

HORIZONTAL SPATIAL PROXIMITY AND INNOVATION ACTIVITY IN POLISH REGIONS

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Abstract: Spatial proximity with competitive enterprises is a factor influencing the acceleration of the technological progress in industrial systems in the most developed countries, but is it like that also in Poland? The main aim of the conducted studies was the evaluation of influence the localization the competitor, in context other countries' experiences, on the innovation activity of the selected regional industrial systems in Poland. Surveys were conducted in the years of 2007-12 on a group of 2 434 industrial companies in four diverse provinces located in different parts of the Poland - Masovian, Greater Poland, Silesian and Swietokrzyskie. The methodical side of analyses was based on the theory of probability – the probit modelling. The obtained results of the analyses indicate that both the location and the current level of the economic development of the analysed provinces do not influence the diversity of the innovation activity of the regional industrial systems. Therefore, the discussed regularities in Poland have the system nature. The challenge to creating cluster structures and facilitate their development in Poland in the horizontal (system) approach, taking into account the obtained results of studies, will be extremely difficult to achieve. The knowledge deficit and low own abilities create areas of local system technological gaps. The regional level in any case did not show significant statistical co-dependencies, what proves that this level of aggregation currently remains neutral for the implementation of the innovation activity. The obtained research results indicated a different effect of the spatial proximity of competitors in Polish regions on the innovation activity of the industrial systems compared to the most developed countries.

Key words: innovation, competitor, system, region, industry.

Introduction

Sources of the companies' advantage within the cluster and the degree of their concentration are dependent on balance between the competition and cooperation. There is no contradiction between cooperation and competition. Cooperation between companies may help increase their innovation level, in order to achieve or maintain their comparative advantage. For this reason, the benefits from cooperation may outweigh the negative effects associated with the "curvature" of competition and diseconomy of the scale (Raco, 1993).

Research works of M. Dodgson and S. Hinze on the increase of importance of the horizontal cooperation and developed by them set of indicators suggest that the understanding of the nature and importance of competition and the spatial proximity for the labour division in innovations, and the quality and effectiveness of the regional innovation systems are still unclear (Dodgson and Hinze, 1999).

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The innovation and cluster policies are connected in parallel with different components of the regional network of innovation, they favour the horizontal linkages, to stabilise the system habits, what is reasonable in highly developed countries. Interactions shaping the innovation habits occur in the “catching up” type of countries, however more in the vertical than horizontal systems. The latter are naturally an incidental phenomenon. Unlike in countries characterised by a large, calculated for a few decades, technological gap. Thus, it is not a system anomaly, but a typical backwardness in the development of institutional mechanisms, which require time (Morgan, 1997).

The relatively high degree of concentration of cooperative compounds for the vertically unrelated companies in the same region means the relatively high role, which is for the innovation activity played by the geography economy. This is consistent with the results of many analyses showing that the innovation activity in a given technological field aims at the high concentration in space (Feldman, 1994).

M.E. Porter in the part of his studies on the competitive advantage noted that many states in the USA and regions in Europe have oriented their policies towards the promotion of cooperation between enterprises (Doeringer and Terkla, 1995). The approach of local authorities involving the preference of the support for horizontal cooperation networks at the expense of the vertical ones is not clear in the foreign literature, not to say incorrect, and inclining towards the advantage of the specific solutions should have strong fixation in the studies conducted in particular countries, taking into account their specificity.

Trust strengthens mutual benefits resulting from the relations between companies. This confirms the thesis that it can be stronger in geographically concentrated networks than in case of the distributed relationships (Belussi, 1996). The consequence is that the increasing importance of tacit knowledge to achieve and maintain competitiveness proximity is more important, because it is realized through interpersonal, face-to-face contacts and the development of personal relations based on trust that tacit knowledge can be more readily shared (Uyarra, 2008).

The horizontal local networks should at the same time have essential links with the “outside world” in order to absorb knowledge generated outside the region to boost its innovation activity. Concentration to a greater or lesser extent on local connections may influence the worsening of the competitive position of companies (Fritsch, 2001).

Empirical analyses of the relations between the habit of cooperation and the quality of the innovation system in the regional perspective do not lead to the clear conclusion that the focus on cooperation in the region determines the innovation activity (Fritsch and Franke, 2000). Research conducted by M. Fritsch in the regions of Vienna and Slovenia showed that “cooperation is positive for innovation”, but this hypothesis is too harsh to confront it with reality.

There is a further need for studies, which will test the empirical ideas and will complement and develop the theoretical constructions of such concepts like “the learning region”, “innovation environment” and “industrial districts”. Especially interesting in these cases seem the countries undergoing the transformation of the economy, where there was brought the destruction of many of the previously help cooperative compounds (networks of connections) and indicated the inadequacy of popular assumptions, concepts and boundary conditions of the economic development in the developed countries, what puts into question the meaning of the direct transfer and application of new solutions to the ground of a country like Poland (Albach, 1994).

Based on the presented theoretical solutions there was formed a hypothesis that the phenomenon of competition in the regional dimension contributes to the acceleration of innovation processes in Polish provinces.

The main objective of the conducted studies was the evaluation of influence the localization the competitor, in context other countries’ experiences, on the innovation activity of the selected regional industrial systems in Poland.

Surveys were conducted in the years of 2007-11 on a group of 2 434 (the number of filled in questionnaires) industrial companies in four selected, diverse provinces located in different parts of the country – Masovian, Greater Poland, Silesian and Swietokrzyskie.

Methodology – probit modelling in innovation studies

The methodical side of analyses was based on the theory of probability – probit modelling. When a dependent variable takes dichotomous values, the possibilities of using the popular multiple regression, widely used for quantitative phenomena, are limited. The problem can be solved by an alternative solution – the logistic regression (Frenkel, 2000). Its advantage is that an analysis and interpretation of results are similar to the classical regression method; hence the methods of selecting variables and testing the hypotheses have a similar pattern. There are, however, also differences, which include: more complex and time-consuming calculations and production of the residual plots usually do not contribute significantly to the model (Stanisz, 2007). In a model where the dependent variable can equal either 0 or 1, the expected value of the dependent variable may be interpreted as a conditional probability of an event at given independent values.

The forerunners in using the logistic curve were P.F. Verhulst and R.F. Pearl. A full model was not used, however, until 1994 and 1953 by J. Berkson (Berkson, 1990).

In the methods with a dichotomous variable, the parameters are estimated according to the maximum likelihood (ML) method. According to its rules, a vector of parameters is searched for which gives the highest probability of arriving at the values observed in the sample (Welfe, 1998). Generally, the application of the ML method requires formulation of a likelihood function and finding its extreme value, which can be done in two ways: analytical and

numerical. Despite its complex procedure, the ML method has gained popularity since it can be applied to a wide array of models, including models with variable parameters, complex delay structure models, heteroscedastic models, and nonlinear models. The features of the ML method, even for small samples, are in many cases much better than other alternative estimators.

The presentation and interpretation of the models was limited to their structural form. The tables included only the models, including the parameters, satisfying the condition of the statistical significance. All models were verified by some statistical test: t-students (independent variable), chi-square (model) and significant probability (model). The positive sign occurring by the main parameter indicates that the probability of the occurrence of the given phenomena is statistically significantly higher in the given group of companies than in the rest group of all subjects. The negative sign can be interpreted as the opposite phenomenon. Probit modelling is an increasingly popular tool to examine economic phenomena, and the results obtained this way constitute only a selected fragment of the effects of studies conducted by the author in this area in all provinces in the country.

Results and discussion

The Swietokrzyskie province

Given the frequency of the occurrence of models with statistically significant parameters in the Świętokrzyskie province, it can be stated that the distance from the nearest competitor quite often determines different areas of the technological activity in the region.

Table 1. The form of probit with the independent variable “distance from the competitor”, in models describing the innovation of the industry in the Swietokrzyskie province

Innovation attribute	Location of the nearest competitor	
	locally	in the country
Expenditures for the B+R activity	-0.39x-0.33	-
Investments in the previously not used fixed assets	-	+0.65x+0.69
Computer software	-0.43x+0.65	+0.51x+0.33
Implementation of new technological processes (including):	-0.43x+0.65	-
a) by-production systems	-0.42x-0.32	+0.37x-0.58
Cooperation with competitors	-	+0.68x-2.01
Cooperation with universities	-	+1.31x-2.44
Innovation cooperation in total	-	+0.42x-0.53

* $p < 0.05$

If the competing subject is in the immediate vicinity (locally) then industrial companies less often show the tendency to implement innovation processes. This results from the problem of the system isolation of companies and the low level of their original innovation abilities – resulting in total from the low maturity of the

market mechanisms. The observed phenomena concern several planes of the innovation activity (four models with statistically significant parameters). The discussed problems do not occur in a group of subjects, for which the competitor is located outside the region, but not outside the borders of the country. Unfortunately, there are not many units like that in the region (28.5%), nonetheless, they prove the necessity to maintain close contacts with subjects operating on the market, at least domestic, which actuates the flow of knowledge and gives access to its latest aspects, despite the need to overcome the distance barrier.

The Masovian province

Analysing the influence of spatial aspects on the innovation of companies it is worth to mention at the beginning that also in this case the geography plays a significant importance for the shape of innovation processes in the region. Given the frequency of the model occurrence with statistically important parameters it can be stated that the distance from the nearest competitor determines different areas of the technological activity.

Table 2. The form of probit with the independent variable “distance from the competitor”, in models describing the innovation of the industry in the Masovian province

Innovation attribute	Location of the nearest competitor	
	locally	in the country
Expenditures for the B+R activity	-0.54x-0.15	+0.50x-0.50
Computer software	-0.37x+0.46	+0.30x+0.23
Implementation of new products	-0.30x+0.52	+0.31x+0.31
Implementation of new technological processes (including):	-0.42x+0.65	+0.32x+0.39
a) manufacturing methods	-0.24x-0.05	-
b) by-production systems	-0.42x-0.32	+0.37x-0.58
c) support systems	-0.31x-0.73	-
Cooperation with PAN units	-0.71x-1.76	-
Cooperation with national JBR	-0.37x-1.24	-
Cooperation with foreign JBR	-0.85x-1.86	+0.70x-2.34
Cooperation with recipients	-0.33x-0.67	+0.34x-0.89
Innovation cooperation in total	-0.30x-0.05	+0.32x-0.26

* $p < 0.05$

If the competing entity is in the immediate vicinity, also locally, then industrial companies are less often characterized by the tendency to implement innovation processes. Although the presented case belongs to the group of the most developed provinces in Poland, we observe analogous dependencies regarding the Świętokrzyskie province connected with the system insulation of companies and the low level of their original innovation capacities. The observed mechanisms apply to all planes of the innovation activity (twelve models with statistically significant parameters), what proves that in the developed province the identified geographical dependencies occur even stronger. The reason for this is the strong

link between the regions with the domestic industry. Therefore, the distance from a competitor is limited to this level. The discussed problems do not occur, as before, in the group of companies, for which the competitor is located outside the region, but not outside the borders of the country. Such entities are also a few in the region (23.4%), nonetheless, they prove the sufficient national aggregation to maintain the high dynamics of the knowledge flow, giving access to the latest technology, despite the imperative of the geographical barrier.

The Greater Poland province

In case of relations of the studies entities with competitive companies in the Greater Poland province there can be noticed two general conclusions. Distances from the competitor often influence the shaping of the innovation activity in the region. When the competitor is located further away – not locally, then the innovation activity of the industry in the Greater Poland province is higher. In this case the national level is critical – twelve models with positive signs by the statistically significant parameters. At the same time the foreign location of the competitor also has a positive influence in this region the shaping of the innovation activity of the analyzed companies. Differently than it was previously considered in two cases.

Table 3. The form of probit with the independent variable “distance from the competitor”, in models describing the innovation of the industry in the Greater Poland province

Innovation attribute	Location of the nearest competitor		
	locally	in the country	abroad
Expenditures for the B+R activity	-0.44x-0.23	+0.53x-0.50	+0.46x-0.38
Investments in the previously not used (including):	-	+0.24x+0.59	-
a) in buildings, premises and lands	-	-	+0.57x-0.73
b) in machines and technical devices	-	+0.21x+0.34	-
Computer software	-0.20x+0.22	+0.21x+0.11	-
Implementation of new products	-0.24x+0.46	+0.33x+0.30	+0.65x+0.36
Implementation of new technological processes (including):	-0.40x+0.80	+0.32x+0.58	-
a) manufacturing methods	-	+0.21x-0.15	-
b) by-production systems	-0.45x-0.29	-	-
c) support systems	-0.36x-0.62	+0.37x-0.83	-
Cooperation with suppliers	-	-	+0.50x-0.74
Cooperation with PAN units	-	+0.89x-2.98	-
Cooperation with universities	-0.48x-1.65	+0.80x-2.08	-
Cooperation with national JBR	-0.84x-1.22	+0.66x-1.62	-
Cooperation with foreign JBR	-	-	+1.11x-2.12
Cooperation with recipients	-0.21x-0.84	-	+0.61x-0.93
Innovation cooperation in total	-0.29x-0.17	+0.29x-0.34	+0.69x-0.29

* $p < 0.05$

The short distance from the competitor (local) does not contribute to the acceleration of progress, quite the opposite. The opposite situation takes place for contacts in the country and abroad. This probably results from the fact of weakness of the inner industrial system characterised by high deficit of knowledge and resistance in its flow. This does not change the fact that even the regional level does not favour the implementation of the innovation activity. This dismisses the chances for the possibility to create clusters in the horizontal dimension. The presence of models for the international distance to competitors result due to the localization of this region in the Western Poland and its closeness to the countries of Western Europe.

The Silesian province

In the last considered province the distance from the nearest competitor also significantly determines the innovation activity within its borders. Just as before, also this time, the further the competitor is located from the studied company, the formation or implementation of new solutions takes place more often. The critical point is the boundary between the local territory and the others (including the region).

Table 4. The form of probit with the independent variable “distance from the competitor”, in models describing the innovation of the industry in the Silesian province

Innovation attribute	Location of the nearest competitor		
	locally	in the country	abroad
Expenditures for the B+R activity	-0.56x+0.06	+0.57x-0.28	+0.51x-0.16
Investments in the previously not used (including):	-0.26x+0.99	+0.32x+0.81	-
a) in machines and technical devices	-0.25x+0.77	-	-
Computer software	-	-	+0.92x+0.63
Implementation of new technological processes (including):	-0.29x+0.90	+0.36x+0.71	-
a) manufacturing methods	-0.28x+0.23	+0.38x-0.04	-
b) by-production systems	-	+0.36x-0.49	-
c) support systems	-0.41x-0.34	-	+0.47x-0.50
Cooperation with PAN units	-0.76x-1.87	-	+0.97x-2.14
Cooperation with universities	-0.56x-1.38	-	+1.02x-1.63
Cooperation with national JBR	-0.31x-1.02	+0.31x-1.21	-
Cooperation with recipients	-0.25x-0.58	-	+0.74x-0.71
Innovation cooperation in total	-0.21x+0.10	+0.30x-0.05	+0.60x-0.00

* $p < 0.05$

In other words, the unfavourable location is narrowed down to the nearest one, what means that the represented technological level and competition in the local grasp are weaker and do not favour the stimulation of the development of new products and technologies. Since the increase in the distance constitutes in the literature the limitation for the implementation of innovation processes, then the

opposite results obtained in the study prove that the local dimension of competition is not sufficient to stimulate the innovation in the region. This, in turn, suggests the need to overcome the geographical barrier for the improvement of technological parameters of the offered products. While what is positive is the argument that the discussed difficulties have only the local nature. The presence of models for the international distance to competitors result due to the strong connections of this region with FDI's and export-oriented production.

Geography actively and strongly influences the involvement of the industry in the region into the innovation activity. The present economic potential of the province, similarly as in other considered cases, over the years from the perspective of horizontal section relations did not create the strong industrial system being able to compete on the external market (the lack of the element supporting the self-development), although in this case there can be observed symptoms of the improving situation.

Summary

The aim of the conducted studies was the identification of the influence of the location of the nearest competitor on the innovation behaviours of companies in the selected regional industrial systems in Poland. For the analysis there were adopted four diverse in terms of location and economic level regions in the country – Masovian, Greater Poland, Silesian and Swietokrzyskie provinces.

Research conducted in the most developed countries show that the geographical proximity influences the acceleration of the technological progress and transfer of technologies between the companies. The spatial close-up in high-tech industries constitutes a significant support point for innovation systems located in such countries. However, in Poland we are dealing with the permanent and inherent lack of knowledge on the regional level, hence it is difficult to create innovation clusters self-sustaining development. On this basis there was created the scientific doubt whether we are dealing with similar mechanisms in the country classified as the group of “catching up” type of countries?

The obtained results of the analyses, based on the theory of probability, indicate that both the location and the current level of the economic development of the analysed provinces do not influence the diversity of the innovation activity of the regional industrial systems. Therefore, the discussed regularities in Poland have the system nature and are common for all provinces in the country, It's worth to mention, that similar researches were provided by author for others regions, too (Świadek, 2011).

Creating clusters in the horizontal (system) approach in Poland, taking into account the obtained results of studies, will be extremely difficult to achieve. The knowledge deficit and low own abilities create areas of local system technological gaps. The regional level in any case did not show significant statistical co-dependencies, what proves that this level of aggregation currently remains neutral for the implementation of the innovation activity. The geographical proximity in

this grasp remains the factor stimulating innovation attitudes, but in highly developed countries, which do not include Poland. Perhaps at this stage of development more significant for the national companies is the technological proximity independent of the distance or the opposite proportional to it, i.e., the greater the distance from the nearest competitor, the greater the occurrence of the technological closeness, resulting in the acceleration of innovation processes in the domestic companies. Because only the national location or the international one of the nearest competitor determines the transfer of technology.

Although, international literature favours spatial proximity (near distance), in well-developed countries, for intensive innovation activity, it seems that new channels of modern economy (internet and improved communication) don't require such needs in catching-up country – too wide technological gap at this stage of development. Author argue, that distance to main competitor in such country does not work in the same way as theory appointed, but evolution into well-developed economy, should change this trajectory, although we don't know what kind of new solution bring us technology development and when it can happen. New products and processes in this area can restrict significance the spatial proximity concept for all type of economies in a long term.

Companies in Poland are still at the stage of absorption of technology originally developed outside the region's borders – in the country or abroad. Particularly unfavorable conditions for the innovation activity occur in the regional industrial systems at the local level. On this basis it can be concluded that as long as Poland is not in the group of the highly developed countries (strong high-tech region), the theory of the "new economic geography" in terms of studies conducted on the pages of this article will have a limited use.

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LOKALIZACJA KONKURENTA A REGIONALNA AKTYWNOŚĆ INNOWACYJNA SYSTEMÓW PRZEMYSŁOWYCH W POLSCE

Streszczenie: Bliskość przestrzenna z konkurentami jest czynnikiem wpływającym na przyspieszenie postępu technologicznego systemów przemysłowych w krajach najbardziej rozwiniętych, ale czy tak jest również w Polsce? Głównym celem przeprowadzonych badań było określenie wpływu odległości od najbliższego konkurenta na działalność innowacyjną wybranych regionalnych systemów przemysłowych w Polsce. Badania przeprowadzono w latach 2007-12 na grupie 2 434 przedsiębiorstw przemysłowych, w czterech różnych regionach położonych w różnych częściach Polski - mazowieckim, wielkopolskim, śląskim i świętokrzyskim. Metodyczna strona analiz została oparta na teorii prawdopodobieństwa - modelowanie probitowe. Uzyskane wyniki analiz wskazują, że zarówno lokalizacja i obecny poziom rozwoju gospodarczego analizowanych województw nie wpływają na zróżnicowanie działalności innowacyjnej regionalnych systemów przemysłowych. Z tego powodu omawiane prawidłowości w Polsce mają charakter systemowy. Wyzwanie, jakim jest tworzenie struktur klastrowych w Polsce w ujęciu horyzontalnym (systemowym), biorąc pod uwagę uzyskane wyniki badań, będzie bardzo trudne do osiągnięcia. Deficyt wiedzy i niskie umiejętności pracowników tworzą luki technologiczne na poziomie lokalnym. Przestrzeń regionalna na tym etapie prowadzonych badań nie wykazała znaczących zależności statystycznych, co dowodzi, że ten poziom agregacji pozostaje neutralny dla realizacji działalności innowacyjnej. Uzyskane wyniki badań wskazują na przeciwne efekty bliskości przestrzennej w polskich regionach dla aktywności innowacyjnej systemów przemysłowych w stosunku do najbardziej krajów rozwiniętych.

Słowa kluczowe: innowacja, konkurent, system, region, przemysł.

水平空間的接近和創新活動波蘭各地區

摘要：有競爭力的企業空間的接近是影響在大多數發達國家在工業系統的技術進步加速的一個因素，但它像也在波蘭？在開展研究的主要目的是影響國產化的競爭對手的評價，在上下文中其他國家的經驗，在選定的區域工業系統在波蘭的創新活動。馬佐夫舍，大波蘭，西里西亞和聖十字調查是在多年的2007年至2012年上一組2434工業公司在位於波蘭的不同地區的四個不同的省份進行。分析的有條不紊的一面是基於概率論的概率模型。該分析得到的結果表明，這兩個位置和分析各省的經濟發展目前的水平並不影響區域產業體系的創新活動的多樣性。因此，在波蘭的討論規律有系統的性質。的挑戰，以創建簇的結構和促進其在波蘭發展水平（系統）的方法，考慮到所得到的研究結果，將是極其難以實現。知識赤字和低自己的能力創造的本地系統技術領域的空白。在任何情況下，區域層面並未出現顯著的統計合作的依賴，有什麼證明，聚集這一水平目前仍然是中性的創新活動的實施。得到的研究結果表明在對工業系統的創新活動波蘭地區競爭對手的空間接近不同的效果相比，最發達的國家

關鍵詞：創新，競爭，系統，地區，行業