

BUSINESS SUPPORT INSTITUTIONS AND INNOVATION ACTIVITIES OF THE COMPANIES IN SELECTED REGIONS OF POLAND

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Abstract

The current innovation of companies is regarded as a complex process, due to this, it is necessary for local governments to stimulate company innovation potential so purpose orientated plans have been implemented to create institutions for business support. The aim of this article is to analyse the direction and strength of these institution's impact on company innovation in peripheral regions of Poland. In order to verify this research objective, econometric probit modelling was utilised which relies on probability calculus. The examples shown below were based on a sample of 573 industrial companies from the selected peripheral voivodships of Opolskie, Warminsko-Mazurskie and Lubelskie. The results were then compared with the data from one of the most advanced regions in Poland- Wielkopolska. The main conclusions drawn apply for the following statements: 1) Support institutions achieved critical mass in a systemic stimulation of company innovation in the researched areas though the degree varies according to the institution, 2) The directions of the impact of the support organisation, while mostly positive and uniform, include unexpected divergences in the case of financial institutions, 3) more advanced voivodships receive stronger and more widespread help from support institutions.

Key words: Business support institution, innovation, innovative companies

Introduction

The current level of development in Poland means that innovations must now play a crucial role as competition through low production costs is no longer an option. In addition, over the last 20 years we have observed that the traditional factors of competitive advantage have lost their significance to the advancing globalisation processes as well as revolutions in computers and telecommunication [Audretsch, 1998]. The most economically developed countries perceive innovation as a driving force as well as a stabilisation of their advancement [Bukowski et al., 2012].

In Poland however, innovations are the only option available to catch up with the more developed nations.

Companies find it hard to implement innovations single-handedly and, from international experience, we can conclude that the most effective innovation systems are based on cooperation within the so called ‘triple helix’, between the areas of economy, science and public administration [Etzkowitz, 2002; Świadek, 2012]. Regional governments should act with clear goals in order to initiate the transfer of knowledge from scientific circles to businesses. As a result of which, the creation of institutions whose aim is to stimulate innovations in companies and support already innovative businesses have been set up. They are called by the general term, ‘business support institutions’ or ‘institutions of the modern economy’. Literature also includes such terms as, ‘business related institutions’, ‘entrepreneur support groups’ and ‘business support groups’.

Due to their specific nature and the social aspect of their creation, support institutions are an important development which fill the gap between market mechanisms and the activities of the public administration. In the market they offer services that create a specific institutional infrastructure network which enables business people to invigorate the development processes and implement planned strategies [Bąkowski, Mażewska, 2012]. In the subject literature one can find a number of vague definitions of support institutions. For the purpose of this article, the most accurate way of their presentation is enumerating the objectives of the centre’s role in economic development. Taking this into account we can divide them into [Matusiak, 2011]:

- Entrepreneurial centres – widespread promotion and incubation of entrepreneurship (often for groups discriminated against), provision of support services for small businesses and development stimulus for peripheral regions or those disadvantaged structurally;
- Innovation centres – widespread promotion and incubation of innovation entrepreneurship, technology transfer, provision of pro-innovative services, stimulation of academic entrepreneurship and cooperation between science and business;
- Para-banking financial institutions – relaxation of financial discrimination against newly set up businesses or small ones without credit history, provision of financial services adjusted to the new specific economic ventures.

The market of support institutions changes dynamically and business circles frequently witness new institutional bodies whose aim

it is to stimulate entrepreneurship and innovation. Table 1 shows the main types of business related institutions according to the categories above.

Table 1. Innovation and entrepreneurial centres in Poland

Entrepreneurial Centres	Financial Institutions	Innovation Centres
Training and Consulting Centres, Entrepreneurial Centres, Business Centres, Entrepreneurial Clubs, Consulting Points, Consulting and Advisory Centres, Pre-Incubators, Entrepreneurship Incubators	Regional and Local loan Funds, Loan Guarantee Funds, Seed Capital, Business Angels Networks	Technology Transfer Centres, Academic Entrepreneurship Incubators, Technology Incubators, e-Incubators, Technology Parks, R&D Parks, Industrial Parks, Technopoles

Source: A. Bąkowski, M. Mażewska, *Uwarunkowania rozwoju infrastruktury wsparcia w Polsce* [in:] *Ośrodki przedsiębiorczości i innowacyjności w Polsce. Raport 2012*, ed. A. Bąkowski, M. Mażewska, PARP, Warszawa, 2012.

At present it is believed that business support institutions are one of the key instruments in the systems that stimulate economic growth, which is why their presence is required in every industrial and innovation system. One may wonder how effective the influence of business related institutions on a company's innovativeness is. This refers mainly to those regions whose innovative activities in industry remains at a low level (e.g. peripheral regions) in comparison to highly developed ones. Such territories demand substantial attention connected to building a strong regional industrial system. Therefore, the aim of this article is to research the direction and strength of their impact on the innovation activities of industrial companies in peripheral regions of Poland, among others, Opolskie, Warmińsko-Mazurskie and Lubelskie Voivodships and, In order to get a clear picture of the state of innovativeness in the said regions, the results obtained from the research were compared with the data from one of the most developed regions of Poland – Wielkopolskie Voivodship. The research hypothesis of this work is the assertion that the impact strength of individual support institutions is spread unevenly on stimulation

of innovation activities, meaning that some institutions are more effective than others, despite which, their impact remains positive.

Methodological foundations of the conducted research

In order to conduct a comparative inter-regional and international analysis of the research results, it was based on the innovation attributes established according to international standards in the Oslo methodology. These standards were drawn up at the turn of the 1980s and 1990s by experts from OECD member states headed by NESTI Group (Working Party of National Experts on Science and Technology Indicators) and published in an international manual called, *Oslo Manual*.

The Oslo methodology defines innovation as the implementation of a significantly improved product (goods or services) or a process, a new marketing method or a new organisational method in industrial practice in a new workplace or business relations [OECD 2005]. The innovation does not have to be totally new it is enough for it to be new for a given company, according to the above stipulations.

The conditions for the research of innovation activities included in the *Oslo Manual* are based on the so-called 'subject method' which assumes as a starting point innovation activities and other company operations as a whole. It considers the factors which support development and hamper innovation. Such an approach comes from the fact that, at present, the factor that shapes economic results and is significant for public policy is the success of individual companies.

Up until now there have been 3 editions of the manual, each one including changes that stem from more in-depth knowledge on the innovation processes which occur in companies and their impact on the economy. The 3rd edition of the *Oslo manual* establishes the standards regarding collection and interpretation of data on innovation in the industry and services sectors.

The above measurements of innovation activity, which can be determined as setting up cooperation between industrial companies and business support institutions, can be divided into 3 groups [OECD, 2005]:

1. Expenditure on research and development investment in the so far under invested fixed assets (buildings, offices, land, machinery and technical devices) and software.
2. Implementation of new products and processes (within the activities indirectly and directly linked to production as well as the administrative activity of a company).
3. Cooperation in the area of new products and technologies with suppliers, customers and competitors as well as representatives of national and foreign research centres.

Through the survey conducted and through probit modelling it has been discovered what influence entrepreneurship support institutions have on the above mentioned attributes of innovativeness. These include technological parks, technological incubators, academic entrepreneurship incubators, technology transfer centres, business angels networks, local or regional loan funds, loan guarantee funds as well as training and consulting centres.

The research material, consisting of 573 surveys, was analysed through probability calculus. This fact comes from the limited interpretation possibilities of multiple regression. With dichotomous variables (having values 0 as no, 1 as yes), parameters of the functions may have a negative value, which makes the interpretation more difficult. Such a situation calls for a better option, which is logistic regression whose analysis and interpretation is similar to the classic regression method. However there are a number of differences which include more complex and time consuming calculations and the fact that calculating values and drawing rest-graphs often does not bring anything new to the model [Stanisz, 1997].

In its wider aspect, logistic regression is a mathematical model which can be applied in order to describe the impact of a few variables X_1, X_2, \dots, X_k on the dichotomous variable Y . While all independent variables are qualitative, the model of logistic regression is the same as a log-linear model. To describe it one can also apply probit regression [Świadek, 2011]. In models using dichotomous variables, parameter estimation is done by the method of greatest plausibility. According to this method, one looks for a parametric vector which guarantees the highest probability of obtaining the values observed in a sample [Welfe, 1998]. In order to estimate the parameters, the probability function is established and then its extremum. Operations in this case are quite complex, however the method enables us to use it to calculate many models, for example those of various parameters or those with a complex structure of delays.

The models presented in this article are of a structural nature. A + sign next to the directional coefficient of a given model signifies that in a given group of companies the probability of the occurrence of innovation activity is greater than in other groups. At this stage it must be pointed out that the fact that the lack of a model does not mean the lack of an impact of a variable on the analysed attribute of innovation. Such a situation signifies that the research companies react to the analysed factor in a variety of ways and it is hard to determine specific tendencies in their activities. The models were generated through the programme Statistica. Prior to that, the surveys for calculation were prepared in Excel spreadsheets.

Opolskie, Warminsko-Mazurskie and Lubelskie are voivodships of poorly developed industry. Taking into consideration the expenditure on innovation, it can be observed that the aforementioned regions achieved levels below the national average. In Opolskie Voivodship they stood at 191 249 PLN in 2011 (ranked 16th in Poland), in Warminsko-Mazurskie Voivodship, 256 074 PLN (14th) and in Lubelskie Voivodship 478 768 PLN (11th). A similar situation is reflected in expenditure on R&D. Industrial companies in the Opolskie region spent, in 2011, 84.2 million PLN (ranked 15th in Poland), those in Warminsko-Mazurskie region 201.1 million PLN (10th) and Lubelskie 378 million PLN (9th).

573 industrial companies took part in the survey on the innovation activities of businesses initiated by the support institutions. Below you will find their structure presented according to company size, type of ownership, level of applied technology and frequency of establishing cooperation with entrepreneurship support institutions (Table 2).

Micro and small businesses (Table 2) dominated in the 3 regions with a peripheral industrial system and altogether comprise over 70% of the researched companies. Medium sized companies stand at 22.5% with large ones at 6%.

Table 2. Structure of industrial companies in peripheral regions of Poland in 2011 according to size

No.	Company Size	Number of companies	Percentage
1.	Micro	207	36.13%
2.	Small	202	35.25%
3.	Medium-sized	129	22.51%
4.	Large	35	6.11%

Source: Own research based on conducted survey.

Polish owned companies (Table 3) dominated in the researched regions standing at 90% of companies. The number of companies with either foreign or mixed capital was similar- at about 5% each.

Table 3. The structure of industrial companies in peripheral regions of Poland according to their ownership structure (in 2011)

No.	Origins of capital	Number of companies	Percentage
1.	National	519	90.58%
2.	Foreign	29	5.06%
3.	Mixed	25	4.36%

Source: Own research based on conducted survey.

Industry in the researched regions is mainly based on traditional branches (Table 4) which is proven by the fact that nearly 60% of companies conduct their business on a low technological level. $\frac{1}{4}$ of the researched companies belong to the medium or low technologically advanced sector, whereas only 10% are medium-high and less than 5% of companies are highly technologically advanced.

Table 4. The structure of industrial companies in peripheral regions of Poland (in 2011) according to applied technologies

No.	Level of Technology	Number of Companies	Percentage
1.	High	28	4.89%
2.	Medium-High	61	10.65%
3.	Medium-Low	144	25.13%
4.	Low	340	59.33%

Source: Own research based on conducted survey.

As for cooperation with business support institutions (Table 5), the total percentage does not equal 100 as not all companies surveyed availed of such institution's services. Moreover, it is also possible to begin cooperation with a few institutions simultaneously.

The highest number of companies in peripheral regions avail of the services of various types of training and consulting centres and their share of the research sample stood at almost 30%. One can also observe a substantial interest in financing institutions with local and regional loan funds making it possible to obtain capital for almost 20% of researched companies and the loan guarantee funds granted guarantees for 14% of companies. In the voivodships covered, there is also noticeable interest in cooperation with technology parks (10% of companies) and technology

transfer centres (5%) while the participation of the remaining business support institutions is marginal.

Table 5. The structure of industrial companies in peripheral regions of Poland according to their cooperation with business support institutions (in 2011)

No.	Support Institution	Number of Companies	Percentage
1.	Technology Parks	54	9.42%
2.	Technology Incubators	15	2.62%
3.	Academic Entrepreneurship Incubators	14	2.44%
4.	Technology Transfer Centres	29	5.06%
5.	Business Angels Networks	10	1.75%
6.	Local and Regional Loan Funds	112	19.55%
7.	Loan Guarantee Funds	78	13.61%
8.	Training and Consulting Centres	166	28.97%

Source: Own research based on conducted survey.

Analysis of the impact of business support institutions on the implementation of new solutions in industrial companies in the peripheral regions of Poland

Analysing the activities of business support institutions in the peripheral regions (Table 6) one may notice the strong positive impact of technology parks and training and consulting centres on initiating innovation in industry. Technology parks contributed to the search for new solutions as shown by the growing expenditure on R&D. Moreover, such companies also invested in fixed assets and software as well as introducing new products and technological processes. These were linked not only to direct manufacturing but were also of a production related and administrative nature. A similar situation occurred in the case of training and consulting centres, the only exception being investment in machinery, offices and land, which did not show any patterns.

Technology transfer centres contribute to a lesser extent to the improvement of innovativeness in peripheral regions. For this support centre, 4 statistically significant models (out of 10 possible) have been generated.

The centres also contribute to the running of R&D operations, increasing the range of companies through the introduction of new products and the application of new technological processes, in general and directly linked to production (e.g. logistics).

It is worth pointing out that in the companies surveyed, technological incubators enhance the likelihood of conducting R&D operations and the implementation of new production related technologies, whereas academic entrepreneurship incubators encourage the purchase of new computer software.

While technology parks, technology transfer centres and training and consulting centres reinforce the potential of peripheral regions in the area of initiating innovations and entrepreneurship, in the case of financial institutions, the regions face a shortfall related to the difficulties in obtaining capital to implement new solutions. Out of three financing institutions: business angel networks, local and regional loan funds and loan guarantee funds, only the latter generally encourages the implementation of new technological processes in general and manufacturing methods. In the case of new software, for loan funds and loan guarantee funds, models of a negative directional coefficient were generated, therefore the probability of purchasing new software is greater in companies not cooperating with these two institutions. In addition, no model was generated for the business angels networks, which highlights the problem of securing high risk capital for highly innovative projects.

When observing the impact of support institutions in regions such as Wielkopolskie Voivodship (Table 7), one notices the greater influence on stimulating innovation than in peripheral regions. The impact of technology parks and training and consulting centres is similar regardless of industrial advancement. Significant divergences can be observed in the case of technology transfer centres as in Wielkopolskie Voivodship they are much more effective - out of ten possible statistically significant models eight were generated. Apart from initiating more innovations than in peripheral regions, there is a greater probability of investment in new fixed assets (general as well as machinery), software and support systems.

Table 6. Probit modelling with independent variable ‘business support institutions’ in statistically significant models describing innovation in industry and innovation cooperation in the peripheral regions

Support Institutions Innovation Attributes	Technology Parks	Technology Incubators	Academic Entrepreneurship Incubators	Technology Transfer Centres	Business Angels Networks	Local and Regional Loan Guarantee Funds	Loan Guarantee Funds	Training and Consulting Centres
Expenditure on R&D	+0.7x-0.5	+0.7x-0.4		+0.8x-0.4				+0.3x+0.5
Investment in the so far under invested fixed assets including:	+0.7x+0.7							+0.4x+0.6
a) buildings, offices and land	+0.4x-0.8							
b) machinery and technical devices	+0.7x+0.4							+0.4x+0.3
Software	+0.5x+0.1		+0.9x+0.2			-0.4x+0.2	-0.4x+0.2	+0.3x+0.1
Implementation of new products	+0.7x+0.6			+0.9x+0.6				+0.5x+0.5
Implementation of new technological processes, including	+1.0+0.6			+0.9x+0.6			+0.4x+0.6	+0.6x+0.5
a) manufacturing methods	+0.4x-0.1						+0.5x-0.1	+0.3x-0.1
b) production-related systems	+0.7x-0.5	+1.1x-0.5		+0.7x-0.5				+0.3x-0.5
c) support systems	+0.5x-0.9							+0.6x-1.0
Cooperation with suppliers	+0.7x-0.7		+0.8x-0.6					
Cooperation with competitors							+0.6x-1.9	
Cooperation with Polish Academy of Sciences departments			+1.3x-2.4					
Cooperation with universities	+0.5x-1.6							
Cooperation with national R&D centres	+0.8x-1.3			+0.8x-1.3	+1.0x-1.3			+0.4x-1.4
Cooperation with foreign R&D centres								

Support Institutions	Technology Parks	Technology Incubators	Academic Entrepreneurship Incubators	Technology Transfer Centres	Business Angels Networks	Local and Regional Loan Guarantee Funds	Loan Guarantee Funds	Training and Consulting Centres
Cooperation with clients								
General innovation cooperation	+0.6x-0.1		+0.7x-0.1					+0.3x-0.2

Source: Own research based on conducted survey.

Table 7. Probit modeling with independent variable ‘business support institutions’ in statistically significant models describing innovation in industry and innovation cooperation in the Wielkopolska Voivodship.

Support Institutions	Technology Parks	Technology Incubators	Academic Entrepreneurship Incubators	Technology Transfer Centres	Business Angels Networks	Local and Regional Loan Guarantee Funds	Loan Guarantee Funds	Training and Consulting Centres
Expenditure on R&D	+0.9x-0.5		+0.6x-0.4	+0.9x-0.4		-0.3x-0.3		+0.5x-0.5
Investment in the so far under invested fixed assets including:	+0.8x+0.6			+0.4x+0.6			+0.3x+0.6	+0.5x+0.5
a) buildings, offices, land	+0.4x-0.8							
b) machinery and technical devices	+0.5x+0.3	+0.6x+0.3		+0.6x+0.4			+0.3x+0.3	+0.5x+0.3
Software	+0.4x+0.1			+0.4x+0.1				+0.5x+0.0
Implementation of new products	+0.6x+0.3			+0.4x+0.4				+0.3x+0.3
Implementation of new technological processes, including:	+0.8x+0.6	+0.9x+0.6		+0.7x+0.3			+0.6x+0.6	+0.6x+0.5
a) manufacturing methods	+0.5x-0.1							+0.4x-0.2
b) production-related systems	+0.5x-0.5	+0.6x-0.5		+0.6x-0.5			+0.3x-0.5	+0.3x-0.5
c) support systems	+0.4x-0.8		+1.1x-0.8	+0.4x-0.8				+0.3x-0.9

Support Institutions Innovation Attributes	Technology Parks	Technology Incubators	Academic Entrepreneurship Incubators	Technology Transfer Centres	Business Angels Networks	Local and Regional Loan Guarantee Funds	Loan Guarantee Funds	Training and Consulting Centres
Cooperation with suppliers				+0.4x-0.8				+0.2x-0.8
Cooperation with competitors				+0.5x-1.8	+0.9x-1.7			
Cooperation with Polish Academy of Sciences departments		+1.9x-3.0		+1.1x-2.8				
Cooperation with universities	+0.9x-1.9		+1.5x-1.7	+0.5x-1.8		-0.7x-1.7	-0.8x-1.7	+0.6x-2.1
Cooperation with national R&D centres	+0.8x-1.5	+0.8x-1.4		+1.0-1.5				+0.5x-1.6
Cooperation with foreign R&D centres	+0.6x-2.1			+0.5x-2.1				
Cooperation with clients								+0.3x-1.0
General innovation cooperation	+0.6x-0.3		+0.8x-0.3	+0.8x-0.3		-0.3x-0.2		+0.4x-0.4

Source: Own research based on conducted survey.

Technology incubators encourage investment in machinery and implementation of new technologies, in general and in production related systems. Establishing cooperation between academic incubators of entrepreneurship boosts the probability of R&D operations and the introduction of new processes in support systems.

In the case of financing institutions, there is a similar shortfall in the peripheral regions though slightly smaller. Loan guarantee funds encourage investment in fixed assets (general and machinery) as well as new technological processes (general and production related). However securing capital from loan funds decreases the likelihood of expenditure on R&D which may be linked to a slowdown in the economy and to the fact that companies look to the fund for short term liquidity not for conducting research. In Wielkopolskie region there is a negative aspect connected to the lack of operations (or very limited) of business angel networks.

While analysing innovation cooperation in the peripheral regions, there is only a slight influence of support institutions (Table 6). The most prolific cooperation, in the areas of new products and technologies, is established under the influence of technology parks and academic entrepreneurship incubators, however, for technology parks only 4 out of 8 possible statistically significant models were generated, for academic entrepreneurship incubators 3 out of a possible 8. Both parks and incubators encourage innovation cooperation in general and along with their suppliers. Transfer of knowledge from scientific circles, aided by parks, occurs as a result of cooperation with universities, national research departments and, in cooperation with incubators, with departments of the Polish Academy of Sciences.

Training and consulting centres encourage innovation cooperation in general and with the national departments of research and development. This cooperation is also stimulated by technology transfer centres and business angel networks. The probability of establishing cooperation with competitors increases under the influence of loan guarantee funds.

The frequency of establishing cooperation inspired by the support institution in both the peripheral regions and Wielkopolskie (Table 6 and 7), seems to show that these institutions are more effective in developed areas. In Wielkopolskie Voivodship, technology transfer centres are most effective at contributing to cooperation in all the researched institutions apart from with their clients. Training and consulting centres seem to also be quite effective at establishing general innovative cooperation and with national R&D centres (as is also the case in peripheral regions), universities and along the supply chain, meaning with suppliers and clients. Technology parks, apart from their contribution to the transfer of knowledge from universities to national research departments, as is also the case in peripheral regions, increase the possibility of establishing cooperation with foreign R&D centres. Academic entrepreneurship incubators encourage cooperation with universities in general, while technology incubators (for which in peripheral regions no model has been generated) encourage cooperation with the Polish Academy of Sciences and national R&D centres.

Among financing institutions only business angels encourage cooperation with competitors. In the case of local and regional loan funds and loan guarantee funds, models with a negative directional coefficient were generated, which means that, under the influence of these two institutions, there is little probability of establishing cooperation with universities, and in the case of loan funds, innovation cooperation in general.

Summary

The Opolskie, Warminsko-Mazurskie and Lubelskie regions have underdeveloped industrial systems. However while analysing the influence of support institutions on the innovation activities of industrial companies and, comparing it with the developed region of Wielkopolskie, one can see phenomena that may lead to the conclusion that industrial systems in these areas are growing stronger.

Technology parks and training and consulting centres achieved their critical mass in activating innovativeness in both the peripheral regions and Wielkopolskie. Moreover, the developed region can boast a high effectiveness in initiating innovation thanks to technology transfer centres. In peripheral regions it is lower, however one may assume that this is a delay resulting from the weaker development of these voivodships and that, in future, along with the development of the region the influence of technology transfer centres on a company's innovativeness will increase.

Support institutions have a mainly positive influence on stimulating innovation. There are however unexpected divergences linked to the financing of new solution implementation. In both the peripheral regions and Wielkopolska one can observe the positive impact of loan guarantee funds and local and regional loan funds on the activity and innovation cooperation as well as its lack of impact. In developed regions this refers to cooperation and R&D while in peripheral regions it refers to investment in new software. In the peripheral regions business angels networks hardly operate which most likely stems from weak demand as high-risk investments are strongly dependant on the state of the local economy.

In both the peripheral regions and the developed one, one can see a stimulating influence of support institutions on conducting R&D activities. This is undoubtedly positive as there is a high probability that the created innovations will not be mere copies of new solutions from abroad but will bring about the creation of their own new ideas.

Peripheral regions are characterised by a much lower tendency to cooperate than the developed region. In each of these regions knowledge is transferred from scientific circles, but in regions of underdeveloped industrial system it only comes from within Poland while in Wielkopolskie Voivodship also from abroad. In peripheral regions business people are very unwilling to cooperate with each other. Two cases registered a stimulation of cooperation with suppliers and one with competitors. The situation is slightly improved in Wielkopolska, however the level of cooperation stimulation is still not satisfactory. This tendency is worrying, as in order

to create a strong industrial system only transfer of knowledge from scientific circles to business is not enough. Cooperation between businesses themselves is also a vital element.

Business support institutions in Wielkopolska encourage innovation more vigorously and is more widespread than in the peripheral regions. This particularly relates to cooperation on new solutions. Therefore a request to the local government of the peripheral regions should be put forward to focus their policies on the encouragement of innovation cooperation. Taking the above conclusions into consideration, one can claim that the research hypothesis has been partly confirmed. There is however an uneven, though still mainly positive, impact of support institutions on innovation encouragement. Only financing institutions registered slight divergences.

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