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Innovativeness of Podkarpackie District on the Background of European Union

INTRODUCTION

Innovations are considered to be one of the most progressive determinants of socio-economic growth, also in the territorial, regional and local perspective [Niedzielski, Jadźwiński, 2002]. The challenge of regional innovativeness as a specific social process becomes more important to the regional policy and to Polish economy. The means of pro-innovative regional policy is particularly important in the light of globalization challenges and official policies, made by European Union and member states [Markowski, 2004].

The main aim of this article is to explore the degree of innovativeness of Podkarpackie District on the background of the rest of Polish districts, regions of the European Union and find factors that determine this position. All scientific work that has been conducted during realization of the abovementioned goal, have been divided into two parts. In the frame of the first part, the analysis of the secondary-core materials have been conducted, that refer to the topic of innovation.

The second part of the research contained the analysis of the statistical data from Eurostat on the selected sights of innovativeness, that have been possible from the NUTS-2 classification perspective, coherent with Polish district nomenclature.

INNOVATION AND THEIR MEANS FOR SOCIO-ECONOMIC GROWTH OF THE REGION

The literature on the innovativeness of enterprises and economics together with regional development is reach in the aspect of competitiveness. However it is in the process of knowledge actualization in the context to the changing processes of socio-economic development and new qualities that have been accruing

in them. The Issues of competitiveness and innovativeness in the context to economies and territories are bounded to each other [Kot, 2006]. Together, the innovativeness and competitiveness of the regions have been in the recent years a popular topic of the economic theories, as well as of the practical activities. The reason of this is a fact that, in the nowadays world economy the competitiveness is a main mechanism of growth, and one of the ways to achieve innovativeness [Reichel, 2006]. The competitiveness is subjected to innovativeness and the perpetual technologic growth might be challenging for countries and regions, that feels the need to develop. In this manner the issue of innovativeness, as a specific socio-economic process, becomes more and more important for the development of all economies. In the economic literature there are two ways of interpreting the concept of innovation: as a result and as a process [Markowski et al., 1997]. Where in the first case, connection is made to goods, services and ideas perceived by the receivers as new. Although innovations as a processes include formulation of the idea, scientific work, and project management, production, marketing and dissemination.

According to GUS (Central Statistical Office in Poland), and according to international statistics – innovation is: “introducing on the market a new or better product, as well as introducing a new process or updated process of production, with the product or process new from the perspective of enterprise that implements it” [*Oslo Manual*, (<http://www.oecd.org/dataoecd/35/61/2367580.pdf>)].

A modern way to perceive innovation moves away from perceiving it as the only one event, but a complex of events or phenomenon that make new patterns, goods or technologies in the area of production and services. Innovations are made in the specified expanse with a system of linkages, that is called *innovation system*. It contains production and scientific sub-systems, institutional solutions and interdependent relationships among them. They are characterized by the level of innovativeness of the particular region [Markowski, 2004].

Innovativeness is the most related concept of innovation. Through innovativeness of enterprises W. Janasz [2002] understands: “Their skills and motivations to constantly seek and apply new scientific work, new ideas, thoughts and inventions”. Niedzielski and Jaźwiński [2007] stated that, innovativeness generally is related to a ability to generate innovation. Innovativeness of industry of the region can be understand as an ability and willingness of the subjects and enterprises localized in the given regional network to constantly seek and implement in business practice the scientific work and R&D, new concepts, innovations, and upgrades and developments related to new technologies of production, that are material and immaterial, also implementation of new methods and techniques to the organization and management, upgrading and

developing new infrastructure and knowledge. Associated absorption and diffusion of innovation is an integral element of the innovative processes, that are existing in the economy¹.

PODKARPACKIE DISTRICT

Podkarpackie district is a region of a poor, comparing to polish GDP per capita, labor productivity, low wages, and poor infrastructure. In 2008, GDP per capita in the Podkarpackie region was equal to 69% of GDP of Poland and 39% of the EU-27. In this manner Podkarpackie district is on the last position in Poland. In 1997–2008, GDP per capita grew, similarly to all districts in the country, also to GDP per capita in relation to average for European Union, but it raised slower than Polish growth rate. The difference between the weakest (eg. Podkarpackie) and the fastest growing districts, becomes more significant.

In some sections of the economic performance, the labor productivity of the Podkarpackie district increased in 2002–2008, particularly in the farming and constructions. All other sectors in Poland grew relatively slow. The manufacturing sector decreased, which is the most important part of the districts' industry. Also, the negative decrease in the performance in relation to countries performance of services have been noted, which is the most productive sector in the GDP growth. Despite the growth, the labor productivity in the farming is very low – equals approximately 1/3 in relation to the country's productivity.

Manufacturing have been playing an important role in the district's economy, what is reflected by the greater fraction of added value made by this section of industry, comparing to the country's average (23,5% in 2008 r. to 19,3% in the country). In 2006–2008, this percentage decreased in the country as well as in the district because of the global crisis, that impact this section of economy greatly. In the root structure of the manufacturing in the Podkarpackie district, dominates: the aviation and electro-machinery industry, chemical and food production sector, that are producing almost 70% of the total production of the district. The important role belongs also to the: glass production, and building materials, wood production and light manufacturing.

In 2002–2008 the added value of the farming decreased, as well as for the country as in the district. The fraction of the added value of farming in the regional economy of Podkarpackie district is lower than in the country, what is related to its fragmentation and low profitability. The negative factor, contributing to its low performance is smaller than in the rest of the country's percentage

¹ The absorption of innovation means to assimilate and receive innovation and diffusion of innovation means generally its spread and distribution.

of the service sector. In the added value its proportion equaled in 2008, 63,3% to 65,34% average in the country. In 2002–2008 it decreased in the Podkarpackie as well as in the country. The BAEL data on the number of working in different economic sectors shows that the proportion of the industry is lower, and services – significantly lower than for those who work in the farming sector. Lower than in the country was also the proportion of the added value of the farming, with the grater employability in this sector, what implies a low development of the district.

METHOD OF THE RESEARCH

During the works on the first part of the analysis there were 18 indicators selected with the focus on a different level of the innovativeness. Selection of the indicators was motivated by the accessibility of the NUTS-2 data. Despite that, the data contained significant gaps. That is why the linear interpolation of the data was made. The gaps were removed in two steps. In the first step, it was assumed that EU regions, that contained data gaps, have been classified in the analogical positions that in the subsequent years, for which the data were available. If the gaps existed for all years, in the second step, the interpolation was made with use of the variables with the strongest correlation coefficient with the one under interpolation process. Using this method it was possible to fill all the gaps in the data set. In the analysis the dataset of 225 regions of EU have been used, available from the innovation perspective. The analysis was made for the data from 2000–2010, although the availability of the data have been different for different indicators. As a result the coherent classification was possible only for 2008–2010. However, not all indicators were available for the above time interval, so for the purpose of this analysis the average value of indicators was taken for the abovementioned interval.

Emerging was the set of indicators of innovation that gave relevant information on the innovativeness. Although, some of them replicate bits of the information reflected by thers. That is why in the next phase of the studies the factor analysis had been made using the principal component method [Rummel, 1970]. Its goal was to find mutually orthogonal factors responsible for unique information that was observed in the indicators of innovation. Obtained factors made it possible to classify EU regions in the dimension of innovativeness. The classification had been made using the hierarchical analysis [Aderbers, 1973], which had been corrected using the k-means method [Hartigan, 1975].

The solution was formulated in the number of notions on innovativeness of Podkarpackie district, weak and strong sides of the region in this manner and possible areas of growth.

CLASSIFICATION OF THE PODKARPACKIE DISTRICT ON THE BACKGROUND OF THE EUROPEAN UNION

First, the analysis 18 indicators of innovativeness were taken into consideration. After applying the method of principal components, those indicators were collected into for components, that explained 79% of the variances of the 'raw' data. The rest of the components would not increase values to the scale greater than 1 and significantly decreased the growth of the explained variance (what could be observed on scree diagram). After applying the Varimax rotation with the Kaiser's normalization, 4 of the components obtained a suitable interpretations. The component 1 was mainly defined by the human resources in the science and technology (percentage of the population and active labour force), as well as by the percentage of the adults in life-long learning and the percentage of the employed in the technologically advanced sectors, particularly in the services. The second component was described mainly by R&D as a percentage of the GDP, the number of the patent applications per capita and the R&D personnel as a percentage of the labour force. The third component was mostly influenced by the relative number of students, and the fourth – by the percentage of the population with the higher, and secondary education and the percentage of the employed in the high and medium-high technology manufacturing. The indicator of number of students in the age of 17 to all population in this age was correlated highest with the 1st and 4th components, and the percentage of 4-year-old in the process of education appeared not to be correlated with either of the variable or indicator.

The table 1 shows position of the Podkarpackie district on the background of EU considering innovativeness and the value of the principal components. In the case of the first two individual measures of innovativeness, Podkarpackie district positioned itself below average value for the regions, what was particularly visible in the case of the second component, described mostly by the expenditure on R&D and employment in R&D as well as patent applications. In terms of areas described by the 3rd and 4th component Podkarpackie district positioned itself above the average value for the analyzed regions. In the area of population with secondary or higher education and innovativeness of industry Podkarpackie district was on the 10th position, being on the top of analyzed regions.

Following a preliminary classification made by the hierarchical analysis the analyzed regions of EU have been divided into 67 clusters. The classification showed that, Podkarpackie district does not differ in terms of condition of innovativeness from the rest of the Polish districts, except Mazowieckie district. Changing into a higher level of aggregation, observed through dendrogram, that contained 39 clusters did not change the size of the composition of this cluster. Re-examination made with use of k-means method showed, that in the number of clusters equaling 30–67 Podkarpackie district stayed in the same cluster, that

contained 15 districts. Providing existence of the 15 clusters the number of districts in the cluster the Podkarpackie was found in grew to 25 regions, in the 5 clusters the number grew to 50 regions.

Table 1. Podkarpackie province position on the background of EU regions at NUTS-2 in 2008–2010

	Position of Podkarpackie district	The value of the variable (standardized)	Center (30–67 clusters)	Center (15 clusters)	Center (5 clusters)
Component 1	165	-0,69	-0,46	-0,42	-0,46
Component 2	215	-1,20	-1,26	-0,96	-0,56
Component 3	64	0,32	0,73	0,51	0,01
Component 4	10	1,61	1,30	1,18	1,14

Source: own research.

Taking into account 5 clusters, cluster nr 3, which contained Podkarpackie district was characterized by the significant value of the 4th component, which is a high percentage of the population with secondary and high education and innovative industry. On the background of the Poland Podkarpackie district was in this scope second after Dolnośląskie district. Regions that had been classified to the 3rd cluster were above average when it comes to the relative number of students. In the context of first two components those region's performance was weak, including the 2nd component – the weakest in the EU. For the significant improvement of innovativeness of Podkarpackie district, as well as for the country it is important to increase R&D, employment in the innovative areas and patent applications.

CONCLUSIONS

On a basis of conducted analysis, it could be assumed that socio-economic growth of the regions, and Podkarpackie district is highly subjected to the factors connected to innovations and the level of innovativeness. Simultaneously, the socio-economic policy and regional policy is gradually directed towards strengthening the regional innovativeness. The example streams from the Regional Strategy of Innovation of Podkarpackie district, a program-document of the socio-economic policy of the Podkarpackie district, and is a primary tool to realization of the innovation policy of regional policymakers. It shows the schemes of action, that will influence the growth of innovativeness and competitiveness of the entire regional economics. In the document the assumption has been made, that, building competitive advantage in the modern economy should be based on the implementation of new technological solutions, because innovativeness is the basic condition for the market success in the current economic

reality. In the one hand, it is beneficial to develop new strategic documents related to the socio-economic growth, that take into account regional specific conditions, in the other hand it is good to remember, that there are significant possibilities to intensify the development of the Podkarpackie district through supporting innovativeness and innovation.

Podkarpackie district is a region of a low level economic development. One of the factors that contribute to the above is a low level of innovativeness in the matter of several conditioning factors. Particularly negative were indicators of innovativeness output, such as a relative number of submitted patents, or R&D expenditures in GDP, and as well as Life-long Learning. The improvement of those areas will be, in the highest degree involved to the position of the Podkarpackie district in terms of innovativeness, and hence the economic development. However the Podkarpackie district is characterized, as well in the background of the country as in the EU, by some very innovative areas (aviation sector). It is related to innovativeness of industry and relative number of people with higher education. Those advantages should be used to stimulate innovativeness in the rest of the areas in the Podkarpackie district.

REFERENCES

- Anderberg M.R, 1973, *Cluster analysis for applications*, Academic Press, New York.
- Drozdowicz-Bieć M., 2008, *Regionalne cykle koniunkturalne. Doświadczenia światowe – implikacje dla Polski*, „Barometr Regionalny” nr 3.
- Guinet J., 1995, *National Innovation Systems for Financing Innovation*, OECD, Paris.
- Hartigan J.A, 1975, *Clustering algorithms*, John Wiley and Sons, New York.
- Instrumenty transferu technologii i pobudzania innowacji*, 1997, Zespół Zadaniowy ds. Polityki Strukturalnej w Polsce, Warszawa.
- Janasz W., 2002, *Proces innowacji w modelu działalności przedsiębiorstw* [w:] W. Janasz, K. Janasz, M. Prozorowicz, A. Świadek, J. Wiśniewska, *Determinanty innowacyjności przedsiębiorstw*, Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, Szczecin.
- Kot J., 2006, *Innowacyjność i konkurencyjność regionu. Raport zbiorczy z badań przeprowadzonych w Zespole badawczym – Gospodarka i Przedsiębiorstwa*, Uniwersytet Humanistyczno-Przyrodniczy w Kielcach, Kielce.
- Markowski T., 2004, *Konkurencyjność i innowacyjność polskich regionów wobec akcesji do UE* [w:] *Ekonomiczno organizacyjne uwarunkowania rozwoju regionu*, Wydawnictwo UŁ.
- Markowski T., Stawasz E., Zembaczyński R., 1997, *Instrumenty transferu technologii i pobudzania innowacji: wybór ekspertów: praca zbiorowa*, Zespół Zadaniowy ds. Polityki Strukturalnej w Polsce, Warszawa.
- Matusiak K.B. i inni, 2005, *Innowacje i transfer technologii. Słownik pojęć*, Polska Agencja Rozwoju Przedsiębiorczości, Warszawa.
- Niedzielski P., Jaźwiński I., 2002, *Absorpcja i dyfuzja innowacji jako czynnik intensyfikujący rozwój regionalny*, Zeszyty Naukowe WSZ „Oeconomicus” PTE w Szczecinie „Gospodarka – rozwój i zmiany”, nr 2.

- Niedzielski P., Jaźwiński I., 2007, *Polityka regionalna i innowacje w rozwoju społeczno-gospodarczym województwa zachodniopomorskiego*, Wydawnictwo Naukowe Uniwersytetu Szczecińskiego, Szczecin.
- Oslo Manual, *The Measurement of Scientific and Technological Activities, Proposed Guidelines for Collecting and Interpreting Technological Innovation Data*, Organisation for Economic Co-operation and Development, <http://www.oecd.org/dataoecd/35/61/2367580.pdf> (stan na dzień 5.03.2012).
- Pater R., Wariacki M., 2008, *Specyfika cyklicznych wahań rynku pracy województwa podkarpackiego na podstawie badań testu koniunktury*, Prace i Materiały IRG, SGH, Warszawa.
- Reichel M., 2006, *Potencjał innowacyjny Polski południowo-wschodniej w strukturach subregionalnych*, PWSZ, Nowy Sącz.
- Rummel R.J., 1970, *Applied factor analysis*, Evanston: Ill.: Northwestern University Press.

Summary

The main aim of this article is to explore the degree of innovativeness of Podkarpackie district on the background of the rest of Polish districts, areas of European Union and factors that determine this position. All scientific work that has been conducted during realization of the abovementioned goal, have been divided into two parts. In the frame of the first part, the analysis of the secondary-core materials have been conducted, that refer to the topic of innovation. The second part of the research contained the analysis of the statistical data from Eurostat on the selected sights of innovativeness, that have been possible from the NUTS-2 classification perspective, coherent with Polish district nomenclature. During the works on the first part of the analysis there were 18 indicators selected with the focus on a different level of the innovativeness. For the analysis the dataset of 225 regions of EU have been used, available from the innovation perspective. The analysis was made for the data from 2000–2010, although the availability of the data have been different for different indicators.

Innowacyjność woj. podkarpackiego na tle regionów Unii Europejskiej

Streszczenie

Celem artykułu jest zbadanie stopnia innowacyjności woj. podkarpackiego na tle regionów Polski i Unii Europejskiej i czynników warunkujących tę pozycję. Prace badawcze, które podjęto w związku z realizacją założonego celu badania zostały podzielone na dwa etapy. W ramach pierwszego etapu badania przeprowadzona została analiza wtórnych materiałów źródłowych dotyczących zakresu problematyki innowacyjności. Drugi etap badania obejmował analizę danych statystycznych, pochodzących z baz Eurostat nt. poszczególnych aspektów innowacyjności, co umożliwiło dokonanie klasyfikacji regionów poziomu NUTS-2, odpowiadającym polskim województwom. Do analizy przyjęto 225 regionów UE, dla których dane nt. innowacyjności były dostępne. W analizie przyjęto dane dla lat 2000–2010. W pierwszym etapie prac wyodrębniono 18 wskaźników świadczących o różnych aspektach innowacyjności. Dobór wskaźników był podyktowany ich dostępnością na poziomie NUTS-2 oraz porównywalnością wyników z tymi dla innych regionów UE. Przyjęte do analizy wskaźniki innowacyjności zostały ustalone według zharmonizowanej metodologii dla Unii Europejskiej – Regional Innovation Scoreboard.