated that innovation accounts for as much as 80 per cent of economy-wide growth in productivity. Research at the firm level has shown that firms that innovate outperform their non-innovating peers. Less is known about innovation and its economic impact in low and middle-income economies. However, the available evidence similarly suggests that innovating firms in those economies are more productive – especially if applying a broad view of innovation that includes incremental product and process improvements. Indeed, the experience of several East Asian economies has demonstrated how innovation can spur economic catch-up – even if innovation may be only part of the success story of those economies.

Conclusions:

WIPO's first World IP Report explores the changing face of innovation. We aim to explain, clarify and contribute to policy analysis relating to IP, with a view to facilitating evidence-based policymaking.

Clearly, this Report leaves many questions open. Where the available evidence is insufficient for making informed policy choices, the World IP Report formulates suggestions for further research. This first edition does not address all the important IP themes – notably, trademarks and branding, copyright and the cultural and creative industries, or the protection of traditional knowledge.

Link:

www.wipo.int

Internationalisation of business investments in R&D and analysis of their economic impact

Authors:

B. Dachs et. al. (2012)

Abstract:

Enterprises not only produce and sell, but increasingly also develop goods and services outside their home countries. Today, it seems to be the rule, not the exception, that large European firms have R&D activities at different locations inside and outside the Single Market. In addition, firms from the United States and other non-European countries have considerably extended their R&D activities in the European Union, and new players from emerging economies are entering the scene: India, the People's Republic of China, and other locations have come into focus as host countries for the R&D activities of European multinational enterprises (MNEs) in recent years.

Conclusions:

Firms not only sell or produce their products and services abroad, but increasingly also do research and development (R&D) at locations outside their home countries. We call this development the internationalisation of business R&D. The results of the project indicate that the member countries of the European Union are active players in the internationalisation of business R&D and that the EU benefits from this process to a considerable degree. There is evidence that the internationalisation of business R&D has strengthened intra-EU integration and the exchange of knowledge between EU countries. Around half of all R&D expenditure of foreign-owned firms in the EU can be assigned to firms from other EU Member States.

Data collected in the project indicates that the European Union is also an attractive R&D location for firms from outside the EU-27. Non-EU firms, have continuously increased R&D expenditure in the EU since the 1990s. Multinationals from India, China, Brazil or other emerging economies are just about to make their first steps into the EU as a location for their R&D activities. EU countries benefit from R&D activities of foreign owned firms. Their R&D expenditure raise overall R&D intensity in order to achieve the goal of 3% research. Moreover, R&D expenditure and labour productivity of foreign-owned affiliates is positively related to labour productivity of domestic firms which may indicate spillover and competition effects.

EU firms are also very active in R&D abroad. The home countries may benefit from the global expansion and from reverse knowledge spillovers. Based on today's empirical evidence, it is unlikely that these overseas R&D activities are a substitution for similar domestic activities.

The analysis also identified some blind spots where more knowledge is needed. One of these areas is the role of emerging economies, including China and India, for which considerable data gaps exist. Another blind spot is the service sector. Detailed data on R&D of foreign-owned firms in the service sector is missing in a number of countries. Moreover, there is only limited knowledge on what happens inside multinational firms, how knowledge and people move inside multinational firms between countries, or how specialisation, roles and mandates of subsidiaries change over time.

Policy can help in various ways to maintain Europe's favourable position in the internationalisation of business R&D. First, policy makers should try to create a research-friendly environment. Rather than trying to attract R&D intensive foreign-owned firms, results from the econometric analysis indicate that policy should look to maintain stable economic 'fundamentals', increase the skills of the workforce, strengthen university research and increase the innovative capabilities of firms. Second, in order to maximise spillovers from foreign-owned firms, policy should raise the capabilities of domestic organisations to absorb knowledge and help foreign-owned firms to integrate into domestic innovation networks. Third, policy makers should not be too worried about R&D activities of EU firms outside the European Union. There is no evidence that these activities substitute domestic research; in contrast, they are a means to open up new markets and may contribute to growth at home.

International patent protection for small businesses

Authors:

USPTO (2012)

Abstract:

Recent economic research shows that small businesses are the primary driver of job creation in the United States, with young start-up companies, which are by their nature small businesses, creating on average three million U.S. jobs per year. Though this pattern of job creation has largely held true for over thirty years, the capacity of American small businesses to create jobs is at risk. American firms compete and grow by supplying products and services that consumers demand, and by internationalizing their businesses through licensing, franchising, or exporting. For many small companies, patent protection prevents competitors from simply copying their innovations, and aids in attracting investor capital needed to grow, build market share, and create jobs. Yet small companies face significant financial challenges in acquiring, maintaining, and enforcing patents outside the United States. Therefore, supporting small firms and fostering job creation requires a thorough understanding of these challenges and an exploration of possible remedies.

Conclusions:

Available information, including the comments and testimony that the USPTO received, indicates that while patenting appears relatively uncommon among U.S. small businesses, it tends to be concentrated in high technology companies and can aid in securing for them a competitive advantage.

Many small companies grow and create new jobs by following an internationalization strategy, and in this regard international patenting – when done early in the life of a company – can provide a platform for tapping new markets later in life. Evidence also suggests that U.S. small businesses may be patenting less frequently than larger firms, and that they face high costs in pursuing international patent protection.

These high patenting costs often occur early in the life of these companies, when funding and cash flows are generally limited. These international patenting costs are also often exacerbated for U.S. small companies because – unlike the USPTO, which gives discounts to eligible small businesses from all over the world – foreign patent offices do not generally provide discounts for small businesses.

Link:

http://www.uspto.gov/aia_implementation/20120113-ippr_report.pdf

Patent Litigation in Europe

Authors:

Cremers et al. (2013)

Abstract:

We compare patent litigation cases across four European jurisdictions – Germany, France, the Netherlands, and the UK – covering cases filed during the period 2000-2008. For our analysis, we assemble a new dataset that contains detailed information at the case, litigant, and patent level for patent cases filed at the major courts in the four jurisdictions. We find substantial differences across jurisdictions in terms of case loads. Courts in Germany hear by far the largest number of cases in absolute terms, but also when taking country size into account. We also find important between-country differences in terms of outcomes, the share of cases that is appealed, as well as the characteristics of litigants and litigated patents. A considerable number of patents are litigated in multiple jurisdictions, but the majority of patents are subject to litigation only in one of the four jurisdictions.

Conclusions:

The European patent system is currently undergoing fundamental changes. The institutional reforms that are being implemented are controversial. The discussions concerning the reforms of the European patent system, and especially the discourse regarding changes to the legal and procedural framework of patent enforcement have been characterized by a striking lack of representative quantitative evidence.

With respect to the results of the study, we show that the number of cases heard by German regional courts exceeds by far the number of cases heard in the other three jurisdictions. Even when we account for the over-counting of cases due to bifurcation, idiosyncratic practices at regional courts and procedural differences, the number of cases in Germany exceeds the combined number of cases in the other three jurisdictions over the same time period. We also demonstrate that the number of cases has increased in the UK and Germany over time, but there is no evidence for an upward trend in case filings in France and the Netherlands.

Regarding the settlement of disputes, our analysis also reveals significant differences across countries. More than 60% of cases in Germany end with a settlement, whereas this is true for only around 40% of cases in the UK. When cases are decided by a judge, outcomes differ across jurisdictions. In the UK, revocation is the most likely outcome regardless of whether the initial claim is for infringement or revocation. Infringement is most likely to be found by German and Dutch courts. In France, the large share of patents that is held not to be infringed (but valid) stands out.

The data also allow us to compare the time it takes to obtain a judgment in the first instance. The time lag that lapses between the filing of a claim for infringement and a first decision is less than one year in Germany, the Netherlands, and the UK. Infringement cases take almost one year longer in France to reach a decision. Claims for invalidity are decided fastest in the UK (within less than a year), but take considerably longer in Germany (on average 18 months). Moreover, our evidence indicates that the PHC in the UK does not decide faster when there is only either infringement or validity at issue.

We also obtain insights regarding one of the main motivations for the current reforms of the European patent system: fragmentation. We show that most EPO-granted patents that are litigated in a given jurisdiction have also been validated in all other jurisdictions (possibly with the exception of the Netherlands). This means that there is scope for parallel litigation of the same patent in multiple jurisdictions. However, our data reveals that the share of duplicated cases (cases that involve the same patent and litigating parties in multiple jurisdictions) is low in Germany (2%) and France (6%). Nevertheless, the share attains 26% in the UK and 15% in the Netherlands. This provides mixed evidence for fragmentation and the resulting need for parallel litigation in multiple jurisdictions. Quantifying the cost of duplication that arises from such parallel litigation deserves further work. However, we note that the vast majority of patents are litigation only once.

Our data also allow us to look at the characteristics of the litigating parties across the four jurisdictions. We find large shares of claimants and defendants that are domestic entities. The share of only domestic entities is largest in Germany (over half of claimants and defendants) and smallest in the UK (less than 40%). Most of the litigating parties are registered companies, although there is a significant share of individuals involved in the disputes, in particular in Germany (24% among claimants and 29% among defendants). Looking at the distribution of litigating companies across industries, we note a concentration of companies in pharmaceuticals/chemistry and in electronic products in the UK, whereas litigating companies in Germany are concentrated mostly in the areas of machinery and engines. The distribution of companies across economic activities is also reflected in the distribution of patents across technology areas. Most litigated patents in the UK protect pharmaceutical and chemical inventions, as well as inventions related to telecommunication and digital data transmission. In Germany, most patents are in the area of mechanical engineering.

Link:

http://ftp.zew.de/pub/zew-docs/dp/dp13072.pdf

Comparing patent litigation across europe: a first look

Authors:

Stuart J.H. Graham & Nicolas Van Zeebroeck (2013)

Abstract:

Although patent litigation has become increasingly global, with litigants earning billion-dollar verdicts and seeking judgments in many different jurisdictions around the world, scholarship has been almost completely silent on how such litigation develops outside the United States. This void in understanding is particularly glaring in Europe, where U.S. and other litigants are increasingly drawn, and to which policy makers interested in harmonizing the U.S. patent system look in vain for answers. Courts, litigants, commentators, and policy makers speculate about how litigation and judicial outcomes differ, but have no factual basis for comparing or understanding what actually transpires. With a view to settling this uncertainty and allowing for the emergence of a more robust body of scholarship, this Article sets forth the results of an empirical study of a database including nearly 9,000 patent suits from seven of the largest and most judicially active countries in the European Union during 2000-2010. In the process, it shows that the incidence of litigation and the bases of judicial outcomes diverge radically across the different countries and types of patented technologies in Europe. Accordingly, the Article, for the first time, provides an empirically grounded, factual basis for examining stubborn questions relevant to those needing clarity about the legal environment in Europe, and to comparatively study the United States' system.

The results unveiled in this Article are profound, bringing clarity to a legal environment that has been heretofore shrouded in shadow. The results show that the frequency of patents reaching a judgment in litigation varies widely across European countries in ways that belie the simple differences associated with the quantity of domestic stocks of enforceable patents. By demonstrating that disputes are much more frequent in some countries (e.g., the Netherlands and France) as compared with others, the Article uncovers that practitioners' estimates—the sole previous baseline source—are not accurate. By showing how litigation varies widely across technologies, this Article provides critical insights into the likelihood of different kinds of patents reaching a judgment in the diverse European courts. It also offers surprising evidence regarding how litigants' raising of patent validity and infringement claims differs from one European court to another, and how outcomes too are starkly different.

The main policy implications of the Article follow from the reported patent litigation patterns across technologies and countries. The findings highlight both the fragmentation and variation within the European patent system, and the fundamentally different dynamics that will continue to shape patent enforcement across technology sectors and industries. The patterns also underscore the variation in predictability, and differences in legal certainty, that innovators, patent holders, and their technology competitors experience in the fragmented European system. These cross-country differences highlight institutional variation among the jurisdictions, which in turn drives the costs and incentives to use the courts, helping to provide critical comparative data as Europe moves to a continent-wide Unitary Patent and Unitary Patent Court in 2015. Moreover, since several of the changes proposed in Congress closely resemble rules already in place in the several European jurisdictions, the Article's findings are relevant to current U.S. policy debates on potential patent reform. The Article's important and unprecedented empirical analysis enable comparative patent system policy debate in a way which previously was impossible.

Conclusions:

There is ample evidence that patent litigation is a critical issue because it conditions the enforcement of patents and therefore helps to set their value and significance in the market place. The balancing act that courts must undertake, in deciding questions of the scope of validity and infringement, helps determine incentives to innovate, to commercialize, to litigate, and even to copy (or not) competitors. If courts fail to enforce valid patent rights, or do so too generously in favor of infringers, then infringement will tend to be a dominant strategy. If courts impose complex rules and procedures so that enforcement is made more expensive, then the threat of infringement actions may not be credible, with patent owners enforcing fewer rights at the margin. Similarly, excessively strong IP rights, enforced too severely by courts at a relatively inexpensive price, may produce a greater supply of infringement actions, with possible reduced entry due to excessively high threats of litigation. Nevertheless, the effective operation of the patent system is predicated upon market players having the capacity to challenge invalid patents at reasonable prices, and so courts face a delicate balancing act between procedural and substantive rules of law which will invariably influence the cost of litigation and the relative attractiveness of enforcement and infringement.

The European patent litigation system has been intensively debated and finally subject to political agreements that will transform it substantially. These changes include the creation of unitary protection and the creation of a Unified Patent Court. But the design of the new litigation system and the rules for allocating cases across sections of the central division of the UPC have been decided largely in the absence of reliable statistics on the actual incidence and character of patent litigation in Europe.

Using new and never-before analyzed data on patent litigation in several of the largest European countries, this study offered a first view into the complex and fragmented European patent litigation environment. This exceptionally rich data source provided the opportunity for a first cross-country empirical analysis of patent litigation in Europe. Our analysis provides well supported orders of magnitude and identifies country, technology, and procedural patterns in European patent litigation, contributing meaningfully to our knowledge of legal disputes over European patent rights. The results both challenge and complement practitioners' estimates of the frequency of patent litigation in Europe, which have heretofore been used as a baseline.

Our analysis suggests that the dynamics of patent litigation and its practices are substantially different from country to country and from technology to technology. Following prior theoretical models, the difference in patent litigation incidences across industries may suggest, in particular, that the fixed cost to engage in litigation is not perceived evenly across industries, that the stakes are lower or higher across industries, that the asymmetries of information vary substantially (possibly influenced by the predictability of the courts decisions), or any combination of these. More research is therefore desirable to aid in uncovering how these different litigation systems perform in an otherwise unified Europe.

The differences that our data uncover in the rates and incidence of suits across countries may be driven by technological specialization (which we know exists among the oft-patenting countries of France, Germany, and the U.K.) or by institutional differences, local laws, and country-specific factors. These latter differences may include litigation costs (much higher in the U.K. than in continental courts) or the "attractiveness" of each system as it relates to the types of disputes or competitive realities among parties. While our findings suggest that opportunities for and instances of forum-shopping exist in Europe, more research is needed to uncover the exact dimensions of that phenomenon.

Overall, our data confirm the existence of substantial variation across countries in the European patent litigation system. Some commentators have suggested that such variability creates uncertainty, and that a solution may lie in the type of unified system that European policy makers are now implementing. Since prior research has shown that more harmonization and consistency of decisions across courts and over time tends toward easier and faster settlement in disputes, the Unitary Patent Court scheduled to begin operations in 2015 may yield benefits to society. While we remain agnostic about such a solution, we believe that our data and analyses—which offer some tantalizing first insights into the system of European patent litigation—deserve to be complemented by more research in this area. We are confident that this research is forthcoming, now that more European litigation datasets, including the one we describe here, are becoming available to researchers and students.

Link:

http://stlr.stanford.edu/pdf/patentlitacrosseurope.pdf

International Patent Litigation

Authors:

CMS (2013)

Abstract:

The document provides an overview of litigation procedures across key jurisdictions in Europe and both Russia and China from the perspective of practitioners. The guide provides information on the courts, the trial format and timing, appeals, remedies (including injunctions) and alternative dispute resolution mechanisms.

Link:

http://www.cms-cmck.com/Hubbard.FileSystem/files/Publication/45f4b798-fa2b-414e-88aa-ffdd6174430e/Presentation/PublicationAttachment/c9c99da2-ef4f-495d-8b35-02c62542b121/CMS%20International%20Patent%20Litigation%20Guide%202013.pdf

Glossary

BERD	Business Enterprise Expenditure on R&D
CAGR	Compound Annual Growth Rate
CRISP-DM	Cross Industry Standard Process for Data Mining
EC	European Commission
EP	European Patent
EPC	European Patent Convention
EPO	European Patent Office
EU	European Union
EU-28	European Union of 28 Member States
EUR	Euros
EUROSTAT	Statistical Office of the European Communities
GDP	Gross Domestic Product
GERD	Gross Expenditure on R&D
HERD	Higher Education Expenditure on R&D
IP	Intellectual Property
IPC	The International Patent Classification
NACE	Statistical Classification of Economic Activities
NPO	National Patent Office
OECD	Organisation for Economic Cooperation and Development
PATSTAT	EPO Worldwide Patent Statistical Database
PCT	Patent Cooperation Treaty
PLI	Patent Litigation Insurance
PO	Patent Office
PPP	Purchasing Power Parity
PRO	Public Research Organisation
R&D	Research and Development
RB	Roland Berger
SME	Small and Medium-sized Enterprise
SRA	Single Renewal Approach
VC	Venture Capital
WIPO	World Intellectual Property Organisation

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While patents play a key role as regards the technological output of research and innovation systems, their costs and relative affordability still varies widely between countries.

The report gives a statistical overview of patent costs and their key elements such as administrative, maintenance, process and translation costs for the EU, EFTA and key partner economies.

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