



# The role of the patent system in the internationalization of the technical knowledge diffusion

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**Abstract:** The author attempts to show the role of the patent system in the internationalization of diffusion of technical knowledge. The purpose is to analyse the use of international technical knowledge made available through patent systems by Polish companies that are inventively active. To accomplish it, research was carried out based on a quantitative analysis of the so-called patent citations, included in the technical documentation submitted for the protection of inventions. Conclusions resulting from the research show a high degree of internationalization of the diffusion of technical knowledge in relation to scientific and technical publications and a low one when the existing technical solutions are the basis.

**Keywords:** knowledge diffusion, inventions, patents, patent citations

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## 1. Introduction

Internationalization of a company activity can take place at various levels and with varying intensity. In modern economy, where knowledge is a source of permanent competitive advantage (Nonaka, 1991: 96–104), internationalization also applies to the knowledge diffusion process. The knowledge resources used by enterprises can have a different character. In the process of creating

new technical solutions, they refer to the so-called technical knowledge codified (made available in publications). It is particularly desired both by technologically advanced economies that create new breakthrough solutions, as well as those that are focused rather on its imitative use. For the purposes of the publication, diffusion of knowledge will be understood narrowly – as the use of existing solutions to create new breakthrough innovations (inventions), eliminating imitative innovations that arise rather as a result of the spread of knowledge. Internationalization, on the other hand, will be perceived as the process of obtaining any type of specialist knowledge, which the company draws from foreign sources and then uses in its own inventions. In this context, the internationalization is passive, which means it boils down to the use of external knowledge to develop solutions submitted for patenting on the internal market. The purpose of this article is to examine how Polish enterprises use international sources of technical knowledge made available by the Polish patent system. In order to realize it, a comparative analysis of data obtained from subjective and objective assessment on the state of technology was carried out. To obtain subjective data, the method of analysing references contained in the description of inventions applied for protection within the national patent system was used. The obtained results were then confronted with a description of the state of the art made by specialists in a given field, whose task is substantive verification of the application. At this stage, an objective state of knowledge has been established. The comparison of the above results allowed comparing the preferred sources of technical knowledge, and thus assessing the internationalization of its diffusion process.

## **2. Technical and technological knowledge**

On the wave of interest in technology-based economy, the concept of knowledge and its role as determinants of development have been widely discussed in the literature of the subject. Regardless of the definitional differences, it can be assumed that it is the empirically used information that was obtained for the implementation of a specific goal or decision. Knowledge is not the same as information. The first is characterized by the ability to actually create and modify the reality specific to a given entity. The other one is theoretical, it is the sum of data, which – taken together – creates a compilation of elements with a certain practical potential. One of the kinds of specialist knowledge is technical knowledge. It is defined as a repetitive production system in which initial data influences the output parameters of products or services (Baran, Ryszko, Szafraniec, 2014) or

as a set of structured and proven information designed to change the surrounding reality (Baran, Ryszko, Szafraniec, 2014). It covers strictly technical knowledge (the so-called engineering knowledge, covering specific scientific standards) and procedural (legal regulations in the field of patents, licenses and protection rights). It can therefore be concluded that the purpose of technical knowledge is to improve the effectiveness of certain solutions. The useful value of technical knowledge, as a special product of the intellect, lies in the fact that it is the starting point for a series of feedback loops. Enabling the creation of technological solutions, it determines the expansion of knowledge resources and ensures the continuity of the stream of new goods and services. This knowledge may be of a secret nature (know-how) or be made available to the public (codified knowledge). This understanding of technical knowledge coincides with the definition of the state of technical knowledge by which is understood “a set of achievements illustrating the state of production equipment and production methods that serve the production of goods and services, and a set of activities leading to the achievement of this state” (Niewęglowski, 2010: 55). The concept associated with technical knowledge is the concept of technological knowledge, i.e. the ability to influence an increase in production efficiency using technical and scientific progress, offering new product solutions, but above all – process solutions. Technological knowledge is a systematic resource necessary to launch production of products, implementation of a technological process or provision of services (Markiewicz, Niedzielski, 2010). Technical knowledge understood in this way is divided into:

- pure knowledge (placed in each formalized form, project documentation, publications, judgments),
- knowledge embodied in intellectual capital (research and development teams),
- knowledge objectified in specific products (Markiewicz, Niedzielski, 2010).

Inventions, as a new solution of the technical nature, possessing an inventive level and suitable for use in any field of industry, are an example of the embodiment of technical knowledge in a real product or process.

### **3. Technical knowledge diffusion channels**

Foreign direct investments (FDI) are considered to be a significant channel of technical knowledge diffusion. FDI do not always lead to objectively the most effective knowledge flow of this kind. This is, among others, due to the development level of the host country (where the investment incentive is cheap and unqualified workforce, imitations are implemented first of all) and unfair market practices applied by holders of a dominant position (enforcing mutual licenses, introducing territorial, subjective and objective limitations, limiting the research independence of entities in the host country). The geographical distance shaping the transfer costs is also important (the further the distance, the higher the concentration on local resources) and the actual ability of the host country to absorb and use specialist knowledge (Kluzel, 2007). Often, the co-existing with FDI as a channel of specialist knowledge is the migration of specialists and the emphasis laid by foreign companies on training employees. Over time, this causes knowledge to leak beyond the walls of the parent unit and the process of the so-called reverse engineering – the phenomenon consisting in the development of available solutions and then making them a base for technologies that are their copy or imitation. When it is applied, the intended functionality is obtained; however, it ignores the limitations imposed by industrial or proprietary rights. This is, among others, the reason why the degree of availability and consequently diffusion of technical knowledge obtained through the influx of FDI is also strongly associated with the effectiveness of intellectual property rights protection. A strong or weak system of its protection is also important for stimulating the diffusion of knowledge from sources other than FDI. One of them are license agreements providing the so-called operative knowledge, that is enabling direct use of the solution being subject to it. Behind the license agreements there are often high indirect costs associated with the necessary import of equipment and other parts. The diffusion of knowledge is also favoured by other forms of technology import (acquisition of the infrastructure necessary to start the production process or to buy a patent). One of the channels is also the import of goods and services, causing the increase of domestic productivity and their import, which enriches the knowledge resources mainly through direct commercial contacts. The channel providing specialist knowledge of the cognitive nature is to obtain it through scientific publications, especially those containing results of empirical works (monographs, papers) and technical studies intended for a specific group of specialists in a given field. It serves as a guide for searching for and creating solutions of the breakthrough or imitative nature. An example of the last type of channel is the technical documentation.

#### **4. Technical documentation as a channel of technical knowledge diffusion**

One of the technical knowledge channels are patent descriptions and state-of-the-art reports being an integral part of the process of obtaining patent protection. The effectiveness of this type of specialist knowledge channel has significantly improved the availability of patent information platforms with diversified geographic coverage. Patent systems are a base of scientific and technical knowledge, the importance of which in the economies of the global information flow is impossible to downplay. They contain information about not only the fact of the invention being submitted and the consequences resulting from it, but also through substantive verification of the invention at the notification level, they provide guidelines, among others, about its commercial value. Technical knowledge materialized in the invention is disseminated through technical documentation containing both technical and scientific information as well as economic and commercial information. Technical documentation of inventions serves to implement the concept contained in it. Its component is a description of the invention from the date of the application and the claim. The claims must include a set of technical features allowing identification of the subject matter of the invention and the scope of the desired protection. The idea behind the attached drawings is to help to understand the design of the solution. However, the description of the invention should describe the essence of the invention as comprehensively as possible, so it must be written in a comprehensive manner so that a specialist in a given field can realize it. The title of the solution, the field of technology to which the invention pertains, references to solutions in technical areas, detailed specification of the object to be protected, examples of implementation or economic exploitation of the invention, are defined by default. This last element allows estimating the commercial potential in relation to a specific market or recipient. References to known creators of solutions of other entities included in the description constitute a universal bibliometric database with a wide spectrum of use. For example, it permits to specify sources of specialist knowledge and enables geographical identification. Through patent citations, a network of connections between technical solutions is growing wider and wider. Networks of this type have been recognized as one of the criteria for measuring the investment potential in relation to a given

solution (Hur, 2017). Patent references also allow for qualitative and quantitative identification of the flow of information between individual scientific disciplines (Hur, 2017). Beside, patent references form the basis for an indirect assessment of the degree of internationalization of technical knowledge diffusion channels. One can accept the hypothesis that the more citing of foreign knowledge, the higher the degree of internationalization of its diffusion. It is worth mentioning that the patent-related requirement to provide technical documentation raises certain controversies; on the one hand, it is supposed to favour the diffusion of technical knowledge, on the other one – it raises the threat of infringement of exclusive rights during the patent procedure. The problem is particularly important in relation to the use of information and knowledge contained in the patent documentation for the needs of science. The attempt to solve it is the introduction of the so-called research privilege, which was supposed to neutralize obstacles in conducting research works and make work in this area independent from the need to obtain a license from an authorized entity. “In a situation of uncertainty of results, being an immanent feature of research, such difficulties may significantly discourage scientific research in the area "saturated" by patents” (Żakowska-Henzler, 2011: 181). The research privilege is an issue that is stepping in the problem of the knowledge flow, because it often determines the cognitive activity (acquisition of information) by third parties and the process of internationalization of its flow.

## **5. Internationalization of technical knowledge channels based on patent references**

Applications to the Patent Office of the Republic of Poland made by enterprises located in the Wrocław Technology Park were accepted as the basis for the research. Of the total number of the enterprises operating within it (162), 15 were patent active. The selection of the research group – enterprises focused in the structure of the technology park – was motivated by the fact that by assumption enterprises of this type show high innovative potential and strong inventive activation, thus they provide a comprehensive, as for Polish conditions, cognitive material. The analysis covered a total of 60 patent applications, i.e. all filed by selected enterprises (in the period from 1991 to the first quarter of 2017).

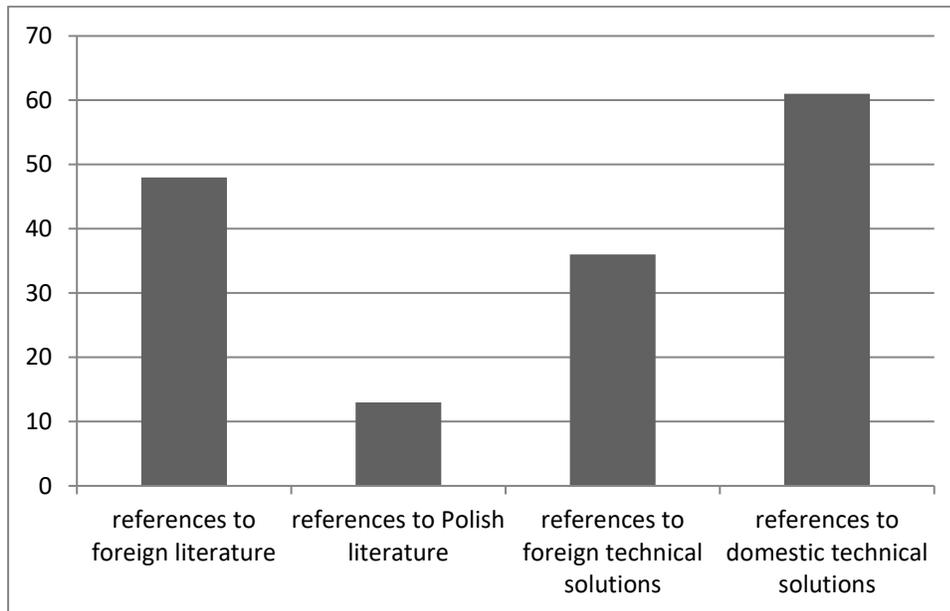
**Table 1. Patent applications of enterprises from the Wrocław Technology Park**

Kogeneracja	Apeiron Synthesis S.A.	Stem Cells S.A.	Technology Transfer Agency Techtra sp. z o.o.	Kriosystem sp. z o.o.
19	9	7	6	4
Technox sp. z o.o.	Lediko Walendowski	Prometgas sp.z o.o.	Silesian Catalysts	Lipid System
3	2	2	2	1
Mitsubishi Electric Europe	Nestmedic sp. z o.o.	Eurol Innovative Technology Solution sp.z o.o.	FLC Pharma sp. z o.o.	Embedded System Design Center
1	1	1	1	1

Source: UPRP data, www.uprp.pl, 12.11.2018

In the case of some of them, the technical documentation was not available. The research was divided into two stages. At the first stage, the channels of subjective technical knowledge were identified (knowledge possessed by the creators of the solution), and its basis was the analysis of citations to literature and technical solutions (patents, patent applications, utility models) of third parties. All in all, the creators of the reported inventions placed in the documentation 158 references to other solutions and scientific literature. Among them, foreign references prevailed (they constituted over 53% of all the references), but this advantage is not uniform (Fig. 1).

**Figure 1. Identification of subjective citations**

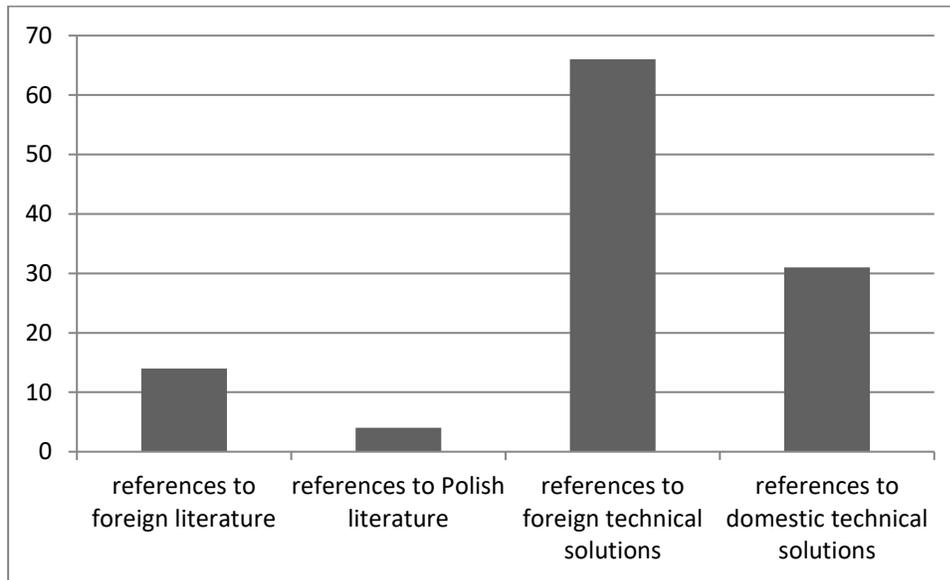


Source: UPRP data, [www.uprp.pl](http://www.uprp.pl), 12.11.2018

While references to foreign literature are dominant (30% of all the citations), reference to foreign technical solutions are not (23% of all the citations). In the latter case, references to domestic solutions are leading (39% of all the citations). Only 13 times Polish scientific literature was mentioned (8% of all the citations). It turns out that Polish inventors know and move well in the field of foreign scientific and technical publications, but when it comes to practical solutions, they are based on domestic achievements.

Other conclusions come from the second stage of the research – evaluation of the state of the art (objective analysis). In this case, specialists referred in total to 115 sources, of which 70% came from abroad, and 30% from Poland. With this method chosen, references to foreign knowledge were consistently dominant in both aspects, in reference to literature and technical solutions (Fig. 2).

**Figure 2 Identification of objective citations**



Source: UPRP data, [www.uprp.pl](http://www.uprp.pl), 12.11.2018

The implications of the conclusions indicate a high degree of objective and subjective internationalization in relation to professional literature. In the case of a subjective internationalization, the geographic proximity of the technical knowledge channel proved to be a significant factor. As a summary of the both types of analysis results, a list of identified technical knowledge sources can be used. It turned out that only in 11 cases the state of subjective and objective knowledge coincided. It happened once in reference to foreign literature, 10 times in relation to technical solutions, including 7 to Polish and 3 to foreign solutions. This indicates a complete separation of the state of technical knowledge assessment, which means that experts and creators use completely different sources, both in terms of domestic and foreign achievements.

## 6. Summary

In the literature on the subject, the internationalization of the technical knowledge diffusion related

to the generation of inventions is mainly discussed in the context of the necessity of removing the local patent protection from the museum in the direction of its internationalization. The problem related to the locality of the average patent portfolio of active inventing entities is an important issue, but in Polish conditions, usually occurs at a later stage. Meanwhile, the issue of internationalization appears much earlier, at the stage of acquiring knowledge and the need to diversify its sources. It is easy because knowledge does not respect geographic barriers – it spreads in a spontaneous and democratic way. Knowledge diffusion internationalization should therefore rely on the best use of its foreign resources using the access to the global technological information network. In this context, patent systems may be a significant source of information of the technical nature, which – on the one hand – give authorized entities economic and legal exclusivity of exploitation, and – on the other hand – enforce disclosure of information constituting the basis of the restricted solution. Thus, this information acquires the status of explicit protected knowledge, knowledge that can be absorbed and once again processed by subsequent entities, enterprises, research units, universities. The conducted analysis has proved that subject enterprises that are inventively active and have the status of a technology park's tenant, show a high degree of technical knowledge diffusion channels internationalization, however, only with reference to scientific and technical publications. In the case of specific technical solutions, they base primarily on national achievements, which may indicate the geographical proximity importance in the process of practical technical knowledge diffusion, insufficient research potential or a lack of good practices developed in this area. A comparison of the results of subjective and objective assessment of the state of the art also indicates a disturbing discrepancy between the potential and the actual use of technical knowledge resources.

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### *Rola systemu patentowego w internacjonalizacji procesu dyfuzji wiedzy technicznej*

#### *Streszczenie*

W artykule podjęto próbę ukazania roli systemu patentowego w internacjonalizacji dyfuzji wiedzy technicznej. Jego celem jest analiza wykorzystania przez polskie przedsiębiorstwa aktywne wynalazczo, międzynarodowej wiedzy technicznej udostępnianej za pośrednictwem systemów patentowych. Dla jego realizacji przeprowadzono badania polegające na jakościowej analizie tzw. cytowań patentowych, umieszczonych w dokumentacji technicznej zgłoszonych do ochrony wynalazków. Wnioski wynikające z badań wskazują na wysoki stopień internacjonalizacji dyfuzji wiedzy technicznej w odniesieniu do publikacji naukowych i technicznych i niski, gdy podstawą są już istniejące rozwiązania techniczne.

**Słowa kluczowe:** dyfuzja wiedzy, innowacje, patenty, cytowania patentowe