

International activity of the innovative enterprises – experience and recommendations

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Abstract

Research background:

In the international literature we can find great examples of research in the field of innovation and technological cooperation boosting between companies. Confrontation of theory and empirical research shows that meaning of cooperation and geographical closeness for innovative activity as well as the quality and effectiveness of public support are still ambiguous. Public support of technological cooperation is connected with different components of innovative network, that shows the need of horizontal cooperation, what is legitimate in developed countries. Great example of that kind of international network is Enterprise Europe Network (EEN). Innovative cooperation and technology transfer infiltration always have been a subject of research, but still there are issues to investigate. Because of that reason, there was a research hypothesis created: international technology transfer performed among companies and other economic entities accelerates innovative processes and gives profits for both players.

Purpose of the article:

The purpose of this article is to show different aspects among cooperation and technology transfer and trial to evaluate its synergical impact on international innovative activity of companies.

Methodology/methods:

This paper illustrates theoretical and empirical research in the scope of many aspects of innovative cooperation and technology transfer. The empirical analysis focused on data from the Enterprise Europe Network in 2009-2015 and interviews with offices supporting companies in starting and performing of international technological cooperation. The presentation of spatial connections of technological cooperation was illustrated by the Gastner Newman's amorphous

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(eumorphous) choropleth, created in the ArcMap 10.4.1 programme with the use of the quantile method.

Findings:

The article discusses the role of cooperation among network in the international technology transfer. A special analytical emphasis was put on the public networks supporting such cooperation. Specific knowledge and technology is very often out of reach for companies (especially SMEs) because of costs or limited access, and cooperation provides the opportunity to create new relations which can integrate ideas and knowledge, and in effect, lead to new ground-breaking innovations. There is also the significant element like public support for companies in the whole technology transfer process.

Introduction

Conceptualization of the international activity of companies in the area of technological cooperation is one of the most important areas of research undertaken in the literature (Kuemmerle, 1999, pp. 1-24; Boutellier *et al.*, 2008, pp. 372-391, & Szarucki Knežević, 2012, pp. 392 -397). Careful observation of the behaviour of enterprises in recent years indicates a rapid increase in the number of technological cooperation agreements between both national and international parties (Narula, 2003, pp. 45-60). This trend is particularly evident in the industries where consumption patterns are more uniform in all countries, i.e. those with a high level of capital, as well as intensive knowledge in the field of investment in innovation and technology (Duysters & Narula, 2003, pp. 199-218).

Cooperation in the field of innovation does not necessarily mean that technology transfer is its main aim, but it may be a consequence of the activity undertaken. The reason for businesses to engage in the international technology transfer includes, e.g. access to knowledge and markets and, consequently, the potential size of the economy. Transfer of knowledge should also be regarded as a predictor of creating technological links of cooperation.

The last three decades have seen a significant increase in the number of cooperation agreements (Narula & Martinez-Noya, 2014 pp. 5) in terms of undertaking knowledge-based activities, such as those related to R&D, technologies and commercialization of solutions. It turns out that the growing complexity and the multidisciplinary nature of the process of innovation implies a greater need for businesses. They are trying to be flexible and adaptable to external partners in order to gain access to complementary resources, and to take advantage of more business opportunities, lower the costs, and shorten time-to-market (Duysters & de Man, 2003, pp. 49-58; Hagedoorn 1993, pp. 371-385; -Noya Martínez *et al.*, 2012, pp. 18-37). As a result, technological changes and global competition oblige companies to seek external sources of knowledge and technology through a wide variety of alliances and cooperation (Hagedoorn & Osborn, 2002, pp. 517-142). Thanks to the international technological cooperation, companies have not only found a way to a more efficient and flexible cooperation, but also gained access to the use of a variety of specialized partners located around the world (Chen, 2004, pp. 337-349; Mudambi & Graf, 2005 pp. 253-268), even from emerging countries.

Empirical research on the motivation behind the international technology transfer can be viewed in two dimensions. The first is the observation unit, namely the relation enterprise-country. The second is the geographical and spatial range. In studies of Flemish enterprises, Belderbos *et al.* (2013, pp. 1-32) show that technology transfer is carried out by companies that are struggling with limited resources. In their company level research aimed at the efficiency of technological cooperation Song & Shin (2008, pp. 291-303) and Penner-Hahn & Shaver (2005, pp. 121-140) pay attention to the element of "absorption capacity" of companies to use foreign expertise and the results of R&D. Considering the issue of technological complementarity, Chen *et al.*, (2011, pp. 121 - 148.) showed how the life cycle of technology and expertise affect the effectiveness of cooperation.

In summary, the determinants of international technology transfer can be divided into two blocks. First is the economic capacity and creativity of the enterprises engaged in the exchange of technology. The second block includes the instruments of support for innovative cooperation (Picci, 2010, pp. 1070-1081; Patel & Pavitt, 1991, pp. 141-156; Dachs & Pyka 2010, pp. 71-86; Guellec *et al.*, 2001, pp.1253-1266).

The analysis of literature does not provide a comprehensive theoretical model explaining the formation of technology transfer between countries. Moreover, as explained above, there are various motives that drive companies from one country to seek complementary technological resources outside their own country. The closest concept, which is theoretically suitable for empirical analysis of technology transfer (exploration and transmission) across borders is the gravity model. It is commonly used for the analysis of international trade between countries (De Benedictis & Tajoli, 2011, pp. 55-89). Such an approach has already been used to study the issue of internationalization of technology (Thomson, 2011; De Prato & Nepelski 2014, pp. 358-375).

Technological cooperation, especially on the international level, is associated with additional expenses for the enterprises. Hence, it is necessary to provide systemic support instruments at national and transnational levels. One of the tools for initiating, implementing and diffusion of the effects of international technology transfers is the Enterprise Europe Network (Nesterak & Gródek-Szostak, 2016, pp. 134-143). Public instruments of the systemic support of technological cooperation are linked in parallel with the various components of the innovation network, acknowledging the primacy of horizontal cooperation, which is valid in the developed countries. The problem of infiltration of the innovative cooperation and technology transfer has been taken up in the literature, but research gaps still remain. Based on the above, a research hypothesis has been defined, which is the claim that the international technology transfer implemented in the course of cooperation between enterprises and other economic entities accelerates innovation processes and contributes to achieving the benefits of two-way transfer of knowledge between organizations. The aim of the study is to analyse the multi-faceted relationship between the phenomena of cooperation and technology transfer, and their combined effect on the international activity of innovative enterprises.

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Research methodology

The publication brings the theoretical and empirical oeuvre related to cooperation and transfer of innovative technologies closer in a variety of ways. Analysed empirically were the data of the Enterprise Europe Network (2008-2015), as well as the interviews with the centres of the EEN consortium Southern Poland (Śląskie, Małopolskie, Świętokrzyskie and Podkarpackie voivodships), which support companies in the uptake and implementation of international technological cooperation.

Data visualization was made using the Newman- Gastner anamorphic cartogram, in the commercial programme ArcGIS (ESRI Inc., ArcGIS 10.4.1, 2016). The anamorphic cartogram, which in several of the sources is called amorphic or eumorphic, is a slightly different form of cartographic presentation than other cartograms, and its use is limited for quantification. This cartogram is an inverted map, i.e. it shows the scale of the phenomenon by reflecting the change in the size and shape of the reference entity (in the case of this publication - a country). This method of presentation abolishes a common approach to data visualization in the form of a map, according to which each area of the map needs to be reflected in reality. The applied anamorphosis is designed to highlight the territorial diversity of the phenomenon at the expense of the deformation of its actual borders (Boria, 2013, pp. 127-136). By applying the scale, it applies the theory of phenomena perception more than its physical reference to reality. For increased readability of the obtained results, a political map of Europe was attached to the amorphous maps, in one of the popular cartographic projections of Europe, i.e. a Lambert conformal conic projection. In the case of this study, due to the high linear data dispersion, an additional data classification was made, using quantile. This means that each class has an equal number of items, and there are no empty classes. However, in the interpretation of the resulting map, one should take into account the fact that similar data values can be placed in adjacent classes, and data with very different values in the same class. In accordance with the principle of uniformity, the content of the classes is shown in grayscale, in the 5 progressive value classes.

Technology transfer and technological cooperation

Technological cooperation is defined as the relationships between enterprises, research centres, technology transfer institutions and other institutions of the business environment sphere, aimed at improving the existing advanced technologies, and creating new ones, as well as their implementation, resulting in new products (Zakrzewska-Bielawska, 2012, pp 161-184). Collaboration (positive cooperation) is understood as the links between organizations, each of which takes into account the actions of others, and which are aimed at reaching a mutually non-contradictory objectives, and as a result, at benefiting. These links can be created at various levels,

with different degrees of stability, compactness and intensity. They can also take various forms, ranging from loose cooperation to complex concentration.

The concept of technology transfer is a term used to describe a wide range of activities. It is worth to take a closer look at the various current attempts to define its essence. Technology transfer is (Umiński, 2002, pp. 45):

- building bridges between those who create science and those who are able to apply the results of the research into practice;
- a process, during which the technology was created at some point, and is used for a particular purpose in some other place, or for the same purpose the intended, or for any other; in this case, technology can be defined as the information needed to produce and sell a product or service;
- the process by which technologies (products, processes and services) obtained using the state (federal) funds are introduced to the private sector, while the technologies developed in the private sector, to state laboratories (the definition used by ministries and government laboratories in the USA);
- the process by which technical information and products derived from government funds are transferred to potential customers in a way that supports assessment and/or practical application (the definition of the US Geological Survey, as one can see, quite seriously narrowed);
- preparing favourable conditions for the creation of intellectual property based on technology, and appropriate promotion and management thereof, for the industry to accept it (the mission of the Technology Transfer Office at the Ohio State University).

Technology transfer is considered an important mechanism to help developing countries to address the problem of the lack of capacity for social and economic development. It is defined, e.g. as a movement of the technologies needed for economic development from the country of origin to the place of application (Schmidheiny, 1992, pp. 46-50). Technology transfer may be two-way: vertical and horizontal. The vertical takes place in the enterprise, and the horizontal is characterized by passing from one sector to another country or sector (Osman-Gani, 1999, pp. 9-18). Transfer involves the implementation of a number of commercial and non-commercial transactions, such as management, technical and technological operations. It focuses on aspects including the role of educational and research institutions (Anderson, *et al.*, 1997, pp. 1-10; Garcia & Vredenburg, 2003, pp. 37-49), the interdisciplinary and interdependent nature of technology transfer, as well as the diversity and importance of the involvement of stakeholders.

In business practice, mechanisms have developed, which are typical ways to transfer technology (Firszt, 2011, pp. 196-207). They are referred to as channels of technology transfer (Tab. 1).

Table 1. Forms of technology transfer

Forms of transfer	Method of technology transfer	Type of transferred technology	Type of technology medium	Form of technology transfer
1. Direct investments foreign	Internal	Detailed, ready for practical use or requiring adaptation	People, publications, documents, innovative goods and their components	Equity
2. Joint venture	Internal	Detailed, ready for practical use or requiring adaptation	People, innovative goods and their components	Equity
3. International consulting	Mixed	Detailed, ready for practical use	People, publications, documents	Non-equity
4. Transferring license	marketplace	Detailed, ready for practical use	People, publications, documents, innovative goods and their components	Non-equity
5. Managing contract	marketplace	Detailed, ready for practical use	People	Non-equity
6. Franchising	marketplace	Detailed, ready for practical use	Detailed, ready for practical use	Non-equity
7. "Turnkey" venture	marketplace	Detailed, ready for practical use	People, publications, documents, innovative goods and their	Non-equity

			components	
8. International cooperation (alliances strategic, contractual joint venture)	Mixed	General and detailed, ready for practical use or requiring adaptation	People, publications, documents, innovative goods and their components	Non-equity
9. Trade intensive goods technologically	marketplace	Detailed, ready for practical use	People, publications, documents, innovative goods and their components	Non-equity
10. Sale of patents abroad	marketplace	Detailed, ready for practical use	Publications, documents	Non-equity

Source: (Kochel, 2012, pp. 502-519).

The most important differentiating factor of the individual forms is the different forms of technology transfer. There is the internal transfer, i.e. that, which takes place within one company, and the transfer based on the principles dictated by the market. Internal transfer includes direct foreign investment (greenfield investment) and the creation of a joint venture. The external technology transfer takes place between independent partners and can take place in the framework of the license transfer, a managing contract, a franchise agreement, or contract ("turnkey") production and subcontracting.

Public support of the international technological cooperation

The opportunity to use the public system support instruments plays an important role in managing the process of international technology transfer. One of the instruments of enterprise support in the analysed area is the Enterprise Europe Network (EEN). Initially, it was founded in order to support European small and medium-sized enterprises (SMEs) in taking advantage of the EU single market. The Enterprise Europe Network is now the instrument of support for expansion into important markets. It is predicted that in 2030 60% of world GDP (Performance Report, 2015, pp. 15-17) will be generated in emerging markets. In order to maintain competitiveness and take advantage of the growth potential, European businesses need to operate in these markets.

The Enterprise Europe Network is an initiative of the European Union aimed at providing support for business innovation in small and medium-sized enterprises (SMEs) in Europe. The Enterprise Europe Network is the world's largest network of

business and innovation support, and now consists of 625 partner organizations located in more than 60 countries. Over 4 000 experts in the field of internationalization and technology transfer practitioners offer a wide range of services supporting entrepreneurship and innovation for enterprises. Members of the Enterprise Europe Network are chambers of commerce, regional development agencies, SME organizations, research institutes, universities, technology centres and innovation centres.

The network's offer includes a number of specialized services provided in the one-stop-shop formula (Tab. 2).

Table 2. The offer of the EEN structure

No.	Service	Characteristic
1.	Business partnership.	Organization of B2B events and trade missions. The Enterprise Europe Network organizes "face to face" meetings of European small and medium-sized enterprises and local companies. These meetings are usually held during trade fair and exhibition events of national or regional coverage, or during dedicated trade missions.
2.	A virtual marketplace: generating and disseminating the proposals for partnership with the possibility of cooperation.	The Enterprise Europe Network creates and disseminates technological and economic cooperation through the promotion of tenders or requests from the Partnership Opportunities Database (POD). POD is a virtual partnership proposals market. The number of applications indicates the interest of EU companies in the partnership proposals of companies from outside the European Union.
3.	Market research: Providing information on market access	EEN provides free information on industry regulations, the standards of certification requirements and/or matters related to customs procedures.
4.	Partnership agreements: facilitating the construction of business deals or joint agreements on the transfer of research and technology	Partnership agreements regulate business transactions, technology transfer and/or research cooperation contracts, established between European companies and the companies in third countries. In most cases, these agreements lead to the growth of the company itself, and of its revenues, profits and employment.

Source: (Performance Report, 2015, pp. 5-17)

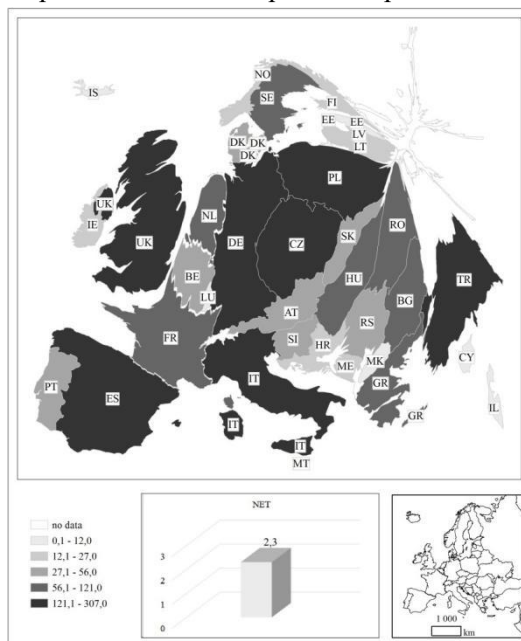
The Enterprise Europe Network runs offices in major international markets outside the EU, known as the centres of economic cooperation. In 2015, there were approx. 100

centres of cooperation between companies in 30 countries around the world (Performance Report, 2015, pp. 4). The economic cooperation centres operate in accordance with Article 7 of the Regulation COSME (2013). Their main focus is on business and technology operations, as well as research partnership.

International cooperation in the Enterprise Europe Network

Analysed was the spatial distribution of the number of contracts finalizing business and technology cooperation in the EEN in 2009-2014. The countries with comparable intensity of the contracts were grouped in reference units (regions). The spatial (geographical) context is conditioned by the entrepreneurial culture and the level of openness to taking up both business and technological cooperation. Business cooperation of international character (Figure 1) in the period analysed was intensified the countries of Central Europe, i.e. Poland, Germany, the Czech Republic, but also the United Kingdom, Spain, Italy and Turkey (the darkest colour). This is not a surprise, since apart from the undisputed position of Germany and the UK, these countries represent economies, which have been developing dynamically over the past two decades, and which are keen on the top position in the EU/European markets. A lesser activity in this field, i.e. in the range of values 56.1-121.0, was demonstrated by the countries that comprise the southern belt, and also the Netherlands and Sweden. The lowest value, i.e. 0.1-12.0, was reached by the southeastern countries, including Iceland, Estonia, Luxembourg, Macedonia, Cyprus and Israel. It should also be noted that this particular range of values coincides with the European average for the EEN (NET = 2.3).

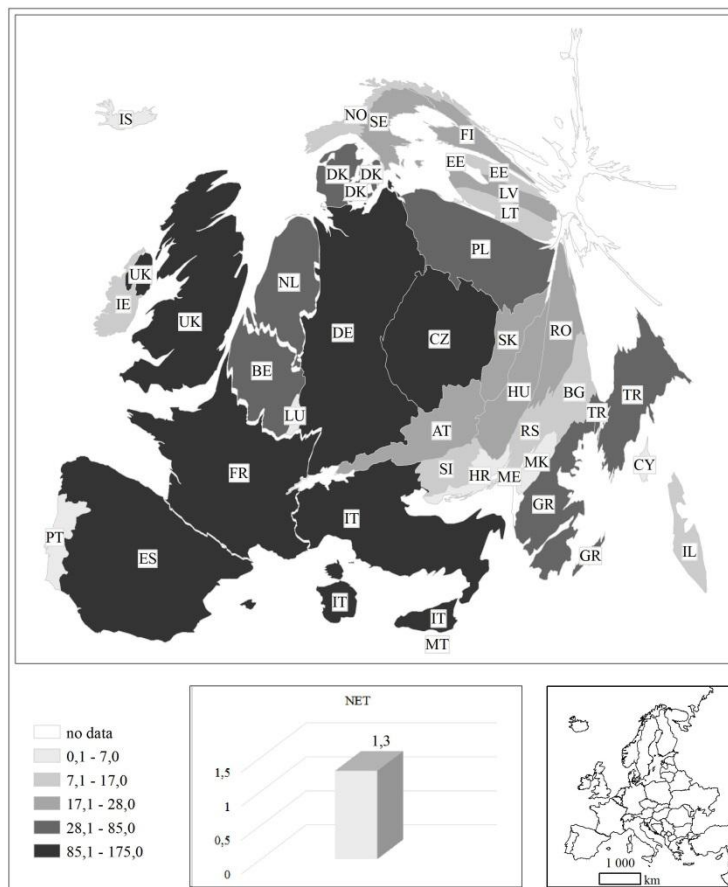
Figure 1. Business cooperation in the Enterprise Europe Network in 2009-2014



Source: own study based on (EEN, 2008-2014), (Performance Report, 2015).

On observing technological cooperation finalized in the form of an agreement (Figure 2), one should first pay attention to the distribution of data with the highest values (the darkest colour). The countries that represent them are clearly concentrated in the western part of Europe. These are: the Czech Republic, Germany, France, Italy, Spain and the United Kingdom. As the leaders of technological cooperation, these countries achieve results between 85.1 and 175. On the other hand, the mean value for the entire NET network is 1.3, in the range of the lowest values, and similar to the countries in Figure 1, relating to business collaboration, i.e. Iceland, Luxembourg, Cyprus, Croatia, Macedonia and Portugal.

Figure 2. Technological cooperation in the Enterprise Europe Network in 2009-2014



Source: own study based on (EEN, 2008-2014), (Performance Report, 2015).

In 2015, 64 agreements on business cooperation were concluded through the EEN, as well as 35 agreements on technological cooperation and 41 agreements on R&D cooperation. Compared to previous periods of operation of the network, the share of partnership agreements reached with the support of the business cooperation centres is growing steadily.

Conclusions

International networks run horizontal activities to ensure a favourable legal and institutional environment for entrepreneurship. They also take measures to strengthen the internal security of the European Union, provide information and advisory services in the field of technology transfer, and offer assistance in obtaining funds. On the other hand, for companies in the SME sector, public support in taking up international cooperation (in business and technology) is an important argument in the decision to start the cooperation.

Among the factors, which significantly influence the adoption of international cooperation one should pay attention to the problem of competition. It is increasingly emphasized that the goal of management should be to strive to deliver customer value, which is likely to be better matched through cooperation between organizations and through joint economical actions. The paper has demonstrated the multi-faceted relationship between business cooperation and technology transfer. In addition, demonstrated was their synergistic influence on the international activity of innovative enterprises. However, it appears that the weakest link in the existing relations is technology transfer. The reasons must be sought much deeper than the scope of this paper, probably in sociological relationships, which can be an interesting subject for further research in this area.

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