Evaluation of Sustainable Development in the Regions of Slovakia Using Selected Indicators

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Abstract

Sustainability is considered as problematic category for evaluation, which incorporates various dimensions including economic development and growth as well as the quality of the environment, quality of life in its social and moral dimension. Sustainable development is generally evaluated via range of indicators representing the four pillars of sustainability. They can serve for monitoring of regional disparities in embedding the sustainability in the regions of Slovakia. The aim of the paper is to analyze the current state of sustainable development in the Slovak regions at NUTS III level using selected indicators of sustainable development. Based on statistic data analysis of selected sustainable development indicators we can identify the pillars in which the regions have some presumption for improvement. Partial improvement of even a single indicator and partial improvement even in just one area, however, will result in an overall improvement of the status of the region.

Key words: sustainable development, regions, indicators

JEL Classification: Q56

1 Introduction

Economic activities of society are often developed at the expense of quality of environment. The issue of economic prosperity and a high quality of environment is currently one of the most debatable. It seems very difficult to achieve high economic growth without negative effects on the environment respectively without negative impacts to the environment (Hronec, 2000; Adamišin, 2007). Dimensions of economy and ecology often stand facing each other and the development of one of them is done often at the expense of the other. It is therefore necessary to look for ways to develop economic life without harming the environment, as the society responds to changes in environmental quality will be much more sensitive than in the past. This may be due to long-term accumulation of problems in certain localities, but also an effort to achieve better quality of life. Regarding O´Riordan (2000) the most important point to grasp about sustainable development it the paradoxical observation that it will only succeed by capturing and redirecting social and economic change.

View of the quality of the environment is often coincided with the view of the quality of life. But it is not easy to ensure the economic development of society and flawless environment, as becomes clear from resource constraints and efficiency of its use.

The need to maintain a good environment and habitat for future generations becomes a key issue in planning economic activities. Requirements for high-quality natural resources are increasing in every economic field. Similarly the increased emphasis is put on waste management and outputs from production, which would be based not only on respect for the principles of economy but also on respect for environmental principles.

Sustainability problem persists in society for many years. A comprehensive definition of sustainable development first appeared in the report of the Club of Rome (1972), which states that sustainable development is a global equilibrium state in which the population of the earth and capital are maintained on more or less constant level and tendencies influencing the growth or decline in these variables must be kept under close control. For the most widely used definition of sustainable development is generally considered the definition given in the report of the World Commission on Environment and Development (1987), that sustainable development means the developing satisfying the needs of current generations without compromising the ability of meeting the needs of future generations. In practice, there are still many views and definitions of sustainable development. Sustainability depends on many current issues that has grown from the local dimension into a global, world problems of mankind (Demo, M. - Hronec, O. - Tóthová, M., 2007).

Sustainability is a multidimensional sphere of enforcement and formation of human activities. Synergy of environmental, social and economic aspects of the environment shapes the lives of the individuals whose quality depends on (his) previous decisions (decisions of the society, decisions made by previous generations) in a given space. Quality of life was thus formed in space and time. These two dimensions together with mutual human relationship with the environment and the surroundings are critical factors that shape and affect the quality of the environment and quality of life in it. Because of the relatively complicated quantification of these quantities, to measure the sustainability is used complex, set of indicators, which are divided into four basic groups. (Demo, M. - Hronec, O. - Tóthová, M., 2007) These are the indicators:
- economic,
- environmental,
- social,
- institutional.

Their synergy offers the opportunity for a comprehensive assessment of the state of sustainability in the selected region. It should be noted that many of these indicators are still developing, in order to clarify the information content of the measurement of some issue.

For the environmental dimension of sustainable development have been developed and aggregated indicators of Wellbeing Index - WI, which aggregates 36 indicators, or the Environmental Sustainability Index (Environmental Sustainability Index - ESI) which was later replaced by EPI (Environmental Performance Index). It is a way of evaluating states in terms of overall environmental performance. EPI uses score, where maximum value of points is 100 and consists of 25 criteria divided into several categories.

2 Materials and Methods

In this paper we used the method of cluster analysis to identify a set of similar regions on the basis of selected indicators of sustainable development. The analysis was performed using the statistical software Statistica and trial versions of statistical software NCSS 9. Quality of clusters was verified through cophenetic correlation coefficient and delta parameters. The input data for the individual variables were obtained from the Statistical Office of the Slovak Republic (http://www.statistics.sk).

3 Results and Discussion

The paper deals with the evaluation of the state of sustainable development in the various regions of Slovakia. Since this is a very complex issue, for the purposes of this paper, we select only some representative indicators of the four dimensions of sustainable development (listed in Table 1) for the period for which data were available for all indicators, i.e. for the 2010. Economic pillar is represented by the four indicators, the social pillar is represented by five indicators, environmental pillar is presented by four indicators and institutional pillar, for the purposes of this paper, consists of only two indicators (particularly because of the overall low availability of evaluation indicators in this pillar). It is known that this choice of indicators does not provide an overall picture of the current state and ensuring the sustainability in the regions of Slovakia, but can help identify "outbreaks of sustainability" i.e. a group of regions that have (already in partial outputs) good approach to implementing sustainability (in all pillars of sustainability) and also tends to identify regions (which even at sub evaluation) do not exhibit the desired (or expected) values, while taking into account all four dimensions of sustainability.

Tab. 1 Values of indicators of sustainable development (SD) in the regions of Slovakia in 2010

Pillars of SD	Indicators of SD	Regions of the SR							
		BA	TT	TN	NR	ZA	BB	PO	KE
Economic	Regional gross domestic product per capita (EUR)	29241	13634	10744	10078	10746	8974	6861	9581
	Gross added value at current prices (mil. EUR)	16635	6970	5851	6460	6819	5325	5042	6786
	Gross fixed capital formation at current prices (mil. EUR)	4777	1397	1195	1261	1373	1253	1146	1448
	Foreign direct investment (EUR)	25 182 386	3 109 697	1 803 931	1 552 909	2 283 702	816171	415900	2 500 399
Social	Unemployment rate (%)	5	8	10	12	11	19	18	17
	Population density per km^2	306	136	133	111	103	69	90	116
	Life expectancy at birth - males	74	72	72	71	71	70	71	71
	Life expectancy at birth - females	80	79	80	79	79	79	80	78
	Number of population supplied with water from public water (%)	96	86	89	90	89	86	78	81
Environmental	Sulfur dioxide emissions in tonnes	10436	472	37232	532	2949	4157	2474	10875

	Nitrogen oxide emissions in tonnes	5564	1487	6892	2603	4757	5399	2785	13541
	The quantity of disposed municipal waste per capita in kg	187	367	289	332	302	232	232	195
	Amount of treated wastewater in thousands m^3	71352	39731	42591	45193	111489	62201	62701	61781
Institutional	Expenditure on research and development (EUR)	208159688	27996351	47520416	18776310	31043817	18775470	11588983	52507710
	Research and development personnel (number of people)	13839	1578	1535	1865	2482	2018	1090	3721

Source: SO SR, http://www.statistics.sk

In this paper, based on data obtained from the Statistical Office we used the method of cluster analysis to identify a set of similar regions on the basis of selected indicators of sustainable development. For analysis, we created a number of dendrograms, as the results of variant clustering methods, whenever the rates of Euclidean distance. Quality of clusters was verified through cophenetic correlation coefficient and delta parameters. Different values at variant clusters were not significant, and dendrograms had a very similar shape. For a better overview within individual clusters, respectively elements of clusters, we applied a standardized scale of dendrogram. The results of clustering are shown below in the dendrogram (Figure. 1).

Fig. 1

Dendrogram for 8 cases
Weighted average of coupled groups
Euclidean distance
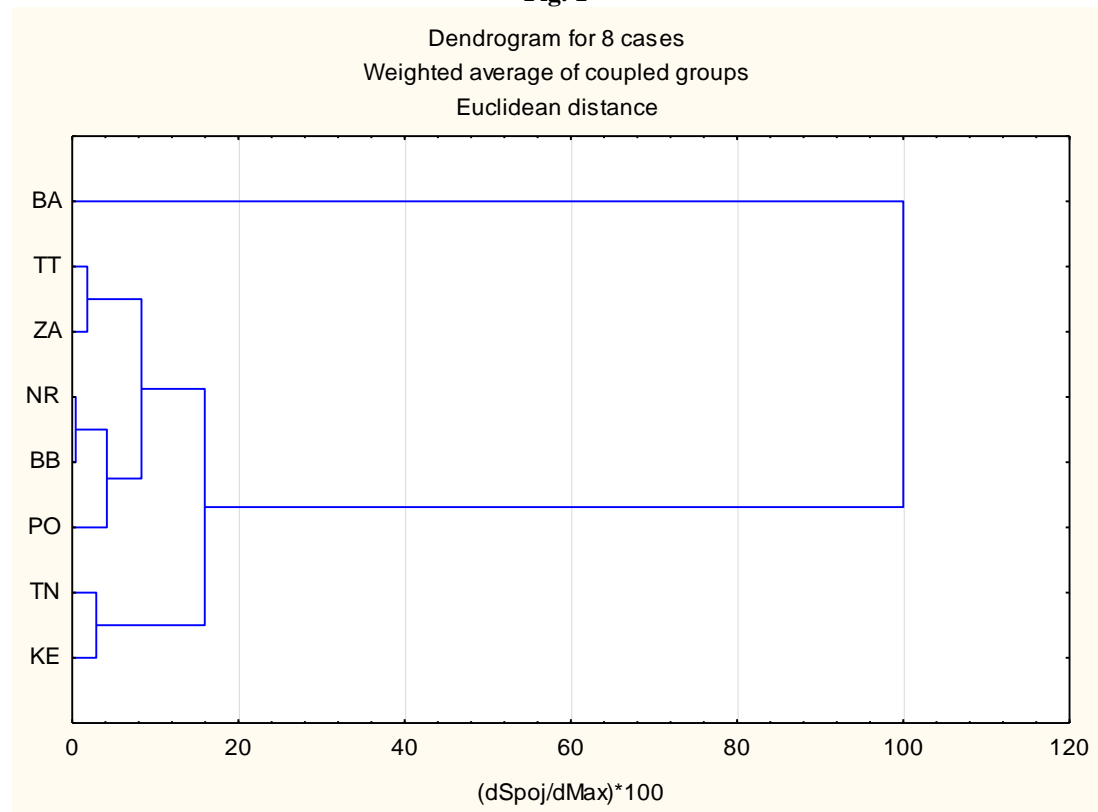
Based on the performed analysis we can very clearly identify several clusters. As we expected, Bratislava creates a separate cluster. It is a region that has a specific position in terms of

economic development and growth and thus has leading position in achieving the best results in the application and building sustainability.

Reached extreme values of the Bratislava region in individual indicators of sustainable development in comparison with those in other regions may lead to reflections on the elimination of this region from further analyses - also with regard to single-member cluster, also due to the distance of the connection of the last region.

The remaining regions can be divided into two, respectively into three clusters. Division into three separate clusters (except Bratislava region; deducing from the above reasons) is represented by these regions:

1) Region of Trnava and Žilina,
2) Region of Nitra, Banská Bystrica, Prešov (while regions of Nitra and Banská Bystrica showed among all analyzed regions of a given set of indicators of sustainable development the highest degree of similarity),
3) Region of Trenčín and Košice.

If we consider only two clusters, the above clusters 1 and 2 form a separate cluster (TT, ZA, NR, BB region) and the original cluster 3 will form a separate second cluster (TN, KE region). The similarity in values achieved is evident in the two clusters, namely:

1) Region of Trnava, Žilina, Nitra, Banska Bystrica and Prešov,
2) Region of Trenčín and Košice.

Again we exclude Bratislava region which achieve separate status among the regions of Slovakia and it achieved specific values in all the indicators. Therefore it cannot be considered as representative of the current state and state of implementation of the sustainable development in Slovakia; though it can be considered as the current optimum in this process when values achieved by Bratislava region are also requested for other regions and they represent the target values (especially in the area of economic, social and institutional), which other regions fail to achieve in long term horizons.

Partial assessment of individual pillars of sustainability leads us to constatation that the Bratislava Region reached the best value in selected indicators. Region of Trnava and Košice also occupy the second place in evaluation of the economic pillar, which is positive. Region of Prešov in all indicators (of economic pillar) performs worst rating, which indicates the problem of building sustainability. The social pillar is also characterized by a predominance of positive results for the Bratislava region, while negative evaluations are no longer in this pillar concentrated in a single region, but three - Banská Bystrica, Prešov and Košice (although it should be noted that this is a small value differences). The environmental pillar achieves the best value in Trnava region and institutional pillar again is strongest in Bratislava region, which is given by the greater localization of research representatives - research centers are mostly located in this region.

For each region, the results of the partial evaluation represent a suitable input for the analysis of building the sustainability and in the planning process of the development and growth of particular region. Performed cluster analysis and the results of clustering are important especially in terms of the selection of appropriate tools useful in the process of regional development. Similarity of regions makes them more suitable for the possibility of using similar procedures or methods in the management of regions and leads to the benchmarking and learning from the more

successful regions. To the deeper assessment of the current state of each sphere of regional development on the level of economic, social and environmental development are devoted works of (Tej - Adamišin, 2012; Adamišin - Kotulič, 2013) and the specific problems of sustainability in the environmental field are dealt in Vilček, J. - Hronec, O. - Tomáš, J. (2012); Fazekašová, D. (2012) and Fazekašová, D. et al. (2014).

4 Conclusion

Based on the evaluation of partial indicators of sustainable development in the Slovak regions in a given year based on performed cluster analysis, we can conclude that different regions produce two to three clusters with similar performance characteristics, while Bratislava region creates a separated specific cluster. Other regions are not sufficiently similar in terms of achieved values and are not capable of achieving positive results in all (four) dimensions of sustainable development nor in most of these dimensions. Usually they have a good rating only in a small number of indicators. Therefore, it is important to identify the pillars in which the region has some presumption for improvement (where it reaches good values of indicators evaluation).

Partial improvement of even a single indicator and partial improvement even in just one area, however, will result in an overall improvement of the status of the region. It is therefore important that the actors and representatives of different regions deal with the results of such assessments and look for opportunities towards building sustainability. It has to be mentioned that it is necessary to take into account some presumptions and specifications of the development of individual regions (particularly in terms of historical, geographical or cultural sphere). After all, important in this process will not be to reach the most satisfactory values of indicators, but achieving the expected (often so complicated and ambiguous quantified) quality of life, including the quality of the environment.

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