

# Diffusion of Technical Knowledge of Petrochemical Enterprises



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**Submission:** November 19, 2018; **Published:** December 13, 2018

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## Abstract

The publication refers to the problem of diffusion of technical knowledge among petrochemical enterprises. The aim of the article is to present empirical data illustrating the diffusion based on patent applications of selected enterprises. The conclusions indicate a significant geographical correlation of the diffusion process and the leading role of American technical solutions for creating further petrochemistry innovations.

**Keywords:** Patents; Diffusion of knowledge; Technical knowledge

## Introduction

Innovative activity of enterprises is conditioned by access to knowledge, first of all technical knowledge. The literature defines a technical knowledge as a certain repeatable production system in which initial data influences the output parameters of products or services, or as a set of technically reliable information, which is enabling the change of reality surrounding the human [1]. F. Hayek emphasized that this type of knowledge is spontaneous, uncontrolled, and its appearance causes that old knowledge becomes useless [2]. In the process of acquiring technical knowledge, enterprises apply the widest possible diversification, reaching both internal and external sources. The use of external knowledge sources is possible thanks to the controlled outflow of knowledge performed by third parties that decide on the conditional publication of technical parameters of inventions developed, the commercialization of new solutions or the sale of intellectual property rights [3].

Reaching for them not only opens the process of innovation, it also determines the spread of technical knowledge, i.e. its diffusion. Diffusion of knowledge stimulates inventive activity and the effect is the emergence of new technical solutions. The diffusion process is particularly important for petrochemical companies. Innovation based on technical knowledge is for them a condition for obtaining and maintaining a strong market position. The aim of the article is to present empirical data illustrating the diffusion of technical knowledge based on patent applications of leading petrochemical companies. The results concerning three companies Exxon Mobil, BP and Rosneft, are a part of widespread research on the diffusion of knowledge and inventive activity of petrochemical companies.

## Diffusion of Technical Knowledge

Because the technical knowledge is implementation-oriented [4], its purpose is to functionally improve existing solutions or develop solutions different from those that have been used so far. It allows to "recognize and understand the trajectory of technological development, which in turn gives insight on how to use current knowledge and skills" [5]. It is also a kind of knowledge strongly associated with the development of technology and science, because it concerns "the issue of proper designing of particular solutions, preparation of production documentation and the choice of the optimal technology for production" [6]. Due to the nature of technical knowledge, its diffusion is understood as the process of knowledge flow occurring in a specific space among individuals, while maintaining a certain degree of knowledge absorption control.

As a result, a phenomenon occurs in which new knowledge eliminates the so far used method. Eliminating does not mean that old knowledge disappears in a literal way, on the contrary it may still co-exist and be exploited, but it becomes obsolete and ineffective. Acquired knowledge becomes a contribution to new technical solutions, which in turn stimulate further diffusion of new knowledge. The example could be the development of renewable energy technologies which replace those previously used, traditional energy resources. Therefore, diffusion described by Griliches as true, occurring when the innovation buyer performs its reconstruction, and then by expanding the resources of own knowledge, the buyer constructs successive solutions that are a source of continuous productivity growth [7].

Although the diffusion depends on the type of knowledge and its characteristic connections, it always determines its progress

and such a change that will match it to the requirements of specific entities or their communities. If the inventor decides to apply for patent protection, the diffusion of knowledge, in this case of explicit knowledge, may occur before the commercialization of the invention. It is the so-called technical quantified knowledge. In the case of patents, the diffusion of technical knowledge is possible thanks to the mapping by means of specific technical parameters. Technical parameters are certain characteristic values that can be measured directly or using mathematical formulas with specific variables [8].

### Diffusion of the Petrochemical Knowledge

For the article, we analysed patent citation included in the patent applications of three companies from different geographical areas: Exxon Mobil Res and Engineering Company (USA), BP Oil Int (GB) and Rosneft (RUS). The filings were made in years 2010-2018. The database used was collections of the ESPACENET patent documentation. The research was two way. First of all, it was checked which patent system was most frequently referred to (diffusion of 1st degree knowledge). Secondly, the further use of technical knowledge contained in the descriptions of the analyzed applications was analyzed, i.e. to what extent they were a stimulus for further inventions (second degree diffusion). The analysis made in order to implement the first stage showed the importance of geographical proximity in access to technical knowledge. A strong geographical concentration of technical knowledge diffusion was noted in the case of two enterprises-Exxon Mobil and Rosneft.

In the Exxon Mobil documentation, American solutions were cited 100 times, and in Russian Rosneft documentation, Russian solutions were quoted 142 times. However, in the case of the third company-British BP-the most frequently referred were not the native but the American solutions. Citations of American patents definitely dominated the total number of citations (569 citations). References to American technical thought constituted nearly 40% of all citations. Analiza dyfuzji II stopnia wykazała natomiast znaczne zróżnicowanie. However, analysis of the second degree diffusion showed significant variation. Exxon Mobil patents were

most frequently cited in the CN patents (39 citation), Rosneft in RU patents (8 citations), and BP in US patents (20 citations).

### Summary

The example of institutional solutions enabling the diffusion of overt petrochemistry knowledge are patent systems that provide data on applications and patents granted. The analysis of technical documentation of enterprises selected for the research, in relation to first degree diffusion, showed the importance of the geographic proximity factor. However, the analysis of patent citations-the second degree diffusion - does not confirm the conclusion from the first stage. This indicates the need to significantly expand the subjective and geographical scope of further research. At the same time, the research clearly shows that in the case of petrochemical enterprises the strongest diffusion occurs in relations to American technical knowledge.

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DOI: [10.19080/RAPSCI.2018.06.555685](https://doi.org/10.19080/RAPSCI.2018.06.555685)

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