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## Open Innovation Process via Technology Transfer and Organizational Innovation

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**Abstract:**

**Purpose:** The main aim of the paper is to determine the relationship between technology transfer as a part of open innovation process on organizational innovation in surveyed firms, what has been investigated empirically.

**Design/Methodology/Approach:** The study is based on a survey on firms (n=100) located in Poland. The research model defines the relationship between technology transfer and organizational innovation in the enterprises has been developed. The survey uses the multi stepwise regression modelling.

**Findings:** The surveys has determined the positive relationship between technology transfer and organizational innovations of researched firms. A strong direct effect on surveyed firm's organizational innovations have different channels of material and non-material technology transfer as well as cooperation for innovation.

**Practical implications:** From the practical point of view it is important that practitioners as managers should invest more effort in innovation activity connected with software development in their companies and cooperation, firstly started from cooperation with the research centers and universities for innovation, based on common innovation projects.

**Originality/Value:** Regarding its methodology, this survey is one of the first studies examining the relationship between technology transfer and technological innovation of firms based on individual-level data and according to the theory. This findings suggest that measurement of technology transfer and its specific channels should be developed further as it is important in firm competitiveness and innovativeness level of firms.

**Keywords:** Open innovation, technology transfer, organizational innovation, open sources of innovation.

**JEL Codes:** O32, C00, M2, L1.

**Paper Type:** Research Paper.

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## **1. Introduction**

Developing a successful organizational innovation is essential for creating and sustaining on firm competitive advantage. It also affects the management process of the company. Through organizational innovation enterprises can manage the needs of clients and the market demand, as well as reduce companies expenses. Technological changes have transformed the current competitive environment (Prahalad, 1998) and enterprises are being on pressure of advance and new technologies in order to ensure long-term prosperity and survival (Steele, 1989). Modern economy is characterized by increasing importance of knowledge related to the quality of human capital and knowledge embedded in the products (Balcerzak, 2010).

Practitioners consider innovation (product, process, organization, marketing) as a tool to improve the avenues of growth available to their firms, and use branding to survive the competition they face in the market (Gupta and Malhotra, 2013). The only way for a company to gain a sustainable competitive advantage is invariably upgrade its processes and activities through innovation (Porter, 1990; Drew, 1997).

From the knowledge-based perspective, technology is more challenging to imitate and it is considered as an essential resource for firms (Mowery and Rosenberg, 1989). Innovation strategies exploiting external flows of technology represent a new source of competitive advantage for companies (Gassmann, 2010). Therefore, using external technology sources is crucial to successful firm innovation.

The most important contribution of this article is to extend the analysis of the relationship between technology transfer and its influence on organizational innovation in researched enterprises. The main aim of an article is to determine the relationship between technology transfer and selected technology transfer channels and organizational innovation implemented by enterprises. Under the survey specific technology transfer channels are characterized and empirically investigated in the condition of indirect influence on organizational innovation and the direct influence and the role for technology transfer.

## **2. Literature Review**

The high costs of innovative activities, the growing need for interdisciplinary science and technology, and the increasing emphasis on research have resulted in changes in relations between science and industry and also among the firms. The concept of open innovation emphasizes aspects of the broadly understood cooperation of an enterprise with external partners in order to generate and effectively implement (market) innovations. Open innovation models are characterized by maximizing the value of various ideas that occur both within the enterprise and those flowing from outside, i.e. from the company environment. In the open innovation model organizational boundaries between the enterprise and its environment are blurred. Technical knowledge in this process is seen as an economic good, that is subject to exchange

between cooperation partners. As part of open innovation, enterprises search for ideas, inspiration and technology in the external environment of the organization. They also cooperate with external scientific and research units. Cooperation also works the other way around. Enterprises with technology, both tangible and intangible, earn on selling their solutions to other companies. Firms sell patents and licenses for their own solutions. The example of open innovations clearly shows the division into vertical and horizontal technology transfer. In this type of cooperation, it is less important to protect innovation from competition. The consequence of the open innovation process is the search for technology transfer channels that can be obtained from the company's environment (Chesbrough, 2010).

Open innovation models assume that not all the best people work for the company, the firms need cooperation with external research units, external R&D works can be a source of tangible benefits for the company, creating a better business model is more important than entering the market first, using the best own and foreign ideas is a source of success, benefit from sharing intellectual property of the company with others and use foreign knowledge if this supports of the business model (Chesbrough, 2003).

Therefore, in order to create innovations in the field of products, processes modern enterprises must take advantage of the opportunities offered by open innovation models. Modern innovative models give the possibility of transferring ready R&D solutions both from scientific and research institutions (vertical technology transfer) as well as from other enterprises (horizontal technology transfer). Smaller enterprises under these models can cooperate with other entities, thanks to which they have an impact on the shape and scope of solutions they want to acquire for efficient and competitive operation in an increasingly demanding market. In addition, an important source of innovation in enterprises is knowledge flowing from the inside of the company like employees or management staff, as well as knowledge from outside acquired from customers, suppliers, subcontractors or from open sources of knowledge. The possibility of being innovative in the modern economy is not only the domain of large enterprises with their own research and development facilities, but also of smaller enterprises. Innovation can be built on the basis of own R&D activity and the internal potential of the enterprise, but it can also be generated using ready-made or collaborative solutions available outside the enterprise.

Since one of the factors considered as a source of competitive advantage is innovation through technology, investment in R&D activities is a strategically important decision making (Rhee and Yang, 2015). Firms, that rely on imitation of technological resources are able to achieve a sustainable competitive advantage (Bettis and Hitt, 1995; Teece, 1977). An enterprise can improve its innovation either by its internal R&D efforts or by forming external collaborative R&D (Huang and Yu, 2011). While internal exploitation of technological assets, through designing, developing, manufacturing, and selling products and processes continues to be important, interest in their external exploitation through technology transfer has intensified

in recent years (Ramanathan, 2011). Successful firms are those who are able to accumulate competence through internal technological learning after technology and knowledge transfer from external technology sources (Lin, 2003).

Technology transfer may be regarded as a term that relates to a specific and limited diffusion of technology with innovative market-driven aspirations (Fernandes and Machado, 2019). Transfer of technology is a general transfer of technology between science and firms (Chakrabarti, 1973). Diffusion and technology transfer must be understood as essentially phenomenological issues. Firms rely heavily on external technology for innovation (Ortega-Argile's, 2009). For many enterprises internal research – development objective of creating their own technology is not possible although still they need new technologies to be able to be competitive and to innovate. This chance gives them external technology (Mayer and Blass, 2002) that can improve a competitive advantages of firm's (Argote and Ingram, 2000). Therefore the survey should focus on the influence of technology transfer and its influence on organizational innovation. Limited resources may incentivize firms to rely on less expensive and less risky alternatives than internal research and development (Dahlander and Gann, 2010).

Technology transfer can take place via specific channels. It may refer to the purchase of new solutions for the needs of enterprise development and the transfer of best practices and innovative technologies (Gibson and Stiles, 2000).

Engaging external entities such as suppliers and customers in the innovation process can facilitate innovation (Von Hippel, 1998). To become more competitive and innovative firms need to exposure to external knowledge. Thus, the research attempts to examine whether firms can gain organizational innovation from technology transfer and if there is a positive relationship among the technology transfer on firm's organizational innovation. In line with this first hypothesis was putted:

*H1: Technology transfer affects positively firm organizational innovation.*

### **3. Data and Research Methods**

Based on the literature in the subject of technology transfer and innovation, as well as of open innovation process, sources of innovation in organization are widely reported (Chesbrough, 2010; Rogers, 1998; Utterback and Abernathy, 1975; Mayer and Blaas, 2002). Although that, there is a detailed approach to the subject of technology transfer as a part of open innovation process and its place in the open innovation process as well as in creation of organizational innovation and competitive advantage. Not enough attention is also given to the direct influence of technology transfer as a part of open innovation process on organizational innovation implemented in firms and by them. Because of that a research model defining the relationship between technology transfer and organizational innovation in enterprises has been developed.

### 3.1 Specification of the Model

The model was specified with particular interest in organizational innovation. All indicators like technology transfer and organizational innovation are more complex and do not have one definition and unambiguous measurement. In the survey technology transfer is an independent variable which is described by means of technology transfer indicators and dependent variable – product innovation – as well is described by indicators as in Table 1. Organizational innovations in a general sense concern the creation, introduction or adaptation of a new idea or behavior in an organization. According to Lam (2004), "*economists assume that organizational change is the answer to technical change, while in fact organizational innovation may be a necessary prerequisite for technical innovation*". It should be distinguished that not every organizational change is also an organizational innovation (Archibugi *et al.*, 2001).

**Table 1.** Independent and dependent variables indicators.

Indicator	Indicator - Variable definition
<b>Technology transfer - T</b>	
T1	Material and non-material technology transfer
T2	Open sources of innovation
T3	Coopetition for innovation
<b>Organizational innovation - OI</b>	
O1	Implemented organizational innovations in the last three years by the firm
O2	The scale of implemented organizational innovation (0-3) in the last three years in the firm

*Source: Author's own elaboration.*

In order to examine the impact of individual technology transfer channels, technology transfer indicators have been described in detail (Table 2).

**Table 2.** Specific technology transfer indicators.

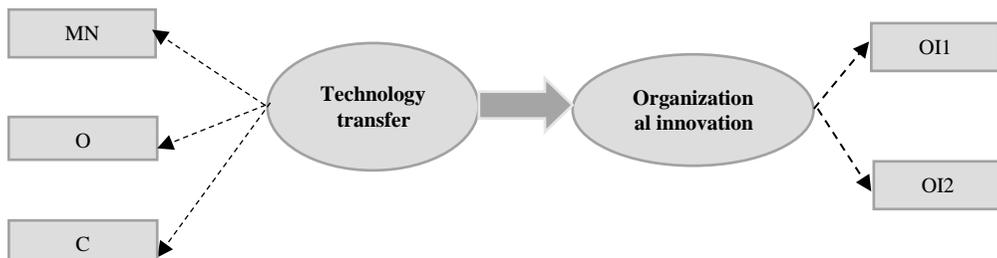
Indicator	Indicator - Variable definition
<b>Material and non-material technology transfer - MN</b>	
MN1	Technological infrastructure
MN2	Software
MN3	Patents
MN4	Licenses
MN5	Know-how
MN6	High technology qualified employees
MN7	R&D outsourcing
<b>Open sources of innovation - O</b>	
O1	Participation in societies and associations associated with technological knowledge
O2	Industry conferences
O3	Exhibitions and trade fairs
O4	Feedback from clients

O5	Feedback from employees
O6	Feedback from suppliers
<b>Coopetition for innovation - C</b>	
C1	Coopetition with private firm
C2	Coopetition with research centers

*Source: Author's own elaboration.*

The scheme of the research model of both the technology transfer and organizational innovation is presented in Figure 1.

**Figure 1.** Technology transfer and organizational innovation research model.



*Source: Based on author's own research.*

Data collection was conducted into two stages during 2016 and 2018 according to in-depth interviews, which were firstly conducted with 10 managers or owners of research enterprises. That interviews served as an priori test of the constructs with a regard to interviews and questions usefulness. In the second part, the relevant data connected to technology transfer and organizational innovation were collected. 315 were contacted and 100 respond to the questionnaire, what gave a very satisfactory respondent rate (32%). The survey adopted a variant of partial studies. The study included stratification of the population before the draw test. This ensured, that the special features included in the group of firms are represented in the sample and reflect the actual proportions of individuals with the same characteristics in the population of firms (Fowler, 1995).

#### 4. Data Analysis and the Results

As part of the study, the impact of individual forms of technology transfer (material and non-material technology transfer, open sources of innovation, cooperation for innovation) on organizational innovations in the surveyed firms were determined. The next step was to examine if the model is statistically correct, with  $p=0,00$  ( $p<0,05$ ), that means that the model is characterized by a strong statistical relationship between the variables of technology transfer and organizational innovation.

In determining the relationship between innovation and material technology transfer, it was important to determine which of the specific material technology transfer

variables have a positive impact on organizational innovation and are statistically significant, and which are not relevant in terms of organizational innovation. Table 3 presents the coefficient of regression equations between the size of the organizational innovation indicator and the statistically significant explanatory variable - forms of material technology transfer (at the level of significance  $p < 0.05$ ) and the coefficient of determination ( $R^2$ ).

**Table 3.** Coefficient of the regression equation between the organizational innovation indicator and statistically significant explanatory variables - forms of material technology transfer in the surveyed firms.

Indicator	B	Standard error (b)	t(98)	p
Free expression	0,32	0,14	3,54	0,00
Software	0,8	0,23	2,45	0,03

$R^2=0,34$ ; adjusted  $R^2=0,31$ ; Significance  $F(13,85)=4,77$ .

**Source:** Author's own elaboration.

The verified model is statistically significant and is characterized by a statistical relationship between the variables of organizational innovations and the acquisition of computer software by a surveyed firms ( $p = 0.04$ ). In determining the relationship between organizational innovation and non-material technology transfer, it was important to determine which of non-material channels have a positive impact on organizational innovation and which are statistically significant.

An insignificant free expression was obtained in the estimated model, as well as a lack of statistical significance of the model. Re-verification of the model after removing the free word also indicated the lack of statistical significance for all channels of intangible technology transfer. This means that there is no relationship between the channels of intangible technology transfer and innovation in the field of organization in the surveyed enterprises.

Also in the case of regression analysis in terms of open sources of innovation, the model is not statistically significant, which indicates the lack of relationship between open sources of innovation and innovation in the organization of the surveyed enterprises. The last step in the model was to determine the relationship between organizational innovations and cooperation for innovations, and to indicate which type of cooperation - was important from the point of view of organizational innovations. The verified model is statistically significant (Table 4) and is characterized by a statistical relationship between the variables of organizational innovation of firms and cooperation for innovation ( $p = 0.03$ ).

**Table 4.** Coefficient of the regression equation between the organizational innovation and statistically significant explanatory variables - cooperation channels form innovation.

Indicator	B	Standard error (b)	t(98)	p
Free expression	0,33	0,17	2,67	0,02

Coopetition with research centers	0,17	0,05	2,23	0,04
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$R^2=0,27$ ; *adjusted*  $R^2=0,29$ ; *Significance*  $F(1,85)=5,31$ .

*Source: Author's own elaboration.*

The verified model is statistically significant and is characterized by a statistical relationship between the variables of organizational innovations and the coopetition with the research centers by firms ( $p = 0.03$ ).

## 5. Conclusions and Recommendations

This study aims to contribute to the innovation literature by untangling the relationship among technology transfer and channels through which technology transfer occurs in enterprises. It was also important to define which technology transfer channel influence organizational innovation of the surveyed firms.

According to empirical analysis in the study, the hypothesis H1 was positively verified. Hypothesis assuming that technology transfer relate positively to organizational innovation in firms was verified statistically through the model of the impact of technology transfer on organizational innovation of firms. Model results indicate a positive impact of in the surveyed SMEs. Firms with higher activity in the field of technology transfer from external sources indicate stronger organizational innovativeness level. According to a survey not all technology transfer channel are important in implementation of organizational innovations by firms. Only few channels are statistically significant and effect organizational innovations. From material technology transfer channel the only important for organizational innovation was acquisition of software and from coopetition for the innovation only coopetition with the research units (like universities, research centers, etc.) is important in gaining the organizational innovations in firms.

Regarding its methodology, this survey is one of the first studies to examine the relationship between technology transfer and organizational innovation of firms based on individual-level data and according to the theory. From practical point of view it is important that practitioners as managers of the companies should invest more effort in innovation activity connected with software development in their companies and coopetition, maybe firstly started from cooperation with the research centers and universities for innovation, based on common innovation projects.

There is a need for future research. The most important points to future analysis are detailed technology transfer aspects and their influence on firm innovativeness and competitiveness.

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