

Summary. The article considers the factors, which influence on the effective use of the potential of the region. The concept of the investment climate is considered. The problems of formation of investment climate and its connection with development potential is determined.

Key words: investment climate, potential development, types of potential development, factors of influence.

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WHAT PATENT DATA TELLS US ABOUT POLISH-UKRAINIAN TECHNOLOGICAL COOPERATION?

This paper aims to answer the question: what is the current state of Polish-Ukrainian technological cooperation? The article presents an overview of available patent data from 2005-2014. In conclusion, the need for stimulating Polish-Ukrainian contacts through innovation policy instruments was also emphasized.

Key words: innovation, international cooperation, patent data.

Introduction

Innovation has already ceased to be a domain of single enterprises or scientific institutions. Increasing complexity of innovation processes and radical changes in the contemporary business environment force establishing and maintaining numerous relationships with various external entities. More and more often, innovation-related inter-organizational cooperation is carried out internationally.

During the transformation in Poland, a fundamental reorientation of international economic relations could be observed. Among others, this led to a gradual weakening of ties with partners from the countries of former USSR and intensifying the economic and technological cooperation with entities from Western Europe and other highly developed countries [1, p. 63-64]. Such trend has been deepened especially after Polish accession to the European Union. This may be also the result of the increasing presence of foreign companies in Poland. For example, in recent years a number of R&D centers of international corporations have been established in Poland [2, p. 158-164].

Nevertheless, Ukraine still remains a very important economic partner of Poland. Therefore, it seems reasonable to ask: what is the current state of Polish-Ukrainian technological cooperation? This paper attempts to formulate a response to this question, based on the patent data.

1. Inter-organizational cooperation and its importance for innovation

There is no doubt that innovation-related inter-organizational cooperation can provide a number of benefits [3]:

- cost and risk sharing,
- shortening of time needed for the project,
- access to the unique resources and competencies of partners,
- release of synergy effect,
- easier access to the public grants and other external funds.

Most empirical evidence confirm a positive relationship between the involvement in inter-organizational cooperation and innovation performance [4; 5]. According to the relevant literature, innovation-related cooperation leads also to higher quality of patents (as measured by forward patent citations) [6, p. 4370].

Modern models of innovation and technology policy emphasize the importance of cooperation between science and business. According to the concept of national and regional innovation systems, universities and other research institutions are a place of knowledge creation, whereas business enterprises are responsible for transforming such knowledge into commercial effects. Research institutions employ highly qualified staff, possess unique research equipment and accumulated knowledge resources. They can also benefit from significant public support [7, p. 116].

The relevant literature indicates a number of factors determining inter-organizational cooperation. One of the most important of them is proximity. However, inter-organizational proximity should be considered not only geographically, but also in a cognitive, organizational, social and institutional context [8; 9]. In other words, the success of cooperation depends not only on the distance separating the partners but also on their mutual adjustment

2. Research design

Exploration of patent data may serve for many purposes, eg. diagnosis of the state of the art, forecasting future technology trends, seeking inspiration for further research, tracking the accomplishments of competitors, etc. [10, p. 412-413]. However, more and more often patent data is also used for diagnosis networks of inter-organizational relationships, both at regional [11] and international level [12]. For this reason, an attempt to recognize the state of the Polish-Ukrainian technological cooperation on the basis of filed patent applications was undertaken.

The undoubted advantage of the use of patent data is their availability, eg. via online databases. Patent data provides many interesting information that cannot be gathered in any other way. However, from the point of view of the subject matter of this paper, information about the applicants (owners of intellectual property rights) and their authors (inventors) was most important.

For the purposes of the analysis presented in this paper, the ESPACENET patent database was used. This database is administrated by the European Patent Office (EPO) and contains around 60 million patent documents from over 90 major patent offices around the world. Patent documents can be searched by several basic criteria [13, p. 182-184]. The Polish-language interface of the ESPACENET patent database is provided free of charge on the website of the Polish Patent Office.

The time range of the analysis covered the period 2005-2014, i.e. the last 10 years, for which the complete data about the patent applications was available. It should be noted that, in accordance with the legal rules, most patent applications are published after the expiry of 18 months from the date of filing [14].

3. Results

As a result of the search, a total of 165 patent applications were identified in the period 2005-2014. This number included not only joint Polish-Ukrainian patent applications, but also Polish patent applications co-authored by Ukrainian inventors, Ukrainian patent applications co-authored by Polish inventors, as well as applications from other countries, which were jointly developed by authors from Poland and from Ukraine (table 1).

Table 1

Polish-Ukrainian technological cooperation: patent applications by the country of origin

Description	Number of patent applications	%
Joint Polish-Ukrainian patent applications (applicants both from Poland and from Ukraine)	25	15.2
Patent applications from Poland (at least one inventor from Ukraine)	71	43.0
Patent applications from Ukraine (at least one inventor from Poland)	49	29.7
Patent applications from other countries (co-inventors from Poland and from Ukraine)	20	12.1

**Source: own work*

The number of patent applications filed in each year varied considerably, especially in the period 2005-2009 (6 applications in 2006 and as many as 34 applications in 2008). The average number of patent applications was: 15 applications per year in the period 2005-2009 and 18 applications per year in the period 2010-2014 respectively.

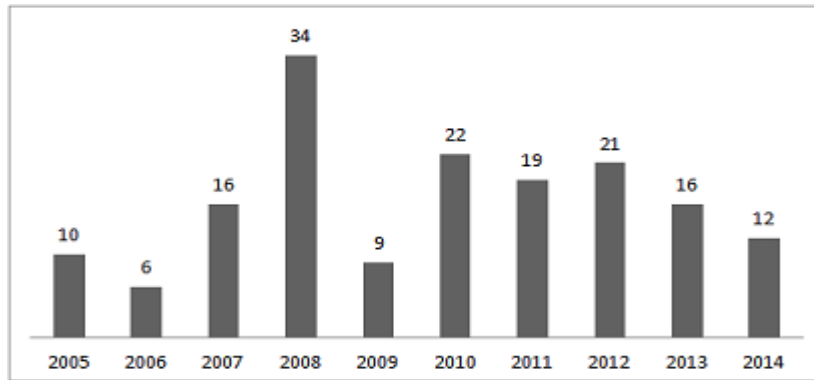


Fig. 1. Polish-Ukrainian technological cooperation: number of patent applications in 2005-2014

*Source: own work.

Although a noticeable decrease in the number of patent applications in 2013 and 2014 has been observed, however, this should not be interpreted as a symptom of a decline in technological cooperation between Poland and Ukraine. According to still incomplete data, at least 21 patent applications were filed in 2015.

The identification of the most relevant technological areas for Polish-Ukrainian cooperation was carried out on the basis of International Patent Classification (IPC). The primary purpose of the Classification is to provide an efficient system for searching patent documents by patent offices or other users (eg. patent attorneys) and thus facilitate their work (eg. to investigate the state of the art in given field of technology and to evaluate the inventive step and non-obviousness of technical disclosures in patent applications). However, the Classification may also be used for creating various industrial statistics [15]. The results of the analysis are shown below (Table 2).

Table 2

Polish-Ukrainian technological cooperation: patent applications by the main sections of International Patent Classification (IPC)

Section	Description	Number of patent applications	%
A	Human Necessities	50	30.3
B	Performing Operations; Transporting	31	18.8
C	Chemistry; Metallurgy	42	25.5
D	Textiles; Papers	-	-
E	Fixed Constructions	10	6.1
F	Mechanical Engineering; Lighting; Heating; Weapons	25	15.2
G	Physics	24	14.5
H	Electricity	19	11.5

Note: the results do not add up to 100% as for some patent applications more than one IPC section was indicated.

*Source: own work

It should also be noted that the importance of particular technological areas varied depending on the type of patent applications. For example, joint Polish-Ukrainian applications usually concerned the section A (particularly the class A61 - Medical or veterinary science; hygiene) and the section C. In turn, a significant part of patent applications from Ukraine were related to the section A (mainly to the class A01 - Agriculture; forestry; animal husbandry) and applications from Poland - to the sections B and C. On the other hand, patent applications filed by the entities from other countries most often were related to the sections G and H.

Patent applications included in the analysis were filed by around 80 different entities: universities, research institutes, enterprises and individuals. The most active of them are listed below.

Entities from Ukraine:

- National University of Life and Environmental Sciences of Ukraine in Kiev - 16 patent applications co-authored by scientists affiliated in Lublin University of Life Sciences,
- more than one application was also identified for such institutions as: Ukrainian Academy of Printing in Lviv, Ternopil Ivan Pului National Technical University, Poltava National Technical University, Admiral Makarov National University of Shipbuilding in Mykolaiv, Lviv State University of Life Safety, Lviv Polytechnic National University, Karpenko Physico-Mechanical Institute under NAS of Ukraine in Lviv, Institute of Thermoelectricity under NAS and MES of Ukraine in Chernivtsi, Institute of Macromolecular Chemistry under NAS of Ukraine in Kiev, Hromashevsky Institute of Epidemiology and Infectious Diseases in Kiev, Odessa National Medical University, Odessa Mechnikov National University.

Entities from Poland:

- Lublin University of Technology - 11 patent applications co-authored by scientists and individual inventors from Lviv, Rivne and Sevastopol,
- University of Opole - 7 joint patent applications with various Ukrainian universities and research institutions from Odessa (eg. Odessa National Medical University, Odessa Mechnikov National University, etc.),
- Anew Institute Ltd. (Cracow) - commercial R&D organization, founded by a group of aerodynamics engineers, industrial experts and businessmen from Poland and Ukraine, specializing in vertical axis wind turbine design and manufacturing - 6 patent applications co-authored by one of Ukrainian shareholders,
- BUSICO Jerzy Buslowicz (Warsaw) - small enterprise founded by an experienced construction engineer, developing innovative solutions for eco-friendly and energy efficient housing construction - 5 patent applications co-authored by Ukrainian partner from Lviv,

- more than one application was also identified for such institutions and enterprises as: Tadeusz Kosciuszko Cracow University of Technology, West Pomeranian University of Technology in Szczecin, Silesian University of Technology in Gliwice, University of Bielsko-Biala, University of Wroclaw, Institute of Physical Chemistry Polish Academy of Science in Warsaw, Henryk Niewodniczanski Institute of Nuclear Science Polish Academy of Science in Cracow, ITS Innovative Technology Solutions Zenon Wasyleczko (Katowice), Polycor Ltd. (Warsaw), Novaled Ltd. (Olawa), New Future Energy Ltd. (Nowogard)

Entities from other countries:

- Qualcomm Inc. (San Diego, California, United States of America) - international semiconductor and telecommunications equipment company - 8 patent applications developed by a team of engineers from Poland, Ukraine and the United States
- Worthington Technologies Llc - a subsidiary company of Worthington Industries (global metals manufacturing company from the United States of America) - 5 patent applications co-authored by engineers from Poland and Ukraine,
- Fyodorov Eye Microsurgery Federal State Institution in Moscow (Russian Federation) - 3 patent applications developed by a team of scientists from Russia, Ukraine, Poland and Azerbaijan.

Based to the information above, it can therefore be stated that Polish-Ukrainian technology cooperation involved mainly the entities and individuals from Kiev and Lviv (Ukraine), as well as from Lublin, Opole, Cracow, Warsaw and Upper Silesian agglomeration (Poland).

More detailed analysis of the identified patent applications has also allowed several further findings to be made. First of all, it should be emphasized that almost all Ukrainian patent applications were filed by universities or other research institutions. The only application from business sector was made by the State Enterprise "Ukrainian Research and Technology Center of Metallurgy Industry - ENERGOstal" located in Kharkov. In contrast, nearly half of Polish patent applications were filed by various business entities. This result may suggest that as far as Polish connections with Ukrainian scientists are already noticeable, there are still great opportunities to strengthen ties with Ukrainian companies.

Second, the vast majority of identified patent applications were the result of pure bilateral Polish-Ukrainian cooperation. Only in a few cases the involvement of individuals or research institutions from other countries has been recognized. The only significant exceptions were: 5 patent applications filed by National University of Life and Environmental Sciences of Ukraine in Kiev, developed by a multinational team of scientists from Ukraine, Poland, Slovakia, Lithuania and Estonia, as well as 2 patent applications filed jointly by Institute of Physical Chemistry Polish Academy of Science in

Warsaw and Claude Bernard University in Lyon (France), co-authored by inventor from Ukraine.

Third, in the case of several applications filed by Polish entities, the involvement of researchers of Ukrainian origin, but already with Polish citizenship has also been recognized. Such persons could make a significant contribution to strengthening Polish-Ukrainian cooperation. They usually maintain an extensive network of personal contacts in the Ukrainian scientific community and simultaneously they are sufficiently well situated in the Polish scientific and economic realities.

Conclusions

The considerations presented in this paper indicate that Polish-Ukrainian technological cooperation is still visible, although its scope may seem rather limited, especially in comparison with Polish relations with EU countries. However, it should be aware that Polish accession to the EU has put pressure on Polish companies and universities to strengthen ties with partners from Western Europe.

Unfortunately, a significant part of Polish business enterprises and scientific institutions do not have sufficient resources and competences to be perceived by entities from highly developed countries as an attractive partner for cooperation. Therefore, searching for cooperation opportunities with partners from such countries as Ukraine may be a reasonable solution to this problem. The combination of Ukrainian intellectual capital with resources and business contacts of Polish companies could bring more than satisfactory economic effects.

However, an urgent necessity seems to create the suitable instruments for innovation policy (eg. financial grants, assistance in finding partners, etc.) and thus to stimulate the development of Polish-Ukrainian relations.

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