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IDENTIFICATION OF CLUSTERS' POTENTIAL IN REGIONS *

The article presents the methodology of cluster potential identification as one of preconditions for their later operation in regions. To achieve this objective different methods of quantitative and qualitative character are used. This research project has been realized at the Faculty of Social and Economic Relations (Alexander Dubcek University of Trencin, Slovakia) in 2012–2014 to draw up a conceptual methodology for identification of clusters' potential in Slovakia regions.

Keywords: cluster; potential; regional development; public-private partnership.

JEL classification: R11; O30; R58.

Катаріна Хавернікова, Пауліна Сровналікова, Борис Янські ВИЗНАЧЕННЯ ПОТЕНЦІАЛУ ДЛЯ КЛАСТЕРНОГО РОЗВИТКУ РЕГІОНІВ

У статті представлено авторську методологію визначення потенціалу розвитку кластерів, що є важливим для подальшого їх успішного функціонування у конкретних регіонах. З цією метою використано низку кількісних та якісних методів визначення потенціалу. Описаний у статті дослідницький проект було реалізовано на базі факультету соціальних та економічних відносин Університету Олександра Дубчека (м. Тренчін, Словаччина) у 2012–2014 рр., результатом чого стала розробка концептуальної методології ідентифікації потенціалу кластерів у регіонах Словаччини.

Ключові слова: кластер; потенціал; регіональний розвиток; взаємодія державного та приватного секторів.

Форм. 6. Табл. 3. Літ. 28.

Катаріна Хавернікова, Пауліна Сровналікова, Борис Янські ОПРЕДЕЛЕНИЕ ПОТЕНЦИАЛА ДЛЯ КЛАСТЕРНОГО РАЗВИТИЯ РЕГИОНОВ

В статье представлена авторская методология определения потенциала для развития кластеров, что важно для их дальнейшего успешного функционирования в конкретных регионах. С этой целью использован ряд количественных и качественных методов измерения потенциала. Представленный исследовательский проект был реализован на базе факультета социальных и экономических отношений Университета Александра Дубчека (Тренчин, Словакия) в 2012–2014 гг., результатом чего стала разработка концептуальной методологии идентификации потенциала кластеров в регионах Словакии.

Ключевые слова: кластер; потенциал; региональное развитие; взаимодействие государственного и частного секторов.

Introduction. As Mura et al. (2012) and Ivanova (2013) stated, the purpose of every enterprise is making gains, effective business activity, and increasing its performance. The impact of these activities has influence on the economic performance of regions, especially through the synergy effect due to cooperation in the form of a cluster. In the economic practices of Central and Eastern Europe in the last two decades, clusters have become an important tool of regional development. The

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* This publication was written in the framework of the project "Alexander Dubcek University of Trencin wants to offer high-quality and modern education", ITMS code 26110230099, based on the Operational Programme Education. Modern education for knowledge society / The project is cofunded by the European Social Fund.

European Union confirms the importance of industrial clusters and firms clustering as a one of important tool of regional policy. There should be a general strategic framework bringing together the approaches of various stakeholders: public administration, universities, research centers and business, so as to implement all processes in a coordinated manner. According Habanik and Hostak (2014) the aim of regional development is to ensure the balanced development of individual regions and to eliminate or reduce the differences in their development levels. This concept also includes the necessity to increase the competitiveness and economic performance of regions. It is clear that under the present conditions of the interdependent globalizing world's economy, it is just the usage of economic instruments that create an important component influencing the strategic development of countries (Klucka et al., 2011). One of the conditions how to make it possible is to create favourable conditions for encouraging the setting up and development of clusters. Their formation is associated with many problems. Creating a cluster is based on information exchange about needs and technologies between buyers, suppliers and even industries (Krajnakova, 2012). Another serious problem is to fulfill the requirements of the public aid effectiveness in the process of cluster formation in a region (Stejskal, 2011). The effectiveness of aid is mainly reflected in the functioning of cluster, not only in its creation. It is very important for those responsible for future development to choose the right way, or at least, to choose the direction which seems to be the most suitable under given conditions (Simak, 2008). For this reason it is necessary to have an appropriate methodology for the identification of clusters' potential in a region. The content of methodology proposal is formed after the analysis of various elements of the environment (social and economic) in which cluster is supposed to be created. As Soosova (2014) stated, the identification of strong economic perspectives of individual industries in a region is essential for cluster formation.

Professional literature reveals many different ways of identifying cluster potential in regions through the evaluation and mapping of prevailing industries in a region (Pyke et al., 1990; Krugman, 1991; Porter, 2003; Yusuf et al., 2008). Several methods are used to identify the sectors, within which it would be appropriate to start cooperation of entities for their involvement in cluster. The basis of these methods is measuring regional disparities (Koisova et al., 2012). Depending on input data, we recognize quantitative and qualitative methods. Their combination is often used in economic practice which may thus contribute to better identification of cluster potential in a region.

This study is based on the results of research realized at the Faculty of Social and Economic Relations (Alexander Dubcek University of Trencin, Slovakia): No. 2/2012 "The problems of measuring the effectiveness of clusters", No. 1/2013 "Models and approaches to measuring performance clusters and possibilities of their application in Slovakia" and No. 01/2014 "Cluster Policy in the Slovak Republic" and also the results of the surveys realized in the framework these projects. The main problem was the lack of data. We selected the appropriate methods for using them in the conditions of Slovak regions. The notion of clusters is essentially new for Slovak Republic. Thus, it is also important to propose a set of steps on clusters' identification in Slovak regions. The novelty of the paper is the proposal of methodology for identification of clusters' potential in Slovak regions.

Problem statement and research objectives. Methods used in this study include localization, specialization, various forms of agglomeration (Stejskal, 2011). We start from the data on the number of employees, sometimes also GDP values, turnover, sales and other statistic indicators (Stejskal et al., 2011; Potomova and Letkova, 2011; Pavelkova et al., 2009; Bergman and Feser, 2009; Porter, 2003). Besides classification as mentioned above, many others are applied to sort the methods according to the type of input data, e.g. data on number of employees by sectors, resp. those ones are based on input-output table. Alternatively, there is a classification method according to the approach of identifying and mapping the cluster in the manner "top-down" or "bottom-up" (Potomova and Letkova, 2011). The main quantitative methods are: the coefficient of localization and specialization; locational Gini coefficient; input-output analysis; Ellison and Glaeser index of agglomeration and Shift share analysis. The methods applicable in the conditions of Slovak Republic are mainly localization coefficient, locational Gini coefficient and shift-and-share analysis.

Localization coefficient ($LQ_{e,i}$): Clusters can be identified and mapped by looking at $LQ_{e,i}$ based in the employment data. Through $LQ_{e,i}$ we can evaluate branch concentration in a region relative to the concentration of all branches in a country. $LQ_{e,i}$ is calculated for each component of the value chain (Adamkovicova, 2013; Alasia and Hardie, 2011). $LQ_{e,i}$ is defined as follows:

$$LQ_{e,i} = \left(\frac{LF_{e,i}}{LF_i} \right) / \left(\frac{LF_{e,N}}{LF_N} \right), \quad (1)$$

where $LQ_{e,i}$ is the relative intensity of employment in sector e in region i and $LF_{e,i}$ is the experienced labour force in sector e in region i , country N . Explanation: $LQ_{e,i} > 1$ indicates that region has higher intensity of employment relative to the nation. $LQ_{e,i} = 1$ indicates that region has same intensity of employment relative to the nation. $LQ_{e,i} < 1$ indicates that region has lower intensity of employment relative to the national level. Thus, a region with an $LQ_{e,i} > 1$ is relatively "specialized" or "intensive", as compared to national average.

The Gini coefficient is one of the most used measures of concentration. We apply the locational version developed by (Krugman, 1991). To compute the **locational Gini coefficient (LG_e)** for industry e , we calculate the region i share of employment in that industry ($S_{e,i}$), relative to the national employment in that industry and relative to the regional share of employment of all industries ($S_{tot,i}$). LG_e is then computed using the following specification: Eq. (1) (Alasia and Hardie, 2011):

$$LG_e = \sum_{i=1}^n S_{tot,i} (1 - r_{e,i}) \times \left(\frac{1}{2} S_{tot,i} + S_{i+1}^n \right) = \sum_{i=1}^n S_{tot,i} \left(1 - \frac{S_{e,i}}{S_{tot,i}} \right) \times \left(\frac{1}{2} S_{tot,i} + \sum_{k=i+1}^n S_{tot,k} \right), \quad (2)$$

with $r_{e,1} < r_{e,2} < \dots < r_{e,n}$. Hence, to compute the cumulative shares, regions ranking is done according to the ratio $r_{e,i} = S_{e,i} / S_{tot,i}$, where the region with the lowest ratio is assigned the #1 rank. The value of this coefficient ranges from 1 to 0, with 1 implying the maximum concentration in one single location and 0 implying a perfectly even distribution across regions.

The shift and share analysis provides a picture of how well regional mix of industries is performing and shows how well individual industries are accomplished. It is a technique for breaking down the regional employment growth into 3 components (Blair, 1995):

1) *national share (NS) component* – growth can be attributed to national economic growth. For instance, the share of regional job growth attributable to the growth of national economy. If a locality grew at the national average, it would have maintained its share of national employment, hence the "share" term of shift and share analysis:

$$NS_{ir}^t = E_{ir}^{t-1} \times \left(E_{NL}^t / E_{NL}^{t-1} - 1 \right), \quad (3)$$

where t – current time period; $t - 1$ – one year ago; NL – national level; i – specific industry; r – specific region.

2) *industry mix (IM) component* – may grow faster (slower) than the national average if it has a disproportionate level of employment in the industries that grow fast (slow) nationwide. For instance, it estimates how many jobs were created/not created in each industry due to differences in industry and total national growth rates:

$$IM_{ir}^t = E_{ir}^{t-1} \times \left[\left(\frac{E_{iNL}^t}{E_{iNL}^{t-1}} \right) - \left(\frac{E_{NL}^t}{E_{NL}^{t-1}} \right) \right], \quad (4)$$

where t – current time period; $t - 1$ – one year ago; NL – national level; i – specific industry; r – specific region.

3) *regional shift (RS)* – may have a competitive advantage (disadvantage) as compared to other areas because its environment is conducive (an impediment) to growth of particular industries. The mix and competitive components account for regional growth that differs from the national level. It identifies the region's leading and lagging industries:

$$RS_{ir}^t = E_{ir}^{t-1} \times \left[\left(\frac{E_{ir}^t}{E_{ir}^{t-1}} \right) - \left(\frac{E_{iNL}^t}{E_{iNL}^{t-1}} \right) \right], \quad (5)$$

where t – current time period; $t - 1$ – one year ago; NL – national level; i – specific industry; r – specific region.

The formula for calculating the shift and share components for a single industry can be expressed as:

$$\Delta e_i = NS_{ir}^t + IM_{ir}^t + RS_{ir}^t. \quad (6)$$

Qualitative methods are based on expert opinions and questionnaire results: the interviews with experts, independent consultants, university teachers, researchers etc., surveys and case studies. This type of methods completes the missing statistical data and also terminates other facts that can't be detected by quantitative methods. They are e.g. social capital, communication networks between regional entities and bodies, regional politicians' attitude to mutual cooperation etc.

The main aim of this paper is to draw up a methodology proposal for identification of cluster potential in Slovakia regions. The proposed methodology has a recommending character and is based on the experience and knowledge of clustering. The *particular objectives* are:

- describing the circumstances of the methodology creation;

- to specify the purpose and the objectives of the methodology;
- to describe the methodology.

Key research findings. The concept of partnership between fundamentally different sectors is still being developed. It is related to the improvement of public sector activities in pursuit of sustainable national development while permanently improving the implementation of essential joint activities delivered in collaboration with business (Tuncikiene et al., 2014). In Slovak Republic, collaboration between business companies and public sector is realized through clusters. There are more than 20 clusters (Table 1) in Slovak Republic (except Trencin region) divided into two groups: technological clusters and tourism clusters. Not all of them are active however. The Slovak Innovation and Energy Agency that states 14 technological clusters and 5 tourism clusters are officially operating in the that country.

Table 1. **Clusters in Slovak Republic** (Haviernikova et al., 2013)

Region	Cluster title
Bratislava	Danube knowledge cluster, Academic Business cluster, National energetic cluster
Trnava	Automotive cluster Western Slovakia, Electro-technical cluster – Western Slovakia, Energetic cluster, Cluster of tourism Western Slovakia, Cluster Smolenice, Construction cluster of Slovakia, Cluster for Green and Innovative Technologies
Trencin	-
Nitra	Slovak plastic production-oriented cluster, Association for the use of renewable and alternative energy sources, Cluster Topol'cany
Zilina	Z@ict, Liptov cluster, Orava cluster, Turiec cluster
Banska Bystrica	1 st Slovak cluster in machine engineering, Balnea Cluster – tourism associations, Cluster Horehronie, Cluster of border castles
Presov	The energetic cluster of Presov region
Kosice	BITERAP cluster, Cluster AT + R, Kosice IT Valley, association of legal entities

Clusters can be formed in two ways: "bottom-up" or "top down". In Slovak Republic clusters have been created mostly bottom-up. For this reason the important part in regional planning becomes cluster potential identification. It is necessary to provide a comprehensive set of measures that will lead to the identification of clusters' potential in a defined area of application. This methodology could be used by subjects of both public sector and business companies. The methodology can contribute for stakeholders' strategic decisions and creation of strategic documents on regional development. The reason for this proposal is the absence of relevant methodology that describes the process of cluster potential mapping in Slovak regions. From the projects realized in 2012–2014 we obtain the materials and information necessary for the development of this methodology.

The *precondition for methodology proposal* is understanding the current situation in the field of cluster policy. To the circumstances of the methodology creation we include:

- Decentralized cluster policy: there is no cluster policy at the state level in Slovakia. The issue of clusters is incorporated into the documents of national level and in regional innovation strategy, without a clear explanation for subjects, which would like to operate in clusters.

- The problematic policy of funding and the unsystematic form of state support. In Slovak Republic the state aid is not provided in a uniform way. It is differentiated due to sectorial division of clusters. The example of state support for technological clusters is presented Table 2. The Ministry of Economy of the Slovak Republic provided in 2014 the scheme to support industrial cluster organizations in the forms of Scheme de Minimis.

Table 2. Cluster support, EUR (www.siea.sk)

Cluster	Costs in total	State budget (70%)	Own sources (30%)
1 st Slovak cluster in machine engineering	23,730	16,611	7,119
Cluster AT+R	30,700	20,000	10,700
Electro-technical cluster – Western Slovakia	25,650	17,955	7,695
National energetic cluster – NEK	28,550	19,985	8,565
Z@ict	28,000	19,600	8,400
Slovak plastic production oriented cluster	27,800	19,516	8364
Automotive cluster Western Slovakia	19,800	13,860	5,940
Total	184,310	127,527	56,783

The second important phase in methodology preparation is to *set the purpose and objectives of methodology*. The use of qualitative and quantitative methods is only one part of identification of clusters' potential in regions. The second part of identification is to evaluate the interconnections between stakeholders in region, because clusters represent the geographic concentration of interconnected companies, various local institutions, universities and research centers in a particular industry situated in a region. Clusters play an important role in regions development in terms of economic performance and competitiveness. Cluster participants could compete, but they could also cooperate. Geographical proximity is important but inter-firms relationships and cooperation are also important. Clusters are formed when groups of businesses start to collaborate and through cooperation develop ties and interdependencies that enable them operate with greater economies of scale and scope. (Atherton, Johnston, 2008). The third part of identification is the analysis of regional programming documents, where stakeholders could find the options on clusters support. For the programming period 2014–2020 it is important to incorporate clusters' support into the Plan of economy and social development of regions and other strategic documents of the regional level.

As the *main purpose of methodology* we can state the general and applicable procedure of cluster potential identification in Slovak Republic. As follows from the results of our research projects, for cluster potential identification we can use mainly 3 quantitative methods: localization coefficient, locational Gini coefficient and shift-and-share analysis. The results are presented in Table 3. The data are calculated for the years 2007–2013. As we can see from the results of LQ_{2013} , LG_e and Δei there is cluster potential in all Slovak regions. As our results show, there is a huge possibility for cooperation in clusters in Slovak Republic.

$LQ_{e,i}$ was calculated according to the formula (1), basing on the statistical data on employment in 8 regions of Slovakia. The data on employment in Slovak regions we also use for our next calculations.

By using formula (2) we calculate LG_{e2007} and LQ_{e2013} . Over the observed period, the levels of employment has increased mainly in the sectors: F, M-N, G-I, L, J, R-U and K. The geographic concentration of employment in the processing activities increased for: J, F, L, K and C. In 2013 the maximum concentration in one location was for branches B-E and perfectly even distribution across regions was for the sectors O-Q, R-U, G-I.

For each sector in different regions we calculated the comparison of data by the formulas (3)–(6) with the components of shift-and-share analysis and then by summing these components we obtain the final variable Δei , which refers to the appropriateness of cluster creation in a given region in a particular sector. For comparison we chose the years 2007 and 2013.

Table 3. Results of LQ2013, LGe and Δei , authors' calculations based on the data from regional databases of SOSR

Region	Coefficient	A	B-E	C	F	G-I	J	K	L	M-N	O-Q	R-U
BA	LQ ₂₀₁₃	0.4	0.6	0.5	0.7	1.2	1.8	2.6	2.5	2.6	1.8	1.4
	Δei	-0.7	-15.0	-11.9	1.1	30.9	6.4	2.8	3.8	25.2	4.1	3.1
TT	LQ ₂₀₁₃	1.0	1.2	1.2	1.7	1.0	0.8	0.6	0.5	0.9	0.8	0.9
	Δei	-10.5	6.0	8.8	6.7	14.2	1.2	0.3	-0.1	8.2	-1.8	1.7
TN	LQ ₂₀₁₃	0.8	1.3	1.4	0.9	0.9	0.6	0.5	0.7	0.7	0.7	0.8
	Δei	-4.2	-2.6	2.7	7.5	22.7	0.0	0.5	0.5	4.9	-0.6	1.2
NR	LQ ₂₀₁₃	1.5	1.2	1.1	1.3	1.0	0.8	0.6	0.7	0.7	0.9	0.9
	Δei	-9.1	7.8	8.2	9.6	13.9	0.9	0.0	0.4	4.9	-2.4	1.2
ZA	LQ ₂₀₁₃	0.7	1.1	1.2	1.2	0.9	1.0	0.5	0.4	0.7	1.0	0.9
	Δei	-6.0	-2.6	0.1	9.2	18.5	1.9	-0.5	-0.5	5.0	2.2	1.6
BB	LQ ₂₀₁₃	1.5	1.0	1.0	1.0	1.0	0.7	0.8	1.0	0.9	1.2	1.5
	Δei	-9.1	-17.2	-14.3	6.1	9.0	-0.4	-0.1	0.9	6.8	-2.7	0.5
PO	LQ ₂₀₁₃	1.4	1.1	1.3	1.4	0.9	0.7	0.8	0.4	0.7	1.2	1.0
	Δei	-8.5	-7.6	-5.2	11.2	9.1	-0.6	0.2	-0.5	3.0	-3.7	-0.3
KE	LQ ₂₀₁₃	1.7	0.9	0.9	0.8	1.7	1.2	0.9	1.6	0.9	1.3	1.0
	Δei	-4.8	-10.1	-3.9	4.0	14.1	1.6	0.2	0.6	3.5	4.6	0.1
Employment (2013/2007)		-42.0	-7.3	-3.1	45.4	28.5	24.5	9.0	26.8	45.0	-0.1	18.2
LGe ₂₀₀₇		0.1	0.4	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.1
LGe ₂₀₁₃		0.2	0.4	0.1	0.1	0.0	0.1	0.2	0.2	0.1	0.0	0.1

Note: A – Agriculture, forestry and fishing; B-E – Industry in total; C – Manufacturing; F – Construction; G-I – Wholesale and retail trade; repair of motor vehicles and motorcycles, transportation and storage, accommodation and food service activities; J – Information and communication; K – Financial and insurance activities; L – Real estate activities; M-N – Professional, scientific and technical activities, administrative and support service activities; O-Q – Public administration and defence; compulsory social security, education, human health and social work activities; R-U – Arts, entertainment and recreation, other activities.

Conclusions. In Slovak Republic the unemployment level is increasing, and flexibility is relatively low, despite the fact that it could help increase the employment (Grencikova et al., 2014). Innovation policies and strategies implementations are the most important aspects of current international economics and business development issues (Kordos, 2014; Kana et al., 2014). In this situation proper identification of clusters' potential can contribute to solving many problems. The initial analysis of

clusters potential in regions is only one of the conditions of their success and contribution to regional development. The result of this paper is the description of methodology for clusters' potential identification. It consists of 3 stages:

1. Initial analysis of cluster potential in a region by using quantitative methods.
2. Preliminary analysis of a region, including the social and economic analysis of a region, cluster mapping and the analysis of interconnections between stakeholders.
3. The description of important indicators of the areas of human resources, quality of life, regional disparities and convergence, technology, information and communications infrastructure and capital.

The main purposes of clusters' potential identification is to determine the regions where the presence of clusters is over the national average, the growth rate is over the national average, the region has export orientation and there is the interdependence among member firms, including large and small companies, their suppliers and their geographical groups.

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Стаття надійшла до редакції 11.03.2015.