

**Tomasz GRZEGORCZYK<sup>1</sup>**  
**Robert GŁOWIŃSKI<sup>2</sup>**

## **TRENDS AND STRATEGIES OF PATENT EXPLOITATION – ANALYSIS OF EMPIRICAL DATA**

The main purpose of this article is to reveal trends and patent strategies in use and explain the reason behind some of them. This will be achieved by theoretical study and by comparing the forms of patent exploitation over time across chosen European countries, industries, as well as types and sizes of the patenting organization. This article also intends to dwell into exploiting patents for strategic reasons, e.g. by blocking competition. Special insight will be provided into the types of the external patent use, which comprises licensing, cross-licensing, patent sale and a set-up of a new venture. The analysis is based on statistics derived from the PatVal-EU survey and the ten year earlier InnoS&T survey.

The findings of this study show that propensity to exploit patents differs significantly across various countries. Comparing data concerning licensing and cross-licensing it seems that companies nowadays may be reluctant to share their knowledge and intellectual property with competitors without obtaining the same themselves. This underlines the role of patent rights in terms of firms' competitiveness. The share of blocking patents increased which confirms the growing importance of patents used for strategic reason. "Sleeping patents" still account for more than 15% which indicates a relatively high rate of patent rights with either untapped potential or poorly estimated suitability at the time of product development. This trend is especially valid for public research institutions.

**Keywords:** patent, patent trends, patent strategy, patent exploitation, innovation management, intellectual property rights.

### **1. INTRODUCTION**

Patent protection is one of the most common types of intellectual property rights used worldwide and a crucial element of innovation management. However, studies point out a very insignificant percentage of successful commercialization 0,6%<sup>3</sup> of innovative ideas across various industries. In spite of many failures in the development and difficulties in the introduction of new ideas on the market, companies all around the world pursue an

---

<sup>1</sup> Tomasz Grzegorzczak, LL.M., Department of International Management, Faculty of International Business and Economy, Poznan University of Economics, Al. Niepodległości 10, Poznań, Poland; e-mail: tomasz.grzegorzczak@ue.poznan.pl; tel. +48618543556.

<sup>2</sup> Robert Głowiński, M.Sc., Rotho AG, Althau 11, Würenlingen, Switzerland; e-mail: glowski.r@gmail.com.

<sup>3</sup> O. Gassmann, M.A. Bader, *Patentmanagement: Innovationen erfolgreich nutzen und schützen*, Springer, Heidelberg 2011, p. 1.

innovation strategy, striving for an invention which would provide them with a temporary monopoly, long-term competitive advantage and therefore financial profits<sup>4</sup>.

Moreover, patent rights are one of the most commonly used indicators of innovative activities and technology output. However, patent right itself cannot be associated directly with company's success. Nevertheless, these intangible assets may be a sign of company's potential, which can be further converted into an added-value for its holder, if patent rights are properly exploited. Recent empirical analysis shows that patent management is positively correlated with firms' level of financial profitability<sup>5</sup>.

One of the principal dilemmas of patent management is the choice of a proper exploitation strategy for a selected patent demonstrating strategic potential. There are numerous factors influencing the choice of the intellectual property strategies, e.g. an objective followed, a degree of the invention's novelty, competitive position of the company, type of the industry, type and size of the innovative institution, availability of resources and other complementary assets<sup>6</sup>.

The main purpose of this article is to identify the main trends and approaches in applied patent exploitation strategies based on the empirical data and then explain the reason behind some of them. This will be achieved through the study of literature and by comparing the forms of patent exploitation across six chosen European countries, industries, as well as type and size of patenting organizations over time. Furthermore, this article intends to focus on the use of patents for strategic reasons, especially by blocking competition. Special insight will be provided into the external patent use, which comprises licensing, cross-licensing, patent sale and a set-up of a new venture. Especially licensing has gained a notable interest in the academic literature, as well as popularity among the inventors.

There is a shortage of comprehensive studies on this topic, apart from Gambardella's report<sup>7</sup>. Most of them, as e.g. carried out by Hentschel were limited to one particular nation and comprised a small sample of investigated legal subjects<sup>8</sup>. Therefore, his findings might be skewed and thus not credible and there is a need to elaborate on this matter.

## 2. PATVAL-EU SURVEYS

The analysis is based on two most comprehensive surveys on activities of European inventors in regard to patent rights. The purpose of the first one, PatVal-EU project<sup>9</sup>, was to examine the characteristics of inventors, the innovation processes, motives to patent, innovations value and the means of exploitation of patent rights. The survey was conducted

---

<sup>4</sup> *Ibidem*, p. 22.

<sup>5</sup> H. Ernst, J. Conley, N. Omland, *How to create commercial value from patents: the role of patent management*, „R&D Management“ 2016, 46, p. 677–690.

<sup>6</sup> W. Schmeisser, H. Mohnkopf, *Ausgewählte Beiträge zum Innovationsmanagement, zur empirischen Mittelstandsforschung und zum Patentschutz*, Rainer Hampp Verlag, München 2008, p. 141; W. Kotarba, *Ochrona własności intelektualnej*, Warszawa 2012, p. 133–139.

<sup>7</sup> A. Gambardella, *Innovative S&T indicators combining patent data and surveys: empirical models and policy analysis*, Final Report INNOS&T Project, Seventh Framework Programme, 2012, cordis.europa.eu.

<sup>8</sup> M. Hentschel, *Patentmanagement, Technologieverwertung und Akquise externer Technologien*, Deutscher Universitäts-Verlag, Wiesbaden 2007.

<sup>9</sup> PatVal: *The value of European patents, evidence from a Survey of European Inventors. Final report of the PatVal EU Project*, 2005, ec.europa.eu.

within 2003–2005 and comprised patents granted between 1993 and 1997 to the largest European economies, namely France, Germany, Italy, Netherlands, Spain and United Kingdom. Patents issued to these countries covered at the time of the research 42,2% of all patents granted to European Patent Office and 88% out of the those granted by EU-15 countries<sup>10</sup>. While the data presented may seem not to be the newest, it still is the most up to date in the researched field.

The second survey “InnoS&T 7FP Project” (“PatVal-EU II” or “InnoS&T”) refers to PatVal-JP, PatVal-US surveys, as well as complementary indicators<sup>11</sup>. The project which is focused on the economic value and use of patents, innovation performance, science-industry linkage and characteristics of inventors, was carried between 2008 and 2011 and investigated patent applications filed within 2003–2005 in EPO in 20 European countries, Israel, Japan and United States. Due to the fact that the PatVal-EU II does not present the use and value of patents in the same form as PatVal-EU did, a direct comparison based on the same dimensions (across countries, industries, as well as size and type of the organization) is not always possible. However, it still allows to outline existing approaches and trends.

Due to three different perspectives of analysing the empirical data on practice of patent exploitation we decided to focus on each perspective in different section, linking the raw data with their elaboration and implications.

### 3. PATENT EXPLOITATION: COUNTRIES' PERSPECTIVE

The propensity to exploit patents differs significantly across various countries. In order to provide the most reliable comparison of changes in patent exploitation approaches within the 10 year period, selected data from InnoS&T will be demonstrated for 6 countries, which were also included in the PatVal-EU survey. However, the total aggregated value of each analysed category (“Total”) cannot be provided in case of PatVal-EU II (2003–2005), because the required data to conduct the appropriate calculations, namely a sample size of each country for each category, is not available due to missing information in survey’s answers.

Submitting a patent application or even being granted a patent is not equivalent to having the invention successfully introduced on the market and receiving any financial benefits from it. The OECD refers in its report to the survey conducted by PatVal-EU (2005), indicating a relatively low percentage of all patented inventions that became industrially applied<sup>12</sup>. Implementation of some products or processes is often void of any reasonable economic justification or is a result of the insufficient cooperation between innovators and entrepreneurs. Another cause may be scarcity of complementary resources necessary to develop the invention or strategic decisions.

Table 1 below presents the comparison of patent exploitation approaches of the 6 largest European economies within a 10 year interval. Accordingly, the role of the internal use of patents has not changed much when comparing total averaged values across all countries, however a slight decrease from 54,56% down to 53,05% was observed. This is unexpected, as one could expect that the drop would be more significant due to increased cooperation between high-tech companies. Therefore more important is the direct comparison of patent

---

<sup>10</sup> *Ibidem*, p. 7–8.

<sup>11</sup> A. Gambardella, *Innovative S&T indicators...*, p. 1–40.

<sup>12</sup> OECD *Patent statistics manual*, 2009, oecd.org, p. 26.

internal exploitation across nationalities. While Germany, Great Britain, Holland and Italy experienced an increase in the share of internally applied patents, a rapid fall was observed in Spain and especially in France. The decline in the former mentioned country amounted to approximately 9% from 57,72% to 48,82%, whereas in the latter fell by 31% from 66,73% to 35,59%. A comparison of the external patent exploitation is also possible to some extent, because both PatVal-EU surveys focused on similar forms of the use.

Table 1. Comparison of patent exploitation approaches of 6 largest European economies based on PatVal-EU and PatVal-EU II surveys

Time scope		Form of the exploitation	France	Germany	Great Britain	Holland	Italy	Spain	Total
Internal	1993–1997	Internal use	66,73%	53,53%	48,76%	51,77%	60,52%	57,72%	54,46%
	2003–2005		35,59%	55,77%	52,20%	53,79%	61,30%	48,82%	53,05%
External patent use	1993–1997	Start-up founded	1,63%	2,72%	9,69%	4,75%	5,97%	9,27%	5,13%
			3,31%	2,67%	9,38%	8,24%	6,20%	18,44%	4,57%
	2003–2005	Willing to found	3,61%	1,83%	4,53%	4,77%	4,62%	5,59%	2,91%
			Licensing	5,42%	4,74%	10,21%	7,57%	5,09%	8,54%
	1993–1997	Cross-licensing	7,35%	2,08%	4,62%	3,83%	1,29%	2,03%	3,03%
		Licensing & use	2,13%	3,94%	3,10%	4,67%	5,00%	5,28%	3,97%
		Total licensing	14,90%	10,76%	17,93%	16,07%	11,38%	15,85%	13,38%
	2003–2005	Licensing	5,88%	6,50%	13,67%	13,43%	9,14%	9,68%	8,19%
		Willing to license	5,63%	4,74%	16,48%	9,45%	9,24%	12,90%	8,45%
	2003–2005	Sold patents	2,87%	3,84%	10,79%	7,06%	5,02%	3,80%	5,47%
		Willing to sale	3,63%	2,63%	8,39%	6,81%	7,34%	13,29%	5,61%

Source: own elaboration following *PatVal: The value of European patents, evidence from a Survey of European Inventors. Final report of the PatVal EU Project*, 2005, ec.europa.eu.; M. Ceccagnoli, *Study on evaluating the knowledge economy – what are patents actually worth? The value of patents for today's economy and society*. CERM Foundation, Markt 2004/09/E, 2005, ec.europa.eu.; A. Gambardella, *Innovative S&T indicators...*

While the older study concentrates on licensing-related activities and an establishment of new start-ups, InnoS&T included also patent sale and propensity for taking actions in the future for all the forms for each country. When it comes to licensing, a decrease in all countries was noted. This is surprising, because it is generally agreed that the role of licenses has

increased over the years<sup>13</sup>. Whereas the total share for the 6 EU countries in the investigation of patents granted between 1993-1997 accounted for 13,38%, 10 years later it was only 8,19%. Nevertheless, the PatVal-EU II examined also the propensity to license in the future which reached a share of 8,46%. British (16,48%) and Spanish innovators (12,90%) intended most often to exploit patents by that means.

Hentschel stresses that cross-licensing is a very suitable tool for cumulative industries where innovations are built on many related technologies<sup>14</sup>. There are two types of cross-licensing deals<sup>15</sup>: (a) the IPRs included in the agreement are licensed for its lifespan or (b) for a certain period of time. After the validity of the deal expires, a new agreement is necessary. Furthermore, cross-licensing is one of the few possibilities enabling manufacturing without carrying the risk of patent infringements<sup>16</sup>.

The statistics on cross-licensing illustrate a significant trend. Although the total share of cross-licensed patents was rather low according to PatVal-EU with 3,03%, the survey showed that above 14% of polled companies perceived it as an important or a very important reason to patent<sup>17</sup>. Giuri and Torrisi analysed the role of cross-licensing in the InnoS&T project<sup>18</sup>. Accordingly, 17,6% of patents were applied in cross-licensing agreements for the sample N=738<sup>19</sup> and 14,22% for the sample N=661<sup>20</sup>, which represents a rapid growth compared to the older survey. Comparing data concerning licensing and cross-licensing it seems that companies nowadays may be reluctant to share their knowledge and intellectual property with the competitors without obtaining the same themselves. This underlines the strategic role of patent rights in terms of their competitiveness.

Another inference may be derived in regard to patents used to set up starts-ups. Although the propensity to license declined over time in each country, the opposite trend can be observed when it comes to starting a new venture. The most notable change concerns Spain and Holland which experienced a rise from 9,27% to 18,44% and 4,75% to 8,24% respectively. PatVal-EU II report additionally provides data on the rate of patents sold (5,47%). The largest share was represented by Great Britain (10,79%), but the highest willingness to sell was observed in Spain (13,29%). Since the average internal patent exploitation

---

<sup>13</sup> D. Ford, *The management and marketing of technology* [in:] R. Lamb and P. Shrivastava (eds.), *Advances in Strategic Management*, JAI Press, London 1985. O. Gassmann, M.A. Bader, *Patentmanagement: Innovationen...*, p. 120–121; M.I. Leone, K. Laursen, *Patent exploitation strategies and value creation* [in:] F. Munari, R. Oriani (eds.), *The Economic Valuation of Patents. Methods and Applications*, E. Elgar, Northampton 2011, p. 89–99; WIPO, *Licensing of intellectual property assets; advantages and disadvantages*. 2012, wipo.int., p. 2–6.

<sup>14</sup> M. Hentschel, *Patentmanagement...*, p. 47.

<sup>15</sup> P.C. Grindley, D.J. Tecce, *Managing Intellectual Capital: Licensing and Cross-Licensing in Semiconductors and Electronics*, "California Management Review" 1997, No. 39(2), p. 11; O. Gassmann, M.A. Bader, *Patentmanagement: Innovationen...*, p. 44–46.

<sup>16</sup> P.C. Grindley, D.J. Tecce, *Managing Intellectual...*, p. 9; D. Somaya, *Patent Strategy and Management: An integrative Review and Research Agenda*, "Journal of Management" 2012, Vol. 38, No. 4, p. 1094.

<sup>17</sup> *PatVal: The value of European patents...*, p. 118.

<sup>18</sup> P. Giuri, S. Torrisi, *The economic use of patents*, University Bologna, InnoS&T Conference, Munich 2011, p. 29–32.

<sup>19</sup> *Ibidem*, p. 31.

<sup>20</sup> A. Gambardella, *Innovative S&T indicators...*, p. 46.

amounted to approximately 54% and external exploitation to about 15%, the question occurs what happens with the rest of patent rights. Consequently table 2 presents a comparison of the share of not exploited patents in the 6 largest European economies.

Table 2. Comparison of the share of not exploited patents in the 6 largest European economies, based on PatVal-EU and PatVal-EU II surveys

		Time scope	France	Germany	Great Britain	Holland	Italy	Spain	Total
Unused patents	Blocking	1993–1997	11,61%	14,40%	23,45%	23,46%	23,53%	19,11%	18,69%
		2003–2005	36,56%	22,06%	22,89%	20,17%	23,88%	25,00%	26,53%
	Sleeping	1993–1997	8,90%	25,25%	12,97%	13,36%	9,57%	12,60%	17,44%
		2003–2005	22,04%	18,89%	16,41%	16,71%	12,00%	16,91%	16,04%
	Total	1993–1997	20,51%	39,65%	36,42%	36,82%	33,10%	31,71%	36,13%
		2003–2005	58,60%	40,95%	39,30%	36,88%	35,88%	41,91%	42,56%

Source: own elaboration following PatVal: *The value of European...*; M. Ceccagnoli, *Study on evaluating...*

The total share of unused patent rights increased from 36,13% to 42,56% across all countries. The greatest change was observed in France, since the rate of not exploited patents almost tripled from 20,51% to 58,60% ten years later. On the other hand, Holland and Germany were the countries where the share remained almost constant. However, their structure of unused patents altered.

There are two types of patents which are not commercially applied. The purpose of the first group is to block competitors and prevent them from developing their own projects through usage of a particular technology. The importance of this strategic means of patent exploitation has increased over time, since according to the PatVal-EU 18,69% have been used for blocking, while ten years later as much as 26,53%. The rise in significance of patents as blocking instruments was mostly observed in France (growth from 11,61% up to 36,56%) and Germany (14,40% up to 22,06%). This shows increasing competitiveness of high tech branches. The second type of unused patents is called “sleeping patents”. They usually belong to patent portfolios of large companies which simply do not perceive these intangible assets as profitable in the long-term, therefore they are not used at all. The total share of “sleeping patents” did not change significantly over time and was within the range of 16,05%–17,44%. However, if one compares rates for particular countries, it can be noticed that only Germany managed to reduce it from 25,25% to 18,89%, whereas in every other country their share grew.

The purpose of InnoS&T 7FP Project was to examine the exploitation of patents in a broader context<sup>21</sup>. Therefore, the report includes data not only for the 6 largest European economies, but also other European countries as well as Israel, Japan and United States.

<sup>21</sup> *Ibidem*, p. 10–13.

The study indicates that patents are mostly exploited by rather small countries showing intensive patent activities (e.g. Austria, Denmark, Ireland and Switzerland). The share of sold and licensed patent rights is also the highest in the patent-intensive countries, e.g. Denmark, Finland, Holland, Ireland and Norway, as well as in emerging markets such as Czech Republic, Hungary, Greece and Poland. This might be caused by the lack of complementary resources necessary to exploit patents internally. Patents in these developing economies and small patent-intensive countries like Ireland and Norway are also often exploited to set up a new start-up, which might be a consequence of a shortage of large domestic enterprises.

#### 4. PATENT EXPLOITATION: INDUSTRY'S PERSPECTIVE

The distribution of patent exploitation differs also across industries, although not substantially. There are sectors, within which brand new inventions are “discrete” or “complex”, therefore the patenting strategy ought to be adjusted to a particular technology. Although the statistics on the following topic were not included in the main report of the Pat-Val-EU, Ceccagnoli conducted a study on the patent exploitation across industries, which is based on the comprehensive survey of European investor activities<sup>22</sup>. The InnoS&T report does not comprise the patent exploitation across industries at all. Due to a lack of raw measures, the change over time of cross-licensing activities is illustrated across macro classes, while the rate of internally applied and licensed out patents by selected micro technological classes.

Table 3 presents the use of patents for macro-technological classes. Although the total average value across all sectors amounts to 50,5% regarding the internal use, only in mechanical engineering and process engineering the share of internally exploited patent rights exceeds 50%, and accounted for 56,5% and 54,6% respectively. This contrasts with the outcome of chemicals and pharmaceuticals, as only 37,9% were used within the innovating companies, whereas 51,5% remained completely unused, and thus this class holds the largest share. Out of this, 29,2% were kept not exploited, due to strategic reasons, while for 22,3% of patents an application has not been found. The share of blocking and “sleeping” patents within other macro technological classes ranked around the average value, namely 18,7% and 17,4% respectively. F. Ruther underlines that the reason why patents are not leveraged optimally may not often be a “function of ignorance, but a function of incapability”<sup>23</sup>.

The licensing rate in the chemical and pharmaceutical industries is relatively high, with 6,5%, which is more than average<sup>24</sup>. The greatest propensity to license was definitely observed in instruments (9,1%), followed by process engineering (7,4%). Cross-licensing deals however, were often applied in the field of instruments (4,9%) and electrical engineering (6,1%), while the total averaged share amounted to 3,0%. The propensity to cross-license patent rights has increased extremely rapidly, since the total share within 2003–2005

---

<sup>22</sup> M. Ceccagnoli, *Study on evaluating the knowledge economy – what are patents actually worth? The value of patents for today's economy and society*. CERM Foundation, Markt 2004/09/E, 2005, ec.europa.eu, p. 40–43.

<sup>23</sup> F. Ruther, *Patent Aggregating Companies: Their strategies, activities and options for producing companies*, Springer Gabler, Wiesbaden 2012, p. 34.

<sup>24</sup> M. Ceccagnoli, *Study on evaluating...*, p. 39.

went up to 17,6%. This growth was to a large extent driven by electrical engineering, as well as chemical and pharmaceutical industries, where the rate accounted for 30,3% and 19,1% respectively. This might be an evidence for the strategic role of cross-licensing in semiconductors and electronics industry as a whole, as in these “complex” technologies, further development without an access to external knowledge is very difficult<sup>25</sup>. The share of blocking patents in electrical engineering class is the second highest across the categories, although still relatively low.

Table 3. Patent exploitation in Europe across technological classes for patents granted within 1993–1997

	Internal use	Licensing	Licensing and use	Cross-licensing 1993–1997	Cross-licensing 2003–2005	Blocking (unused)	Sleeping patents (unused)	Total
Electrical Engineering	49,2%	3,9%	3,6%	<b>6,1%</b>	<b>30,3%</b>	18,3%	18,9%	<b>100%</b>
Instruments	47,5%	9,1%	4,3%	<b>4,9%</b>	<b>14,5%</b>	14,4%	19,8%	<b>100%</b>
Chemicals and Pharma	37,9%	6,5%	2,5%	<b>2,6%</b>	<b>19,1%</b>	29,2%	22,3%	<b>100%</b>
Process Engineering	54,6%	7,4%	4,9%	<b>2,0%</b>	<b>12,6%</b>	15,4%	15,7%	<b>100%</b>
Mechanical Engineering	56,5%	5,8%	4,2%	<b>1,8%</b>	<b>11,6%</b>	17,4%	14,3%	<b>100%</b>
Total	<b>50,5%</b>	<b>6,4%</b>	<b>4,0%</b>	<b>3,0%</b>	<b>17,6%</b>	<b>18,7%</b>	<b>17,4%</b>	<b>100%</b>

Source: own elaboration following P. Giuri, S. Torrisi, *The economic use of patents*, University Bologna, InnoS&T Conference, Munich 2011.

Table 4 presents a comparison over time and across selected technological areas (the same categorization was used in the analysis conducted in the previous section) with relation to a share of patented inventions used commercially, as well as those licensed out. Accordingly, the share of patents used commercially in organic chemistry, pharmaceuticals and biotechnology was one of the lowest across all micro technological classes and accounted for 23,09%, 34,9% and 38,9% respectively. The rate of exploited patent rights for chemical engineering, IT, semiconductors and mechanical engineering ranked around the total average value, namely 50,5%<sup>26</sup>. If one compares the exploitation patterns over time, a rapid rise of internally used patents was observed in case of chemistry, IT and mechanical engineering. The other industries experienced a decline by several percent (semiconductors by 7%, biotechnology by 3% and pharmaceuticals by 1,5%). On the other hand, the licensing activities vary substantially both over time and across technological areas. While phar-

<sup>25</sup> P.C Grindley, D.J. Tecce, *Managing Intellectual...*, p. 1–12; B.H. Hall, R.M. Ziedonis, *The Patent Paradox Revisited: An Empirical Study of Patenting in the Semiconductor Industry*, “RAND Journal of Economics”, 2001, No. 32(1), p. 101–103.

<sup>26</sup> M. Ceccagnoli, *Study on evaluating...*, p. 42. Please note that additional 4,0% of all patents are simultaneously internally applied and licensed.



maceutical industry experienced only an insignificant decrease by 0,4% in the share of licensed patents, changes in other industries were more substantial. Biotechnology, chemical engineering and mechanical engineering noted a decline in licensing activities by several percent, whereas organic chemistry, IT and semiconductors experienced a rise by 4,7%, 1,2% and 8,3% respectively.

Table 4. Comparison of patent exploitation in Europe across technological areas for patents granted within 1993–1997 and 2003–2005

	Time scope	Pharma	Biotech	Chem. engineer.	Organic chem.	IT	Mech. engineer. <sup>27</sup>	Semiconductor	Total
Internal use	1993–1997	34,9%	38,9%	50,21%	23,09%	43,7%	47,7%–62,1%	46,1%	54,60%
	2003–2005	33,5%	35,8%	58,5%	29,2%	57%	56,2–71,2%	39,2%	52,80%
Licensing out	1993–1997	11,4%	22,2%	18%	7,6%	8,4%	7,4%–10,4%	1,32%	13,38%
	2003–2005	11%	14,9%	12%	12,3%	9,6%	4,5%–5,6%	9,6%	8,19%
Start-up foundation	1993–1997	4,72%	8,62%	7,46%	1,77%	6,13%	2,86%–3,69%	1,43%	5,13%
	2003–2005	1,8%	4,2%	2,5%	6,4%	8,0%	2,3%–7,4%	6,7%	4,57%

Source: own elaboration: following M. Ceccagnoli, *Study on evaluating...*; P. Giuri, S. Torrisi, *The economic...*

A very notable change over time and across industries concerns start-up's establishment. Although the total share did not alter significantly, each of the examined technological areas experienced a notable shift. Whereas out of the examined industries, the highest rate of patents applied to found a new venture within 1993–1997 were used in biotechnology and chemical engineering (8,62% and 7,46% respectively), ten years later patent rights in IT (8%), semiconductors (6,7%) and machine tools (7,4%) were the most significant drivers of entrepreneurship. The decrease in total start-up foundations as well as substantial changes between industries in the analysed timespan may mean that there still is a great potential of growth in this field. Furthermore, the importance of patent rights is underlined by the fact that they often serve as a measure of innovativeness<sup>28</sup> or competitiveness of companies and industry branches, although there is a lack of research concerning the impact of various patent exploitation methods on their competitiveness.

## 5. PATENT EXPLOITATION: PERSPECTIVE OF ORGANIZATIONS' TYPE AND SIZE

Another study on the forms of patent exploitation refers to the type and size of the organization. In order to shed the light on this issue, the approach of patenting institutions within the years 1993–1997 and 2003–2005 is examined. A direct comparison over time (see Table 5 and Table 6) is not possible, due to a lack of required data to calculate the

<sup>27</sup> Mechanical engineering comprises various technological areas, thus the result is given as a scope of extreme values.

<sup>28</sup> More on this topic: T. Grzegorzczuk, R. Głowiński, *Patents as firms' innovativeness indicator: advantages and disadvantages*, "Intercathedra" 2016, No. 32/2, s. 30–35.

aggregated values<sup>29</sup>. In consequence, the data concerning the size of the institution derived from InnoS&T survey cannot be collectively grouped into large, medium and small enterprises. On the other hand, separate elements of the PRI (Public Research Institution) demonstrated in the PatVal-EU report cannot be collectively illustrated as it was done in the InnoS&T report. Furthermore, please note that the study of PatVal-EU refers to patents granted to 6 largest European economies, while InnoS&T survey comprises 23 countries.

Table 5. Distribution of patent exploitation forms by type and size of the organization on the basis of patents granted between 1993–1997

	Internal use	Licensing	Cross-licensing	Licensing and use	Blocking (unused)	Sleeping patents (unused)	Total
Large companies	50,0%	3,0%	3,0%	3,2%	21,7%	19,1%	100%
Medium companies	65,6%	5,4%	1,2%	3,6%	13,9%	10,3%	100%
Small companies	55,8%	15,0%	3,9%	6,9%	9,6%	8,8%	100%
Private research organization	16,7%	35,4%	0,0%	6,2%	18,8%	22,9%	100%
Public research organization	21,7%	23,2%	4,3%	5,8%	10,9%	34,1%	100%
Universities	26,2%	22,5%	5,0%	5,0%	13,8%	27,5%	100%
Other government agendas	41,7%	16,7%	0,0%	8,3%	8,3%	25,0%	100%
Other	34,0%	17,0%	4,3%	8,5%	12,8%	23,4%	100%
Total	50,5%	6,2%	3,1%	3,9%	18,8%	17,5%	100%

Source: own elaboration following M. Ceccagnoli, *Study on evaluating...*

In contrast to the form of patent exploitation across industries, there are many differences of patent utilization, depending on the type of applicants (see Table 5). Accordingly, exactly half of the patent rights from the patent portfolio of large companies are used internally. The rate of patents traded accounts for less than 10%, while unused patents represent above 40% of the owned patent rights.

The study of unused patents revealed that out of all types of patent holders, large companies keep them unexploited due to strategic reasons, namely in order to block competitors (21,7%). This strategy is long-term oriented and smaller companies may not be able to afford such. Medium firms use almost 2/3 of the patent portfolio internally, which makes them the most exploitation-oriented type of patent owners. This means that they have the resources allowing to invest in production of products based on their patented invention. Similarly to large companies, middle sized firms are rather not trade-oriented with less than

<sup>29</sup> Information about the sample size of each category is missing, thus a weighted average cannot be defined.

a 10% share. In consequence of a high rate of internally applied patent rights, the share of those unused is relatively low and amounts to 24,2%, which is distributed approximately equally between blocking and sleeping patents. Small enterprises are oriented for both internal exploitation (55,8%) and trade in patents, since nearly ¼ is licensed. Due to the lack of resources they cannot use internally their patents as often as other types of companies and they need to carefully assess which inventions are worth patenting, hence the very small amount of sleeping patents (8,8%).

When it comes to Public Research Institutions (PRI)<sup>30</sup>, a clear orientation towards a patent trade can be observed, hence in case of universities and public research organizations above 30% of the patent portfolio is licensed out and 40% in case of private research institutions. Although the PRI aim to use patents, the share of internally applied patents is relatively low, with the highest rate of 26,2% observed for universities. Those institutions suffer in addition from the high share of sleeping patents, i.e. not employed in any way.

Table 6. Distribution of patent exploitation forms by type of the organization on the basis of patents granted between 2003–2005 (%)

	Used	Willing to use	Sold patents	Willing to sale	Licensed patents	Willing to license	Start-up founded	Willing to found	Blocking	Sleeping
Company	53,3	23,50	4,99	4,45	6,55	6,75	3,23	1,94	27,13	14,53
PRI	29,6	45,58	9,93	15,56	23,40	21,50	14,42	10,38	16,81	36,83
Other	46,5	31,15	7,33	10,34	13,13	16,41	9,86	7,81	27,82	16,83
<b>TOTAL</b>	<b>53,1</b>	<b>25,42</b>	<b>5,48</b>	<b>5,54</b>	<b>8,09</b>	<b>8,35</b>	<b>4,38</b>	<b>2,86</b>	<b>26,53</b>	<b>16,06</b>

Source: own elaboration following A. Gambardella, *Innovative S&T indicators...*

Table 6 illustrates the distribution of patent exploitation by the type of organization based on patents granted within 2003–2005. The examined companies used to exploit internally on average 53,3% of the patent portfolio and almost 25% are expected to be applied in the future. The aggregated, average total values do not point out the propensity to trade in patent rights, since approximately only 5% are used for each of the following categories: sale, licensing or start-up foundation. The propensity to exploit patent rights internally increases together with the size of the company (medium-sized companies have the highest share of used patents, which accounts for approximately 65%) and then goes gradually down to reach 47% for large companies with more than 5000 employees.

Regarding the external patent exploitation, neither the sale, nor licensing and start-up foundation play a very important role for companies, since the shares account for 4,99%, 6,55% and 3,23% respectively. Nevertheless, the propensity for the external patent exploitation differs significantly by the size of the institution. Shares for sale, licensing and start-up foundation are negatively connected with the size of the enterprise. In all cases, the larger the firm, the lower the rate. While microenterprises tend to sell almost 15%, license 19% and apply 27% of patents to set up a start-up, the rates for medium and large enterprises were following: 5%, 8%, 4% and 4%, 6%, 2% respectively. The reason behind this may be

<sup>30</sup> The term includes public and private research organizations, as well as universities.

the fact that smaller companies lack the resources to introduce the invention behind the patent into the production phase.

Although patent use of PRI is based mostly on the external patent exploitation, PRI improved also insignificantly the rate of patents used internally, which reached almost 30%. The share of patents sold accounted for 10%, licensed for 23% and 14,5% were used to found a start-up. Anyway, the statistics show that more than 50% were classified as unexploited and the majority, almost 37%, can be ascribed to sleeping patents.

Table 7. Distribution of patent exploitation forms by size of the company on the basis of patents granted between 2003–2005 (%)

	Used	Willing to use	Sold patents	Willing to sale	Licensed patents	Willing to license	Start-up founded	Willing to found	Blocking	Sleeping	
Number of employees	1–9	55,07	30,02	14,65	16,27	19,17	22,22	27,01	12,43	14,70	13,77
	10–19	61,14	23,27	10,26	12,82	16,26	17,34	11,11	8,21	20,51	9,29
	20–49	63,21	19,65	13,00	6,26	15,44	7,72	7,74	4,86	16,33	13,55
	50–99	64,84	18,41	9,93	5,85	9,18	7,30	4,98	2,41	15,23	11,92
	100–249	65,02	19,03	5,49	3,37	7,40	6,48	4,07	3,01	19,14	11,77
	250–499	60,12	22,11	3,57	3,68	5,78	6,23	2,37	1,19	24,37	13,51
	500–999	56,05	23,55	3,09	3,19	6,88	5,72	2,10	1,40	27,48	13,63
	1000–4999	52,38	24,86	3,93	5,11	6,00	7,64	2,24	1,70	26,95	17,21
	5000+	47,08	27,91	3,71	3,87	6,09	6,26	1,22	1,38	32,87	18,29
<b>TOTAL</b>	<b>53,19</b>	<b>25,32</b>	<b>5,48</b>	<b>5,50</b>	<b>8,14</b>	<b>8,27</b>	<b>4,40</b>	<b>2,80</b>	<b>26,49</b>	<b>16,02</b>	

Source: own elaboration following A. Gambardella, *Innovative S&T indicators...*

All in all, the share of patents exploited internally has not changed significantly over time and across various sizes of the companies. On the other hand, the alleged substantial increase in propensity to license patent rights described by Gambardella cannot be confirmed on the basis of data derived from both reports<sup>31</sup>. Accordingly, the share of licensed patent rights decreased between the two surveys, although since the direct comparison is not achievable, the values might be skewed<sup>32</sup>. Moreover, the share of cross-licensed patent rights increased rapidly by 13–14%. Furthermore, the older report did not include another external means of patent exploitation, namely sale. Thus, modern enterprises might be more often prone to sell patents instead of gaining royalties. The reason behind this change may be the possibility to obtain large financial gains very fast and channel them into the development of another invention, stimulating the growth of a company.

<sup>31</sup> To find out more about motives and propensity to license have a look at: A. Gambardella, P. Giuri, A. Luzzi, *The market for patents in Europe*, "Research Policy" 36, 2007, p. 1–21.

<sup>32</sup> Please note that the PatVal-EU differentiates licensing, cross-licensing and licensing&use separately while InnoS&T presents licensing under one term.

P. Andries and D. Faems show that patenting activities increase the ability of SMEs and large firms to license out patents to external organisations and this positive effect is significantly stronger for large firms<sup>33</sup>. The latter conclusion is contradictory to data derived from InnoS&T. The difference in companies' size and their willingness to license out may be either the result of changing trends or smaller sample size.

A significant change in patent's use can be observed in terms of unexploited patents. The increase in the total share of unused patent rights was driven by blocking patents, which confirms the theoretical considerations on the topic<sup>34</sup>. The propensity to leave patents unused for strategic reasons is correlated with the size of the organization: the larger the company is, the larger share of patents is kept to block competitors. Recent research shows that the relationship between performance and patents is stronger for small firms than for large ones<sup>35</sup>. While the authors underline that the reason behind this may be cost-spreading, complementary assets and especially large firm's inertia, blocking patents may be another explanation.

The InnoS&T report shows that PRI are still oriented more towards trade in patents rights instead of their own exploitation. This may be a result of lack of necessary resources, other motives than financial or institutional regulations which favour making use of patents in ways which do not require long-term engagement in one project. However, the slight growth of internally applied patent rights by several percent has been noted. The total rate of licensed patents by PRI grew over time and the willingness to increase the added-value for the stakeholder through licensing in the future is also very high<sup>36</sup>. Contrary to enterprises, PRI experienced a rapid growth of unused patents, driven to a large extent by sleeping patents, which proves increasing difficulties of PRI to take advantages of their inventions.

## 6. SUMMARY

The comparison of the forms and the rate of patent commercialization on the basis of PatVal-EU and InnoS&T over 10 year period led to many notable findings and inferences which were highlighted in appropriate sections. All in all, the propensity to exploit patents differs significantly across various countries. Furthermore, the general rate of patent rights utilized internally by companies is relatively low and amounted to slightly above 50%. The reason behind this may be the fact that implementation of some products or processes is often void of any reasonable economic justification or is a result of insufficient cooperation between innovators and entrepreneurs. Another cause may be the scarcity of complementary resources necessary to develop the invention.

Secondly, the alleged growth of external patents' use driven by licensing could only be partly confirmed by provided data. Although the propensity to license declined over time

---

<sup>33</sup> P. Andries, D. Faems, "Patenting Activities and Firm Performance: Does Firm Size Matter?", "Journal of Product Innovation Management" 2013, 30: 1089–1098.

<sup>34</sup> D. Somaya, *Patent Strategy and Management...*, p. 1090–1092.

<sup>35</sup> S. Belenzon, A. Pataconi, *How does Firm Size Moderate Firms' Ability to Benefit from Invention? Evidence from Patents and Scientific Publications*, "European Management Review", 2014, 11: 21–45.

<sup>36</sup> S. Torrisi, *The economic use of EPO patents: evidence from the PatVal surveys*, London 2013, p. 14.

in each country, the opposite trend can be observed when it comes to cross-licensing deals, since the share of this form grew double-digit, which is also true for starting a new venture. Comparing data concerning licensing and cross-licensing it seems that companies nowadays may be reluctant to share their knowledge and intellectual property with the competitors without obtaining the same themselves. This underlines the strategic role of patent rights in terms of competitiveness. This trend is also beneficial for companies as cross-licensing enables to minimise the risk of litigation and gain competitive advantage due to access to novel inventions. Reports show also that licensing activities vary substantially both over time and across technological areas. While pharmaceutical industry experienced only an insignificant decrease by 0,4% in the share of licensed patents, changes in other industries were significant.

Moreover, the study of unused patents revealed that out of all types of patent holders, mostly large companies (21,7%) keep them unexploited due to strategic reasons. Medium firms however, use almost 2/3 of the patent portfolio internally, which makes them the most exploitation-oriented type of patent owners. This may be the result of focusing on their core business connected with high technologies and their feeling of not being endangered by potential lawsuits in greater extent than large companies. Furthermore, the study revealed that the smaller the company, the greater propensity to use the patent externally. This may be caused by the lack of resources necessary to introduce the invention behind the patent into the production phase.

Other data concerning the unused patent rights revealed the trend of patenting around, since the share of blocking patents increased from 8% to almost 27%. This confirms the growing importance of patents used for strategic reason. However, this trend may be detrimental to both technological and economic progress and hence ways to overcome it are proposed. One of them is to increase the steepness of renewal schedules by public policy makers which would lead to more valuable patent applications<sup>37</sup>.

“Sleeping patents”, namely those for which no commercialization is expected to take place in the near future, still account for more than 15% which indicates a relatively high rate of patent rights with either untapped potential or poorly estimated suitability at the time of product development. This trend is especially valid for public research institutions. It is a matter of public policy to encourage diffusion of patents through exchange platforms and patent aggregators (such as patent funds)<sup>38</sup>.

There is a need for further studies dwelling into the patent strategies in use, especially when newer data of a similarly broad scope becomes available. This analysis may be of importance not only for academics, but also for companies which try to follow current trends both in terms of strategies of patent exploitation and new patented technologies<sup>39</sup>.

---

<sup>37</sup> S. Torrisi, A. Gambardella, P. Giuri, D. Harhoff, K. Hoisi, M. Mariani, *Used, blocking and sleeping patents: Empirical evidence from large scale inventor survey*, „Research policy“ 2016, 45 (7), p. 1374-1385.

<sup>38</sup> *Ibidem*.

<sup>39</sup> W. Lothar, F.C. Schnitker, *Patentmanagement: Recherche, Analyse, Strategie*, De Gruyter, Berlin, 2016.

**REFERENCES**

- [1] Andries P., Faems D., “*Patenting Activities and Firm Performance: Does Firm Size Matter?*” *Journal of Product Innovation Management* 2013, 30.
- [2] Belenzon S., Pataconi A., *How does Firm Size Moderate Firms' Ability to Benefit from Invention? Evidence from Patents and Scientific Publications*. „European Management Review“ 2014, 11.
- [3] Ceccagnoli M., *Study on evaluating the knowledge economy – what are patents actually worth? The value of patents for today's economy and society*. CERM Foundation, Markt 2004/09/E, 2005, ec.europa.eu.
- [4] Ernst H., Conley J., Omland N., *How to create commercial value from patents: the role of patent management*, „R&D Management“, 2016, 46.
- [5] Ford D., *The management and marketing of technology* [in:] R. Lamb, P. Shrivastava (eds.), *Advances in Strategic Management*, JAI Press, London 1985.
- [6] Gambardella A. (2012b), *Innovative S&T indicators combining patent data and surveys: empirical models and policy analysis*. Final Report INNOS&T Project, Seventh Framework Programme. Cordis.europa.eu.
- [7] Gambardella A., *Innovative S&T indicators combining patent data and surveys: empirical models and policy analysis, Final Report INNOS&T Project*, Seventh Framework Programme, 2012. Cordis.europa.eu.
- [8] Gambardella A., Giuri P., Luzzi A., *The market for patents in Europe*, “Research Policy” 36 (2007).
- [9] Gassmann O., Bader M.A., *Patentmanagement: Innovationen erfolgreich nutzen und schützen*, Springer, Heidelberg 2011.
- [10] Giuri P., Torrisi S., *The economic use of patents*, University Bologna, InnoS&T Conference, Munich 2011.
- [11] Grindley P.C., Tecce D.J., *Managing Intellectual Capital: Licensing and Cross-Licensing in Semiconductors and Electronics*, “California Management Review”, 39/2, (1997).
- [12] Grzegorzczak T., Głowiński R., *Patents as firms' innovativeness indicator: advantages and disadvantages*, “Intercathedra”, 32/2 (2016).
- [13] Hall B.H., Ziedonis R.M., *The Patent Paradox Revisited: An Empirical Study of Patenting in the Semiconductor Industry*, “RAND Journal of Economics” 32/1 (2001).
- [14] Hentschel M., *Patentmanagement, Technologieverwertung und Akquise externer Technologien*, Deutscher Universitäts-Verlag, Wiesbaden 2007.
- [15] Kotarba W., *Ochrona własności intelektualnej*, Wydawnictwo Politechniki Warszawskiej, Warszawa 2012.
- [16] Leone M.I., Laursen K., *Patent exploitation strategies and value creation* (in:) Munari F., Oriani R. (eds.), *The Economic Valuation of Patents. Methods and Applications*. Edward Elgar, Northampton 2011.
- [17] Lothar W., Schnittker F.C., *Patentmanagement: Recherche, Analyse, Strategie*, De Gruyter, Berlin 2016.
- [18] OECD Patent statistics manual, 2009, oecd.org.
- [19] PatVal: *The value of European patents, evidence from a Survey of European Inventors. Final report of the PatVal EU Project*, 2005. Ec.europa.eu.
- [20] Ruther F., *Patent Aggregating Companies: Their strategies, activities and options for producing companies*, Springer Gabler, Wiesbaden 2012.

- [21] Schmeisser W., Mohnkopf H., *Ausgewählte Beiträge zum Innovationsmanagement, zur empirischen Mittelstandsforschung und zum Patentschutz*, Rainer Hampp Verlag, München 2008.
- [22] Somaya D., *Patent Strategy and Management: An integrative Review and Research Agenda*, "Journal of Management", 38/4 (2012).
- [23] Torrisi S., *The economic use of EPO patents: evidence from the PatVal surveys*, University Bologna, Conference on Patent Use, London 2013.
- [24] Torrisi S., Gambardella A., Giuri P., Harhoff D., Hoisi K., Mariani M., *Used, blocking and sleeping patents: Empirical evidence from large scale inventor survey*, „Research policy“ 2016, 45 (7).
- [25] WIPO, *Licensing of intellectual property assets; advantages and disadvantages*. 2012, wipo.int.

### TRENDY W WYKORZYSTANIU PATENTÓW – ANALIZA EMPIRYCZNA

Głównym celem artykułu jest wykrycie trendów i strategii patentowych funkcjonujących w praktyce gospodarczej oraz rozważanie przyczyn części z nich. Zostanie to osiągnięte poprzez porównanie form wykorzystywania patentów w wybranych krajach europejskich, branżach oraz biorąc pod uwagę rodzaj i wielkość organizacji, a także poprzez analizę literatury. Artykuł skupia się m.in. na stosowaniu patentów ze względów strategicznych, w tym poprzez blokowanie konkurencji. Szczególna uwaga jest poświęcona zewnętrznemu wykorzystaniu patentów, licencji, w tym licencji krzyżowych oraz ich sprzedaży. Analiza opiera się na danych statystycznych pochodzących z raportów PatVal-UE i InnoS&T.

Wyniki tego badania wskazują, że skłonność do korzystania z patentów różni się znacznie w badanych państwach europejskich. Porównanie danych dotyczących licencji i licencji krzyżowych wskazuje, że coraz częściej przedsiębiorstwa niechętnie dzielą się swoją wiedzą i prawami własności intelektualnej bez otrzymania tego samego od konkurencji. Może to świadczyć o znacznej roli praw patentowych w kształtowaniu ich konkurencyjności. Ponadto, wykorzystanie praw patentowych wewnątrz firm jest stosunkowo niskie i wyniosło niewiele ponad 50%. Domniemywany wzrost korzystania z patentów zewnętrznych został częściowo potwierdzony. Udział patentów blokujących wzrósł, co potwierdza rosnące znaczenie patentów wykorzystywanych w celach strategicznych. „Śpiące patenty” wciąż stanowią więcej niż 15%, co wskazuje na stosunkowo duży udział praw patentowych z niewykorzystanym potencjałem lub nieodpowiednio oszacowanej wartości na etapie rozwoju produktu. Jest to szczególnie widoczne w przypadku publicznych instytucji badawczych.

**Słowa kluczowe:** patenty, trendy patentowe, strategia patentowa, ochrona patentowa, zarządzanie innowacjami, prawa własności intelektualnej.

**DOI: 10.7862/rz.2017.mmr.16**

*Tekst złożono w redakcji: styczeń 2017 r.*

*Przyjęto do druku: czerwiec 2017 r.*