

Analysis of the Commercial Use of Spanish Inventions Protected by Patents between 1996 and 2006

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Patents are indicators of the organization's output and reflect its level of technological development. Today they have become a key commercial asset, which is why there is increasing interest in their study from the perspective of their monetary value and their economic use. However, the exact number of actually used patents and their actual implementation is not known. In this study, the level of commercialization of Spanish patents granted by the Spanish Patent and Trademark Office (SPTO) during the period 1996-2006, and their rate of economic return has been identified and analysed for the agents developing them. The results obtained show there is still a wide margin for the economic agents to make more efficient use of this intellectual property tool.

Keywords: Patents, intellectual property, inventions

Innovation is one of the keys to long-term economic growth, and so it is necessary to identify to what extent this innovation is of a national origin or has been brought in from abroad through licences, imports, imitations or direct foreign investments. In this sense, it is generally accepted that the number of patents originating in a country is quite a significant indicator of the situation of its science and technology system.¹

The increasing awareness regarding the importance of intellectual property, especially patents, has become a first-rate issue for companies, public research institutes and universities, because they are indicators of organization's output and provide important information on the technological innovation process,² unlike indicators related with R&D costs which only provide information on the results of these activities and do not offer a global vision of technological capabilities available for the organization.³

Patents are currently a critical asset in numerous economic activity sectors because they promote development of technological innovation and ensure an economic flow related with turning ideas into products and processes, at the same time as they affect distribution of economic returns of innovation and the form in which other agents can obtain access to new technological developments.⁴ It has been proven that the development of patents is directly

related with technological development,⁵ but we still do not know exactly what percentage of patents is really used and how that application is implemented.

Nowadays, patents are no longer used solely as the legally acquired rights that help prevent competitors from going into certain markets, but a great number of companies have realized the role they play as key commercial assets. Furthermore, more interest is being showed in the monetary value and the economic use of patents, because they can also be used as a guarantee for financial transactions or as assets for alternative investments.⁶

A generic observation suggested that only a fraction of inventions patented are marketed or used. An optimistic calculation shows that less than 80% of patents are used worldwide,⁷ while researchers and employers hold that around 5% of patents are used commercially. On the other hand, there is also widespread belief that the value of most technologies patented is lower than their registration and maintenance fees. In this sense, Schankerman analysed the value of patents in France between 1969 and 1982, reaching the conclusion that their average value in different technological fields was surprisingly low i.e., US\$ 1,631 in pharmaceutical field, US\$ 1,594 in chemical field, US\$ 2,930 in mechanical field and US\$ 7,933 in electronic field. The author also suggests that only 1% of pharmaceutical patents have a value more than US\$ 50,000.⁸

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The study that has been used as reference to contrast these hypotheses was developed by Jacob Schmookler regarding North American patents.⁹ The starting point of his study was to find out if the innovations planned are actually put into practice and, if this is so, to identify different dimensions offered by the innovation when it is effectively developed and which refer to the profits or losses in economic terms derived from innovation, output relation per input unit, effect patents on revenues of products that compete with one other, as well as with those that are complementary to the innovation, and the change in gross national product caused by innovations and imitations. However, although it was complex at that time to add light to the impact of these dimensions, Schmookler's studies brought significant revelations regarding two specific attributes: the percentage of patents used commercially and the economic returns derived from them.

Bearing in mind Schmookler's contributions, in this the situation regarding commercial use of Spanish patents and to identify their level of economic return for the agents developing them have been analysed. This study is based on national patents granted by SPTO during the period of 1996-2006.

Schmookler's Contributions

Schmookler's findings were developed in two independent studies carried out by the George Washington University Patent, Copyright and Trademark Foundation and by the Harvard Graduate School of Business.¹⁰ The main characteristics of these two studies were:

- (i) In the George Washington University Patent, Copyright and Trademark Foundation study an aleatory sample of 2% of North American patents granted in the years 1938, 1948 and 1952 was taken. The study was carried out through a survey that was applied by means of questionnaires sent by post.
- (ii) The study of the Harvard Graduate School of Business was based on the results of the interviews made to 22 companies and the answers to the questionnaires sent to 172 companies that had been granted more than 200 patents and to 94 companies that had been granted between 90 and 138 patents. The patents were granted in the years 1938 and 1952.

The main variables included in the questionnaires of both studies were:

- (i) Classification of companies according to number of patents
- (ii) Commercial use of patent
- (iii) Incomes obtained from commercial use of patent
- (iv) Company's technological sector

Classification of Companies According to Number of Patents

Classification of companies according to number of patents into large enterprizes (having more than 75 patents in the period under analysis or those that had fewer but with more than US\$ 500 million in assets) and small companies.

Commercial Use of Patent

Commercial use of current, previous and now abandoned, and unused patents.

Income Obtained from Commercial Use of Patent

Income obtained in terms of profits and losses.

Company's Technological Sector

The technological sector of the company, e.g. mechanical, electrical, or chemical.

As a result of both studies, Schmookler was able to prove that more than half of the patents granted to companies (56.5%) were being or had been used commercially (Table 1). Furthermore, 36.4% of the patents granted were in use at the time of the study, although small companies did so in a higher proportion (49.6%) than large enterprizes (31.6%). On the contrary to what had been affirmed until then, Schmookler was demonstrating that rather a significant percentage of inventions patented were being used commercially and, therefore, that the statistics regarding patents were a good indicator of results of the innovation simply conceived in terms of used or unused.

Table 1—Commercial use of North American patents

	Total	Large enterprizes	SMEs
Sampling (patents)	1,127	733	394
Replies	827	607	220
Percentage of replies (%)	73.4	82.8	55.8
Patents currently in use (%)	36.4	31.6	49.6
Patents used in past and then abandoned (%)	20.1	19.4	21.8
Total (%)	56.5	51.1	71.4

Source: Schmookler, 1966

In relation to the economic return from commercial use of patents, the results obtained showed that, approximately, two-thirds of the patents that had been used in the past were profitable and that 93% of those that were being used were not only profitable, but their use was on the increase. On the other hand, the approximate profit and loss figures were provided by the patent holders in 93% of the cases interviewed. Out of these, 57% were profitable and were still in use with an average profit of 567,000 dollars per patent and a profit of between 1,000 and 15 million dollars per patent. On the other hand, 6% of the patents were not profitable and their losses totalled 94,000 dollars on average. Lastly, taking into account the number of replies, it could be seen that the highest percentage of patents used brought in average profits of around half a million dollars per patent.

Application to the Case of Spanish Patents

Design of the Sample and Variable Characterization

In order to assess the commercial use of Spanish patents, the information contained in the database provided by SPTO has been used as reference, comprising a total number of 14,024 national patents granted between the years 1996 and 2006.

As a source of empirical evidence, the research was based on the quantitative data obtained by a questionnaire and the unit of analysis was the organization (company, individual or public research organization). The questionnaire was sent to a total of 148 organizations by ordinary post or electronic mail, which was complemented by means of telephone follow-up. This value was obtained through seeking the representation of population of patents granted for each one of the three strata (companies, individuals and public research organizations) in the whole sample, with a statistical error of $\pm 8\%$ and a reliability level of 95% in case of simple aleatory sampling.

A total of 122 replies were obtained (82.4%). The organizations that did not reply to the questionnaire did so for different reasons, amongst which it is necessary to mention the change of residence (frequent in case of individuals) or having been taken over by another company (the case of some companies). In accordance with the level of replies obtained, samples of each one of the strata present different statistical errors depending on the number of replies: $\pm 7\%$ in case of companies; $\pm 13\%$ in case of individuals; and $\pm 8\%$ in case of public research organizations. Table 2 shows the information on the design of the sample being studied and the replies

obtained according to the type of the organizations holding the patents granted.

The main variables used in the study are:

- (i) Size of company according to its number of employees
- (ii) Patent use
- (iii) Commercial use of patent
- (iv) Economic return from patent

Size of Company According to its Number of Employees

SME (under 250 employees) or large (over 250 employees). This has a clear interest from the point of view that there is a significant difference regarding access to new technologies and the acquisition of technological capabilities on the part of each type of company, because in case of SMEs, they frequently lack necessary resources to have their own R&D department or personnel exclusively employed for these tasks. The sub-sample of companies used shows quite a balanced percentage between large enterprises (58%) and SMEs (42%).

Patent Use

Five variables of a dichotomous nature have been used i.e., internal use for improving products and processes; use as a starting point for developing other patents; use for blocking competitors; commercial use; and it has never been used.

Commercial Use of Patent

A dichotomy variable has been used which makes specific reference to the question.

Table 2—Sampling design

Population of patents	Number	%
Total no. of Spanish patents	14,024	100
Companies	6,760	48.2
Individuals	6,177	44.0
Public research organizations	1,087	7.8
Sample to be interviewed per category		
Companies	72	48.6
Individuals	65	43.9
Public research organizations	11	7.5
Total	148	100
Replies obtained		
Companies	72	59.0
Individuals	39	32.0
Public research organizations	11	9.0
Total	122	100

Economic Return from Patent

In order to find out income obtained on commercialization of patents, a total of nine variables of a dichotomous nature have been used i.e., less than € 10,000; between € 10,000 and 30,000; between € 30,000 and € 100,000; between € 100,000 and € 300,000; between € 300,000 and € 1,000,000; between € 1,000,000 and € 3,000,000; between € 3,000,000 and € 10,000,000; between € 10,000,000 and € 30,000,000; and more than € 30,000,000.

Results of the Empirical Analysis

Use of Patents

In Table 3, the use of Spanish patents varies according to the type of agent analysed. In case of companies, there are certain similarities between the actions carried out by large enterprizes and SMEs. The greatest use occurs from the internal perspective of applying patent to improve products and/or processes, which is more significant in case of small and medium-sized enterprizes (71%). On the other hand, large enterprizes make a greater commercial use of patents (42%) in comparison to SMEs (23%). The two groups are practically identical regarding the use of patent as a starting point for developing other patents (28% and 26%, respectively) and when an attempt is made to use them as an element for blocking competitors, although in a much lower proportion (7% and 3%, respectively). However, SMEs show a higher tendency not to use the patent (16%) compared with large enterprizes (5%), which reveals that the latter has greater capacity for obtaining returns from these assets seeking to launch their technological development onto the market.

Public research organizations mainly use patents granted to develop new patents (45%), while they make a very low internal use for improving products and/or processes (18%) and do not apply them for blocking competitors, which is in line with the aims guiding these institutions (universities and public research centres). Nevertheless, the fact concerning the commercial use of patents by these organizations (36%) shows the ever-increasing importance given to

these assets as an integral part of the management of the scientific and technological know-how generated, which is coherent with the fact that 84.6% of the institutions in scientific field have a strategy aimed at technology transfer, and that both industrial research (more related with technological development) and applied research (more related with application of the know-how) are activities that are developed by an important part of these institutions (79.7% and 75.6%, respectively).¹¹

Finally, the group of individuals is one that reveals greater difficulty in making commercial use of patents, as we can see by the fact that 62% of the sample admits that it has never used the patent granted, compared with 16% that affirms to have marketed it. In this group, the use of patent for internal improvement of products and/or processes and for developing new inventions (22%) is similar, although low.

It is necessary to point out that these results present certain coherence with those obtained in the work ‘Study on evaluating the knowledge economy—what are patents actually worth?’¹² The aim of this study was to evaluate the situation of some European countries in relation to the use of patents during the period 1993-1997 and it was carried out by means of a survey called *PatVal-EU*. The variables used in this study were:

- (i) Internal use
- (ii) Licensing
- (iii) Cross-licensing
- (iv) Licensing and use
- (v) Blocking competitors
- (vi) Sleeping patent

Internal Use

When the patent is used internally for industrial and commercial purposes, incorporated into production processes or marketed products.

Licensing

When the patent is not used by the owner but is licensed to third parties.

Table 3 — Level of use of Spanish patents

Type of applicant	Internal use (%)	Development of other patents (%)	Blocking (%)	Commercial use (%)	Unused (%)
Large enterprizes	58	28	7	42	5
SMEs	71	26	3	23	16
Public research organizations	18	45	0	36	36
Individuals	22	22	5	16	62

Table 4 — Patent use according to PatVal-EU (1993-1997)

Country	Internal use (%)	Licensing (%)	Cross-licensing (%)	Licensing and use (%)	Blocking competitors (%)	Sleeping patents (%)
Germany	49.6	4.7	2.1	3.9	14.4	25.3
Spain	52.4	8.5	2.0	5.3	19.1	12.7
France	64.6	5.4	7.4	2.1	11.6	8.9
Italy	55.5	5.1	1.3	5.0	23.5	9.6
Netherland	47.1	7.6	3.8	4.7	23.4	13.4
UK	45.7	10.2	4.6	3.1	23.4	13.0
Total	50.5	6.4	3.0	4.0	18.7	17.4

Source: European Commission, 2005

Cross-licensing

When the patent is licensed to third parties in exchange for another innovation.

Licensing and Use

When the patent is licensed to third parties at the same time as it is used internally by the patent owner.

Blocking Competitor

When the patent is not used or licensed, but is held by the owner to prevent the development of other patents in a specific area on the part of the competition.

Sleeping Patent

When the patent is not used for any of the above purposes.

In accordance with results of this study Spain establishes the internal use of its patents as high-priority, although it also offers higher values than the European average regarding the percentage of patents that are licensed to third parties. The percentage of Spanish patents which are not used according to the study (sleeping patents) is below the European average (Table 4).

Commercial Use of Patents

In relation to the main aim of this analysis, Table 5 shows that, on a global level, a quarter of the patents granted (25.4%) are at present used commercially. This percentage is greater in the case of large enterprizes (40.0%), whereas small and medium-sized enterprizes have a lower level (19.0%) and very similar to the one offered by public research organizations (18.2%). Individuals, on the other hand, are the group that makes less commercial use of the patents granted (15.4%).

Economic Return of Patents

With regard to economic return generated by Spanish patents as a result of their commercialization, the results are not so encouraging, mainly because it

Table 5 — Commercial use of Spanish patents

Type of applicant	Number	%
Large enterprizes	17	40.0
SME	6	19.0
Public research organizations	2	18.2
Individuals	6	15.4
Total	31	25.4

is difficult to differentiate between the percentage corresponding to the implementation of an invention in the market and the proportion generated by other activities such as marketing, design, production management, etc. Although, the methods used for determining economic value of patents have evolved significantly over the last years, truth is that in most cases, not even the owners themselves are able to estimate this value.¹³

However, the results of the study regarding the incomes obtained by different types of agents through commercial use of their patents show that large enterprizes are the organizations that receive greater economic return per patent as a result of its commercialization. In particular, revenues are below € 100,000 per patent for 13% of the patents marketed, while 12% obtain revenues between € 300,000 and € 1,000,000 per patent. Only 5% of the patents marketed by large enterprizes obtain revenues of more than 30 million euros per patent. Small and medium-sized enterprizes present lower levels of incomes: 10% of the patents marketed obtain revenues between € 10,000 and € 30,000 per patent, 12% between € 100,000 and € 3,000,000 per patent, and only 3% receive more than € 10 million per patent (Table 6).

On the other hand, public research organizations are those that present the less significant income figures, with 18% of the patents marketed having returns of under € 10,000 per patent. Another similar percentage obtains income of between 30,000 and

Table 6 — Level of economic return of Spanish patents

Income levels (€)	Large enterprizes		SMEs		Public research organizations		Individuals	
	Number	%	Number	%	Number	%	Number	%
<10,000	4	9	-	-	2	18	2	5
10,000-30,000	1	2	3	10	-	-	2	5
30,000-100,000	1	2	-	-	1	9	1	3
100,000-300,000	2	5	1	3	1	9	-	-
300,000-1,000,000	5	12	2	6	-	-	-	-
1,000,000-3,000,000	-	-	1	3	-	-	2	5
3,000,000-10,000,000	2	5	-	-	-	-	1	3
10,000,000-30,000,000	-	-	1	3	-	-	-	-
>30,000,000	2	5	-	-	-	-	-	-
NA	26	60	23	75	7	64	29	79

€ 300,000 per patent. Lastly, individuals present more optimistic values than those related to public research organizations, which is indeed significant: 13% of the patents commercialized by this group present incomes less than € 100,000 per patent, and 8% have highly significant returns of between one and € 10 million per patent.

Conclusion

At a macroeconomic level, patents can stimulate growth in two ways i.e., on one hand, providing appropriate structure of incentives to encourage innovation and, on the other, establishing a framework for disseminating technological know-how between countries and industries. In this sense, it is necessary to bear in mind that companies which export technology tend to base their export decisions on the existence of a system that protects industrial property in country (or countries) of destination, on the essential rigour of these rights and on facilities available for enforcing them.

The intention of this study has been to throw light on the commercial use of Spanish patents granted during the period 1996-2006, which established a comparison with the data obtained by Schmookler in 1966. This comparative analysis shows that, at a global level, the percentage of Spanish patents that are currently being marketed is 25.4%. This value is lower than the one obtained by Schmookler (36.4%), although it is not so distant. Likewise, the analysis on the company type level shows that there is a significant proximity between the data obtained for Spain in case of large enterprizes (40.0%) and those obtained by Schmookler for the same group in US (31.6%) for the patents in 'current' use. However, in

case of small and medium-sized enterprizes there is a great difference between the Spanish case (19.0%) and that obtained for North American patents (49.6%).

With regard to Spanish case, use of Spanish patents mainly concentrates on the improvement of products and/or processes in the case of companies, although with a greater tendency for SMEs. Public research organizations use patents more as a starting point for developing other patents, while the group of individuals show the greatest difficulties regarding both internal and commercial use of granted patents.

The analysis reveals that Spanish patents are used on very few occasions to block competitors and that the largest proportion of patents that have never been used is given in the group of individuals (62%). In this sense, some independent inventors expressed different concerns in the survey that may explain this result, since they consider that the information and know-how available to them for introducing their inventions into industry are very scarce, apart from limitations they find for obtaining necessary economic resources.

Finally, the economic return obtained as a direct result of commercial use of Spanish patents differ according to the type of agent, being large enterprizes those that obtain the greatest percentage of income between € 30,000 and 1,000,000 per patent (12%). On the other hand, the SMEs highest percentage of incomes is much lower: between € 10,000 and € 30,000 per patent (10%). Public research organizations and individuals are in particular the groups that present the least significant economic return figures, particularly the former with incomes below the threshold of €10,000 per patent (18%).

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