THE EFFECT OF THE EXISTENCE OF CLUSTERS TO REDUCE REGIONAL DISPARITIES IN THE SLOVAK REPUBLIC

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Abstract

Regional differences in Slovakia, as well as in other EU countries, are becoming more and more observable. These economic, social and environmental differences show different forms. Different indicators are used to quantify these differences. The article deals with the issue of interregional differences and their measurement in the Slovak Republic at the level of NUTS 3 regions, using a composite indicator. The aim is to assess the level of regional disparities in relation to the existence of clusters in regional development. The basic sense of regional development is to sustainably improve the quality of life in the region. Achieving this basic goal requires a comprehensive approach to assessing regional differences. From the results of the analysis of the assessment of the reduction of regional disparities, it is not possible to state a statistically significant decrease in regional differences. A certain tendency was observable, but still there are still large regional differences in Slovakia, as in the economic, social and environmental spheres.

Introduction

The economic development of the Slovak Republic is largely determined by the performance of the regions and the policy of making use of their potential. For effective regional policy is needed for the identification of the relevant factors of development. The active factor is human resources, passive research, development and innovation are, basic infrastructure and services. In addition to the main factors for the development of a region important to analyze economic performance indicators — GDP growth, employment, productivity, and evaluate their impact on regional development and growth. The influence of various factors and depending on the playing field, the development in different regions. It is considered the economic and overall social problem. He disrupts the development in the field of economic, social and environmental. The aim of regional policy is to reduce these differences. Reduction of disparities is also one of the primary goals of the regional policy of the European Union (EU).

With the improvement of the socio-economic level of the EU Member States related to the development of the various regions. Achieving this objective is conditional on the level of economic and social development of the Member States. He is, however, between countries at different levels and is determined by the overall situation and the developments in different regions of the Member States. The region is

seen as a key element in the EU and at the same time an indicator of economic development. At the same time is considered a political, economic, social and cultural unit (Krajňáková, E., Vojtovič, S., 2012).

Activities aimed at improving the welfare and performance of the regions are referred to as regional policy. Regional policy can be defined as a set of objectives, measures and decisions in government activities at the regional level. A priority of the regional policy is to ensure the development of the regions and major differences in their development. Great emphasis is placed on efficient use of own resources of the region. On the overall economic development of the country, affects different socio-economic level of the region. Varying degrees of development of the regions stems from non-equipment production factors. Regions differ and the high rate of unemployment (Habánik, 2014).

Regional development is defined as a set of economic, cultural and environmental processes and relationships. These relations are taking place in the region and contribute to increasing their competitiveness, economic, social and territorial development. The first economic models, which include the factor of regional development are enhanced versions of the theory of economic growth. These models predict that free international trade stimulates economic growth and lead to the convergence of the economies of the regions investigate each other (Dawkins, 2003).

The reason for the implementation of regional policy are different levels of social and economic development between the various regions. These inequalities in the literature referred to as regional disparities. To the understanding of the specific concept of regional disparities (RD) can be accessed from different points of view. According to Kutscherauer (2010) is the diversity of characters, events, or inequality or RD processes having a clear territorial location (can be allocated in the defined territorial structure) and occurring at least in the two entities of the territorial structure. In European terms, RD are a measure of the level of economic, social and environmental cohesion European territory, which leads to their breakdown into three basic categories, and thus to define the economic, social and environmental disparities (Melecký, Staníčková, 2015). In the terminology dictionary (Navratil et al., 2012) are RD defined as the difference or inequality between regions. The main causes are related to the uneven development of the region, by the terms of the action of market forces, the decline in some sectors. Furthermore, it is an uneven development of private enterprise, with varying degrees of facilities, technical infrastructure with low mobility, where appropriate, the territory of the inter-regional labor.

Other approaches in relation to the economic performance of the region explain RD and the standard of living of the population. RD does the differences between economic performance and the well-being of individual regions, or as indicators that indicate the degree of variability in some of the economic phenomenon in the regions of the country. An RD can be regarded as a phenomenon of regional development. Interested in regional policy is growing, even from the perspective of the social sciences. It is, therefore, that spatial disparities and inequalities in the territorial units are still tend to accretion. That happens in the Slovak Republic, but also in the framework of the EU and to overreach the undesirable polarizations and manifests itself in a significant way the space was the social nature of regional disparities (Švecová, Rajčáková, 2014).

One of the options for improving the socio-economic level of the region is to support the development of certain sectors of the prevailing in the region. Their diversification from one region to another creates a unique environment where companies face a similar focus. These businesses are trying to exploit the comparative advantages of the region. So he creates a network of a wide range of businesses and organizations linked to specific links, i.e. clusters. The term cluster is closely related to the theory and practice of regional development. This concept is not new in the regional economy. According to Porter (2000) the clusters represent a certain geographic concentrations of interconnected companies, specialized suppliers, service providers, businesses in related industries and institutions (universities, trade unions) in a certain area (sector), which both compete but also cooperate with each other. It is now considered as an important element of the concept of cluster development.

Clusters play a major role in the development of the various regions by contributing to the enhancement of their competitiveness. Their importance in regional development is based in particular on: improving the division of labor, increasing migration of workers between enterprises, the cooperation of the undertakings within the framework of the Department, the growth in the number of jobs, higher wages, and higher rate of patenting, creation of new types of businesses, their growth and survival (Navickas, Vojtovic, Svazas, 2016).

The basic aim of the paper is to evaluate the use of selected indicators of regional disparities in the Slovak Republic with a focus on the importance of clusters in regional development.

1. Assessment of regional disparities (material and methods)

The primary condition for balancing regional disparities is to quantify their level of. An analysis of regional disparities is subject to obtaining the relevant data. This requires sufficient knowledge and guidance in a wide range of published methods and ways of their implementation. In general one can speak of a threefold assessment choice of units, the selection of appropriate indicators of the RD: observational and selection of the appropriate method. When choosing the observational units we only have statistical data that are available only in defined statistical territorial units at NUTS 3.

The selection of the indicators used to identify and measure the RD is an important task for their investigation. The correct selection of the indicators depends on many factors, from the definition of the RD and the objective pursued, which is to track the analysis. It further depends on the territorial scale, the power indicator lights and their evaluation. There are simple and composite (aggregated, integrated) indicators (Michálek, 2014).

Composite indicators represent a higher degree of identification of a suitable range of indicators based on links RD. Are based on an appropriate number of indicators link. Their basic attribute is sufficient comparative ability, mathematical manageability and readability of the information. Their method of aggregation is based on the use of multiple methods.

1.1 The Design of CI

In assessing the need for an integrated perspective on the issue arises logically RD. This is related to the construction of a composite indicator (*CI*). Currently, there are several ways to calculate. One of the most advanced approaches to the design of the so-called ´Benefit of the doubt' composite indicator (Rogge, 2017; Cherchye at all, 2006). Its construction is using DEA models (Verschelde, Rogge, 2012). The Organisation for economic cooperation and development (OECD) has published a detailed procedure in the year 2008 methodology and its construction. The composite indicator is a higher level of identification and interpretation of RD. The document describes the major advantages and disadvantages of the use of such summary indicators in practice (Handbook on Constructing Composite Indicators, 2008).

Construction of the composite indicator CI can be described in the following steps (in parentheses are given can use mathematical methods):

- the creation of the theoretical framework, the choice and combination of individual assessment of their relevance and statistical sub-indicators, material properties (DEA method, resolution on indicators type of max, min, the method of calculation of missing values, comparative analysis, PCA analysis),
- normalization and aggregation of the original indicators, indicators of weights (scoring method, the standard variable, method, the distance from the fictional object),
- testing the properties of the designed CI (sensitivity analysis),
- visualization of results.

The values of the indicators were standardized method for min-max. For the calculation of the composite indicator for each of the regions it has been used additive aggregate method:

$$CI_r = \frac{\sum_{i=1}^{n} I_{i,r} w_i}{\frac{\sum_{i}^{n} \sum_{r}^{m} I_{i,r}}{m}},$$

where $I_{i,r}$ is the value of standard indicator $i = 1, 2, \ldots, n,$ for the region $r = 1, 2, \ldots, m$ and w_i is its weight.

1.2 Evaluation method of regional convergence

To remain scattered regions with a composite indicator, you can use the methods of real convergence. It is used a number of concepts: beta (β) convergence (absolute, conditional), sigma (σ) and Markov chains. Sigma convergence tests measure whether the variance in the regional distribution of the indicator decreased. Beta convergence tests shall examine whether regions with low levels of indicator experienced stronger growth than regions with a high level of the indicator (Janssen, Hende, De Beer, Van Wissen, 2016).

According to the beta convergence method, less developed regions are growing faster than more developed regions. The subject of research is the only condition for the beginning and end of the period under review. This can be a disadvantage, because the information on developments remain unused. Examines the use of the linear regression equation. Of the estimated value β of the directive of this line is: if $\beta<0$ is trend of convergence, if $\beta>0$ is trend of divergence, if $\beta\cong0$ not none of the tendencies. The coefficient of determination R^2 indicates an estimated reliability of a linear trend. If the value of the coefficient of determination, close to 100%, it is considered a tendency (convergence) as a major. The recommended minimum value is 80%. Otherwise, it is considered to be insignificant (Minařík at all., 2013).

2. Results and discussion

The Slovak Republic is made up of eight self-governing regions. These are the regions of Bratislava, Trnava, Nitra, Trenčín, Žilina, Banská Bystrica, Prešov and Košice. In these regions it operates a total of 25 active cluster. The structure of the regional citizenship of the clusters are listed in the following table.

Table 1. Number of clusters in the regions

region	Bratislava	Trnava	Nitra	Trenčín	Žilina	Banská Bystrica	Prešov	Košice
Počet klastrov r. 2010	0	3	2	0	3	2	1	1
Počet klastrov r. 2018	3	4	2	3	4	2	2	5

Source: own processing by SIEA

Most of the clusters in the SR operates in Košice region, at least in the Trenčín region. For the assessment of the impact of the existence of the cluster in the region on reducing regional disparities were analyzed for some indicators. In view of the official availability of NUTS 3 regions were selected for the following 15 indicators (x_i, $i=1,2,...,15$) in three of the areas surveyed:

Economic sphere: x_1- Regional GDP per capita (€), x_2- Gross value added (mil. €), x_3 - Rate of economic activity (%), x_4- Unemployment rate (%), x_5- Employment rate for 15-64 years (%).

Social sphere: x_6- Incapacity (%), x_7 - Number of beds in health institutions (‰), x_8 - Mean equalized gross household income (€/mouth), x_9 - Number of social welfare facilities (‰),x_{10} - Number of detected crimes (‰).

Environmental sphere: x_{11}- Population density, x_{12} - Solid emissions to km², x_{13} - Share of the waste being recovered (%), x_{14} - Density of motorways and express roads, x_{15} - Share of the population connected to sewerage system with STP (%).

Comparison of the regions from the point of view of selected indicators for the period 2010 and 2016. The year 2010 is the highest increase in clusters in the Slovak Republic. Since some of the key indicators (e.g. regional GDP) for the year 2017 are not officially published, we've compared the year 2016.

Some of the indicators for comparability were converted to km² or per capita.

2.1 Assessment of suitability of selected indicators

Each indicator is included in the analysis was assessed by using exploratory analysis. Descriptive statistics were calculated for this purpose (location, variability and symmetry, the correlation matrix). In the case of a significant correlation was assessed using the VIF factor multikolinearity. Graphical methods are identified the extreme values, data independence, homogeneity). Because the data has not been identified, no statistical anomaly, to further analysis included all 15 indicators.

2.2 Weights of indicators

The starting point to determine the weights of the individual indicators was to analyze the main components (Principal Components Analysis – PCA) that have been identified key indicators and transformed the latent variables. Statistically significant were the first three components which together explain 81.48% of the total dispersion of the selected indicators. After these three variables occurs in the Cattels chart, as shown in Graph 1.

Graph 1. Cattels graph

Source: own processing
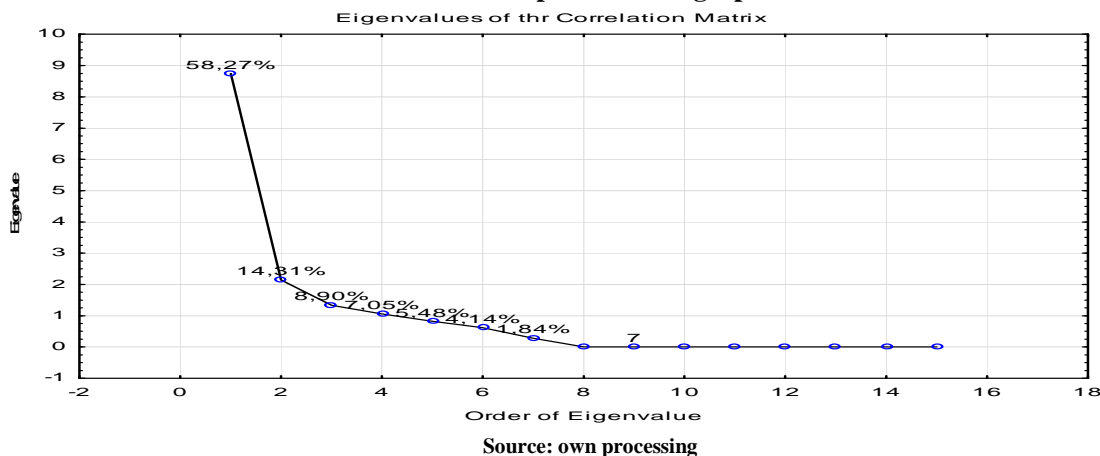
With the highest values of correlation coefficients and the variability explained components were calculated weights w_i for each of the indicators (Table 2).

Table 2. Weights of indicators

| i	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}
w_i	0,19	0,12	0,15	0,09	0,12	0,05	0,04	0,01	0,09	0,02	0,00	0,04	0,05	0,01	0,01

Source: own processing

2.3 The Calculation of the CI

According to the relationships above, sub-indices were calculated per sphere. Sub-indicator for the economic sphere is marked CI_{ec}, for the social CI_s and for the environmental CI_{en}. In the case where the value of calculated indicator $CI \cong 1$, studied region can be regarded as within the average. If the value is greater than 1, then it is above average and, otherwise, below average. The column graph (Graph 2) shows the calculated values of composite sub-indicators per sphere. For each region is displayed in three columns and six spheres are always next to each other compared the years 2010 and 2016.

**Graph 2. Regional subindicators CI in bar graph**
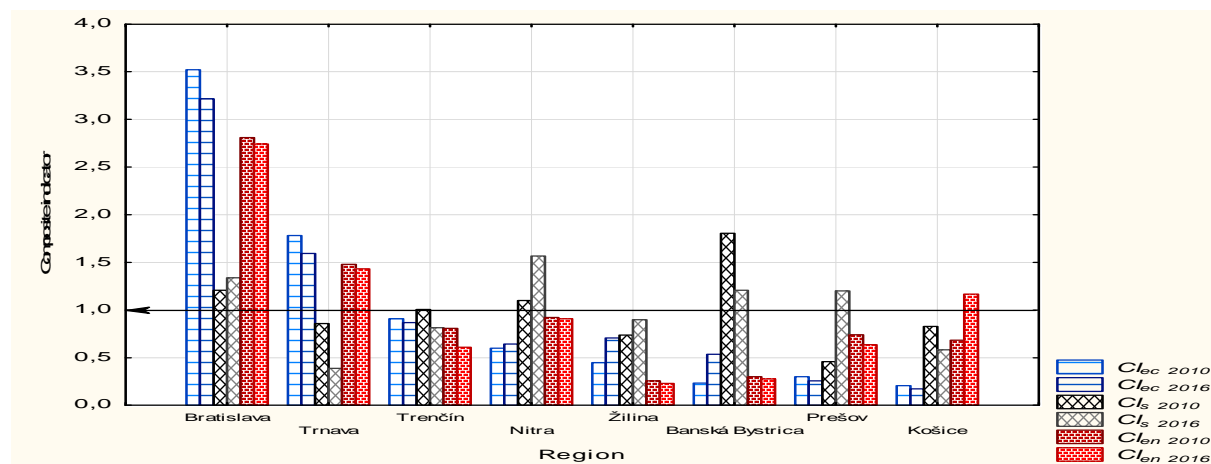
Source: own processing

From the graph it is clear that the best results in the economic sphere reaches the region Bratislava. In the year 2010, the value of $CI_{ec\,2010} = 3,52$, which is above average. A value greater than 1 has only reached the region of Trnava. The Trenčín region was just below the average, $CI_{ec\,2010} = 0,91$. The weakest in the economic area in 2010 was the region Košice, the value of the composite sub-indicator $CI_{ec\,2010} = 0,21$. In 2016, in most regions, value of $CI_{ec\,2016}$ dropped, however, a significant increase is observed in the region of Žilina and Banská Bystrica. The region of Bratislava is well above average in the social field. Since 2010, the situation improved even.

The increase was recorded in the regions of Nitra, Žilina and B. Bystrica. The best value of the monitored sub-indicator is recorded in region Nitra in 2016, $CI_{ec\,2016} = 1,57$. In the environmental sphere is once again the best region of Bratislava. The region of Trenčín also has the value of this sub-indicator overriding. In 2010, the Košice region fell from a deep sub-premium in the period under review to an average to above average.

Subsequently, the total aggregated indicator was constructed from the calculated values of the sub-indicators for each sphere. The chart shows regions with *CI* above and below *CI*.

Graph 3. Regional CI
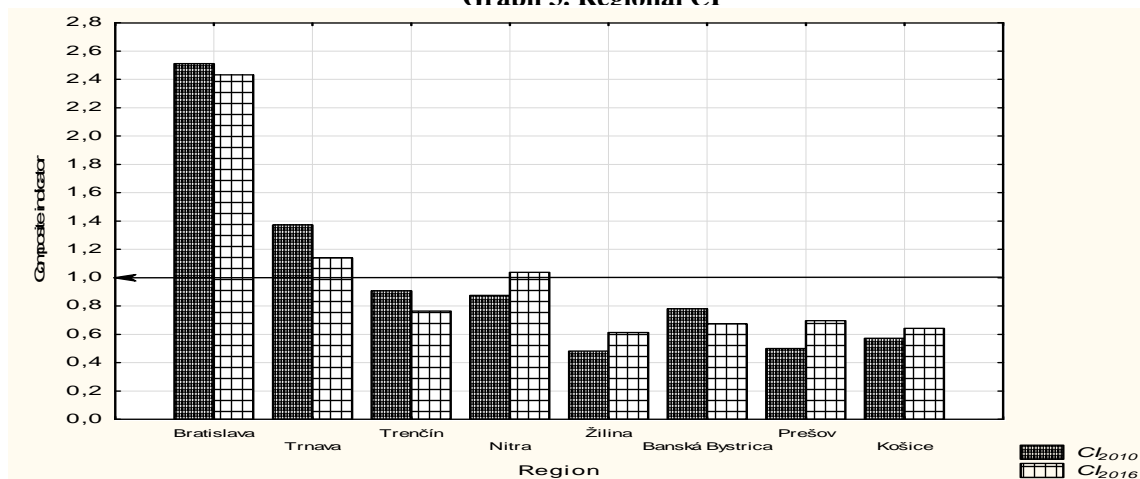
Source: own processing

Region of Bratislava is in the comparison of high-above average. Even though it was a slight decrease over the period considered. Also in the Trnava region, which is still above the average. Above average, the Nitra region was also reached in 2016. The decline has occurred in the region of Trenčín and Banská Bystrica. A slight increase in Žilina, Prešov and Košice. All calculated values of each sub-indicator for each region are in the following table. There are also referred to the aggregate value of the composite indicator for the year 2010 and for the year 2016.

Table 3. Aggregated indicators CI

Region	Sub-indicators						Aggregated Indicator	
	2010	2016	2010	2016	2010	2016		
	CI_{ec}	CI_{ec}	CI_s	CI_s	CI_{en}	CI_{en}	CI_{2010}	CI_{2016}
Bratislava	3,52	3,22	1,21	1,34	2,81	2,74	2,51	2,43
Trnava	1,78	1,59	0,86	0,39	1,48	1,43	1,37	1,14
Nitra	0,91	0,87	1,01	0,82	0,81	0,61	0,91	0,76
Trenčín	0,60	0,64	1,10	1,57	0,92	0,91	0,87	1,04
Žilina	0,45	0,71	0,74	0,90	0,26	0,23	0,48	0,61
B. Bystrica	0,23	0,54	1,81	1,21	0,30	0,28	0,78	0,67
Prešov	0,30	0,26	0,46	1,20	0,74	0,64	0,50	0,70
Košice	0,21	0,17	0,83	0,58	0,68	1,17	0,57	0,64

Source: own processing

The development of regional disparities in the analyzed regions was monitored by the *β*-convergence method. The graph shows the decreasing trend in the regression line, with a coefficient of determination $R^2 = 0,37$, while the speed of convergence is 0,0138. Conclusion of the *β*-convergence measurement is thus that convergence prevailed in the set of eight regions over the period of time, since the regression line directive is negative. Given that the calculated value of the determination coefficient does not exceed 80%, there can be no sign of a significant tendency towards convergence.

Graph 4. Beta convergence
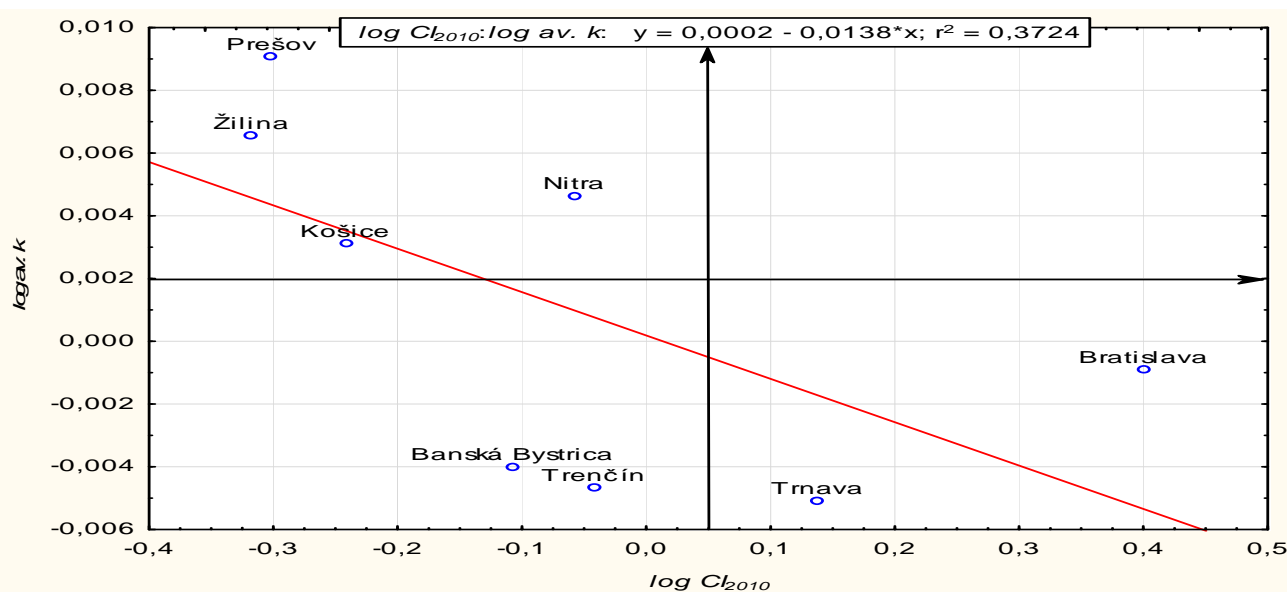
Source: own processing

It can be seen from the correlation chart that the Prešov, Žilina, Košice and Nitra regions are located in the second quadrant. Here are the regions with the under-deduction value and the highest increase over the reference period. Concerning the existence of clusters in these regions, it can be said that the emergence of new clusters is likely to have an effect on the increase in the overall level of these regions. In the third quadrant, the regions of Banská Bystrica and Trenčín. So, regions with under-valued value CI_{2010} and at the same time the slowest growth. In Banská Bystrica there was no cluster initiative for the period under review. In the fourth quadrant are the regions of Bratislava and Nitra. Here the initial value of the monitored composite indicator is excessive, but the growth is sub-average. In the period under review, three clusters were established in Bratislava and one in Trnava.

Conclusion

The basic sense of regional development is to sustainably improve the quality of life in the region. Achieving this basic goal requires a comprehensive approach to assessing regional differences. One approach is to measure and compare the level of regional development or quality of life in the region. The contribution is a composite indicator to compare the social, economic and environmental level of the regions of Slovakia. The base has been elected the year 2010. 15 indicators were analyzed. Using the results of the PCA analysis, they were assigned to individual weights. Using these, three sub-indices were calculated for each region. For the economic, social and environmental spheres. Using these values, the regions were compared to each other.

An aggregated composite indicator was constructed from the calculated sub-indicators *CI*. It is clear from the results that the best value for the *CI* is in the long run the Bratislava region, although its value is decreasing over the 10 years monitored. *CI* has increased in regions Nitra, Žilina, Prešov and Košice. In these regions, there are currently an average of five clusters per region. The Trenčín region has a long-term under-level. Only three functioning clusters are currently registered in this region. In this context it can be stated that the emergence of new clusters could raise the level of the region.

From the results of the analysis of the assessment of the reduction of regional disparities, it is not possible to state a statistically significant decrease in regional differences. A certain tendency was observable, but still there are still large regional differences in Slovakia, as in the economic, social and environmental spheres.

Acknowledgments

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