

## MULTI-CRITERIA EVALUATION OF MUNICIPALITIES IN SLOVAKIA - CASE STUDY IN SELECTED DISTRICTS

Vavrek R., Adamisin P., Kotulic R. \*

**Abstract:** In the Slovak Republic, the economy of the municipality is governed by the law that considers the indebtedness of the municipality (share of foreign resources on assets) as the main criterion. The aim of this article is to propose an alternative to the legal perspective on the evaluation of municipalities in the Slovak Republic. The article describes the TOPSIS technique as a possibly suitable alternative for the complex evaluation of municipalities' economy in selected countries. On the sample of 91 municipalities in Presov district, 85 municipalities in Bardejov district and 68 municipalities in Vranov nad Toplou district the TOPSIS method is applied on the basis of 8 previously set criteria. Results of the application are further studied in order to identify correlations between the result and criteria studied as well as the identification of differences (similarities) in the economy of municipalities in reference districts. As results of our analysis can be mentioned imbalance of municipalities' economy in each district, high variation margin of results achieved or fact that municipalities exhibit the same fixed linking to selected criteria.

**Key words:** Bardejov district, Presov district, Vranov nad Toplou district, TOPSIS technique, comparison.

DOI: 10.17512/pjms.2017.16.2.25

*Article's history:*

*Received July 21, 2015; Revised July 30, 2016; Accepted September 14, 2016*

### Introduction

The economic activity of every economic subject is regulated by the legislature that defines its scope of reference. The municipality is defined by the legislation in the Slovak Republic as well as in other states. According to the Constitution of the Slovak Republic (1992), the local self-government is formed by the municipality and higher territorial units. The basic unit is the municipality defined by the Constitution and the Act No 369/1990 Coll. The higher territorial units (according to Act No 302/2001 Coll.) are defined by the area consisting of a larger number of basic units (municipalities).

The basic general definition of the municipality as the basic unit of the local self-government is based in the constitution of individual states and is always amended by further special legislation. The Constitution of the Slovak Republic (1992) defines the municipality as independent territorial and administrative unit of the Slovak Republic, associating individuals permanently residing therein. The

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\* **Roman Vavrek, PhD., doc. Ing. Peter Adamisin, PhD, doc. Ing. Rastislav Kotulic, PhD.,** University of Presov in Presov, Faculty of Management

✉ Corresponding author: roman.vavrek@yahoo.com

✉ peter.adamisin@unipo.sk; rastislav.kotulic@unipo.sk

Constitution of the Czech Republic (1993) defines the municipality in simpler terms as a territorial community of citizens with the right of self-government. The Constitution of the Republic of Poland (1997) defines the municipality as the basic unit of the territorial self-government that fulfills its specific functions. The Fundamental Law of Hungary (1949) does not define the municipality and the territorial self-government is amended by special laws. In Austria, the municipality is understood as an independent economic subject defined by the Austrian Federal Constitution (1945) as legal entity with self-governing rights. Act No 369/1990 Coll. defines the municipality as an independent territorial and administrative unit of the Slovak Republic. It associates individuals permanently residing therein. It is a legal entity independently managing its economy, property and income within the legislative framework. In the Czech Republic (Act No 128/2000 Coll.), this defines the basic territorial self-governing community of citizens that forms the territorial unit defined by the boundaries of the area of the municipality. It should be mentioned that representatives of cities as well does not prefer replenishment of income budgets loss, reducing the tax burden of citizens and businesses by real estate taxes (Balazova et al., 2016). In the Slovak republic and other above mentioned country, there is no framework (including legislative one) that would complexly evaluate economy of municipalities and the effectivity thereof, which absence is considered as a space for the application of the TOPSIS method for a more complex evaluation of economy of these subjects.

#### **MCDM Methods as Methods of Efficiency Evaluation**

Literature outlines several options to measure efficiency in the public administration, especially in self-government too. Gaster and Squires (2003), Halasek et al. (2002) and others focus either on individual methods or group of methods. The breakdown follows the complexity of the methods used and identifies 3 categories of methods:

- evaluation methods based on one criterion,
- evaluation methods based on a number of criteria,
- comparative and management evaluation methods.

The first group of methods are based on one selected criterion (indicator), e.g. financial indicators or “input-output” methods. These methods are therefore easy to implement, however, they are the most distorted and were created for the purposes of the private sector, i.e. businesses. However, their modifications can also be used to evaluate public sector efficiency. Efficiency evaluation based on multiple criteria (second group) is a more complicated option, but on the other hand, this evaluation gives more insight into the real state of public sector efficiency. The basic advantage of these methods is the fact that they are not in a position to transform non-economic criteria into economic criteria at the cost of delicate, sometimes controversial operations. These methods include scales/ranges, methods of weight determination and methods based on pairwise comparison of variants.

The method of equal importance is not able to distinguish between the greater or lesser importance of the observed criteria, i.e., all criteria are evaluated equally. Ranking is based on assigning a point value based on certain preferences. The scoring method is similar to the previous method, but works with cardinal variables (preference of individual indicators). The principle of the Fuller's method is to allocate the points to each pair of indicators and then to sum up the points obtained. Vavrek (2017) used this method to evaluate municipalities in the Slovak Republic. Saaty's method works much like the previous methods. The only difference is that it also determines the size of this preference. The weighted sum method is particularly suited to determine quantitative criteria, assuming a linear dependence of the utility rate on criteria (indicators). The basic variant method determines the best or desired values and then calculates the utility rate of each alternative. The lexicographic method is based on the assumption that the most important criterion has the greatest influence. In the case of compliance, the second and the criterion after that shall be taken into account. When solving a problem the AHP method takes into account all the elements that affect the outcome (the links between them and the intensity with which they influence each other). The TOPSIS method chooses the variant that is closest to the pre-set ideal and at the same time the furthest from the basal variant. Comparative methods, as a part of the last group of above mentioned methods, are based on a territorial or institutional comparison of the cost of public goods production. Their use assumes the right choice of comparative variables. For the greatest objectivity of comparison, it is required that the comparative indicators have the same scope and apply to the same constant. Managerial methods have been known to the private sector for a long time. They improve the quality of management, which is together with modernization the main premise for increasing the efficiency of funds use (Benchmarking, Benchlearning, CAF model, BSC methods, etc.). Many of above mentioned methods have been used e.g. by Becica (2015), Cooper et al. (2017), Dai and Kuosmanen (2014), Molica and Hirsch (2012) or Vrabkova et al. (2016).

### **Use of MCDM Methods in Managerial Practice**

According to several authors (Wang and Lee, 2010; Wu et al., 2013) the usage of various mathematical models and methods can be seen in for instance the banking sector. Brauers et al., (2014) describe the usage of MCDM methods by rating agencies in evaluation of banks. One of the MCDM methods is the TOPSIS technique that is applied as the primary and sole tool of the evaluation of municipalities' economy. The usage of this method is seen by Olson (2004) in manufactories, financial investment, evaluation of sport teams, and application of automated processes. The method was successfully used in order to compare the performance of companies and as a financial index for the evaluation of the performance in a specific sphere. Shih et al., (2006) recognize its use in among others water management, robot selection or facility location selection. Hashemkhani Zolfani and Antucheviciene (2012) add the sphere of risk assessment

of construction projects or comparison of the regional aircraft parameters, Zhou et al., (2017) use it in RMC quality evaluation, Radulescu and Radulescu (2017) rank cloud service providers using this method. Vavrek et al. (2014; 2015) or Vavrek (2017) used this method in the evaluation of municipalities in the Slovak Republic. Municipalities and financing of its activities are evaluated. The similar methods are used by Drastichova (2016), Papcunova et al. (2015), Suhanyi et al. (2016). The perception of the advantages and disadvantages of this method differs due to their use in different situations and contexts. When comparing with other relevant methods (AHP, ELECTRE), Shih et al. (2006) outline the following advantages of the TOPSIS method:

- the logic representing the rationality of human choice,
- the general value taking into account the best and worst values of the criteria,
- simple calculation which can be easily programmed,
- the result of alternatives can be illustrated by polyhedron (min. in 2 dimensions),

TOPSIS allows the decision maker to solve and analyze a problem, compare alternatives and compile their ranking. Bhutia and Phipon (2012) consider the easy to use, the ability to work with all types of criteria (subjective and objective), rationality and understandability, straightforwardness of calculation or the concept allowing the depict the best alternative though mathematical calculation as strengths of this method. The process of the application of this method is described more closely in the methodology, or described in more detail by Vavrek et al. (2015; 2015b).

### **Methodology**

The process of the application of this method is described more closely in the methodology, or described in more detail by Vavrek (2017). Municipalities are evaluated on the basis of 8 financial criteria that have been selected based on personal consultations with government auditors and municipalities' representatives:

- R1 –overall spending per inhabitant,
- R2 – share of foreign resources on the overall assets of the municipality,
- R3 – overall income per inhabitant of the municipality,
- R4 – result of the economy per inhabitant of the municipality,
- R5 – assets profitability,
- R6 – standard spending per inhabitant of the municipality,
- R7 – foreign resources per inhabitant of the municipality,
- R8 – standard income per inhabitant of the municipality.

Overall, municipalities are evaluated in the basis of the relative proximity to the ideal variant ( $c_i$ ), that can reach values in the interval of  $\langle 0;1 \rangle$ . For the purposes of the pilot comparison of municipalities in the Slovak Republic, districts from Presov region was selected at random. As the representative of this region, Bardejov

district (85 municipalities), Presov district (91 municipalities) and Vranov nad Toplou district (68 municipalities) were selected. Data from years 2013 to 2015 were analysed individually and further on the whole three year period was analysed according to the formula:

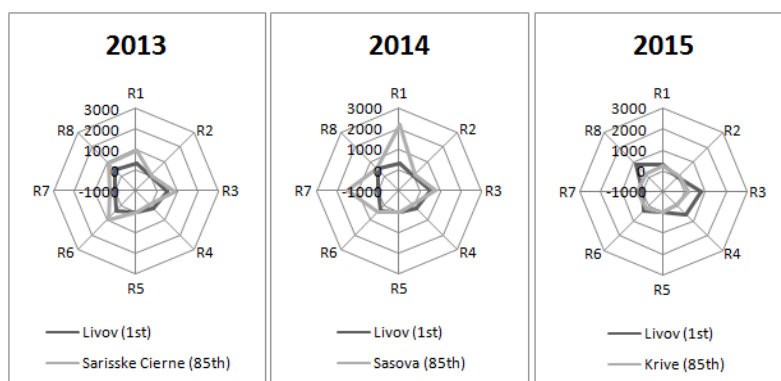
$$V_{10-13} = V_{13} * 0,8 + V_{14} * 0,9 + V_{15} * 1$$

This constructed overall evaluation is set in the interval of  $\langle 0; 2.7 \rangle$ , according to the characteristics of the TOPSIS method the maximization of this indicator is desired. For the purposes of this article, all monitored criteria were equal, i.e. each of them disposed of the 0.125 weight.

The data processing and further analyses were calculated with the use of Statgraphics, Statistica 12 and MS Office Excel.

### **Municipalities' Results of Bardejov District**

In 2013, better evaluated were municipalities with lower amount of inhabitants with the best evaluated municipality Livov reached only 90 inhabitants. The best evaluated municipality with the number of inhabitants above 1,000 was Klusov, that ranked 27th. There is a large variation margin in results ( $R = 0.545$ ), that in the scope of the possible interval of the relative proximity to the PIS represents a large differences between evaluations of municipalities. In 2014, the best evaluated municipality was Livov that registered the same rank since the previous year. Repeatedly, among the best evaluated municipalities were mainly small municipalities, the only municipality with the number of inhabitants above 1,000 in the top 20 was Zborov (15<sup>th</sup> place). The variation margin and thus the diversity in evaluation decreased ( $R = 0.376$ ), which was caused by improvement of the worst ranked municipality. Brezovka descended by 69 places, Hervartov by 59 and Harhaj by 50 places. These three municipalities registered at the same time the highest inter-annual descent. In the third monitored year, the best evaluated municipality was Livov again. The best evaluated municipality with more than 1,000 inhabitants from previous year descended to place 23 and its previous position was taken by Malcov (17<sup>th</sup> place). Municipalities' economy balanced ( $R = 0.312$ ), with first municipality was separated from other by 74 thousandths. Inter-annually, the highest improvement was registered by municipalities from the lower part of the ranking in 2014. Lipova moved by 65 places, Hervartov by 61 places.



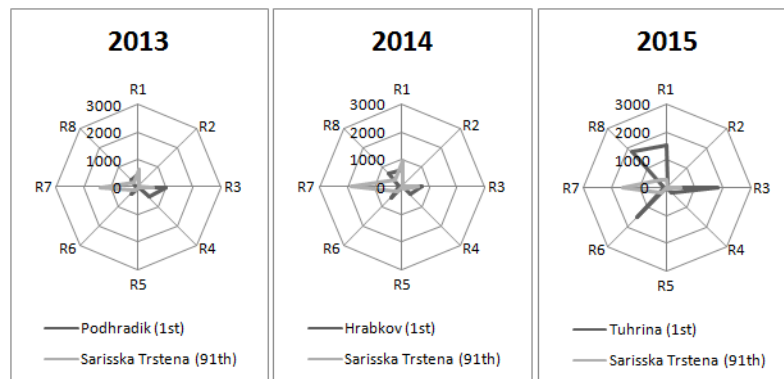
**Figure 1. Graphic comparison of municipalities in Bardejov district in individual years** (own processing)

In order of a more objective evaluation on the basis of selected methods and processed, municipalities were evaluated for the period of three years together emphasizing the last gained data (see methodology). The best evaluated municipality was Livov that reached the best results in individual years of the monitored period. Thanks for the dominant position in 2014, Smilno ranked on the second place. The difference in evaluation of following municipalities is minimal (counted by tenths of  $c_i$ ) with the best evaluated municipality with the number of inhabitants of more than 1,000 was Zborov ranking 21<sup>th</sup>. Based on the individual evaluation of municipalities in singular years it is possible to clearly identify Livov as a municipality that can be considered as the best regarding its economy according to selected criteria).

#### **Municipalities' Results of Presov District**

In 2013, the top five places in the ranking were taken by small municipalities with the number of inhabitants lower than 1,000. The best evaluated municipality was Podhradik with 373 inhabitants. As the highest from municipalities with the number of inhabitants above 1,000 ranked Siroke (6<sup>th</sup> place). The variation margin of results ( $R = 0.487$ ) indicates a unbalance in the evaluation of municipalities' economy. It is mainly caused by the primacy of the evaluated municipality (difference between the first and the second place was 0.202). In 2014, the highest ranking was Hrabkov (687 inhabitants) that has moved by 70 place from the previous year. The most significant fall was registered by Lipniky (87 places) or Podhradik as the best evaluated municipality in 2013 (81 places). On the contrary, the highest inter-annual rise can be seen by Petrovany (73 places), or Hrabkov (70 places). Differences between municipalities' economy decreased as well ( $R = 0.241$ ). In the last of the monitored years, the top ten of the best ranking municipalities included 3 with the number of inhabitants above 1,000 (Siroke, Chminianska Nova Ves, Mirkovce). The highest ranking municipality became

Tuhrina with 460 inhabitants. The highest increase compared to 2014 was registered by the already mentioned Lipniky (69 places) or Velky Saris (56 places).



**Figure 2. Graphic comparison of municipalities in Presov district in individual years**  
(own processing)

Based on the evaluation of municipalities in individual years as well as for the whole period, it is possible to identify Podhradik as the best managing economy according to set criteria. Among main signs of better ranking municipalities there are higher results of economy per inhabitant, higher profitability of assets, less foreign resources and thus lower indebtedness. It is not possible to clearly identify a municipality that can be considered as the best regarding its economy according to selected criteria (e.g. because of imbalanced results).

### **Municipalities' Results of Vranov Nad Toplov District**

The best evaluated municipality in 2013 was Posa. In 2013, better evaluated were municipalities with lower amount of inhabitants (in top 10 was only one municipality with more than 1,000 inhabitants). The best evaluated municipality with the number of inhabitants above 1,000 was Vehec, that ranked 5<sup>th</sup>. There is a large variation margin in results ( $R = 0.300$ ), that in the scope of the possible interval of the relative proximity to the PIS represents a medium differences between evaluations of municipalities. In 2014, the best evaluated municipality was Giglovcé that registered a significant move since the previous year (10 places). Among the best evaluated municipalities were mainly small municipalities, the only municipality with the number of inhabitants above 1,000 in the top 10 was Vehec (7<sup>th</sup> place). Zlatnik descended by 64 and Juskova Vola by 55 places. In the third monitored year, the best evaluated municipality was Bystre which was the best evaluated municipality with more than 1,000 inhabitants too. Municipalities' economy balanced ( $R = 0.323$ ), with last municipality was mainly separated from other by more than 9 hundredths. Inter-annually, the highest improvement was registered by municipalities as Juskova Vola which moved by 52 places, Vysny Zipov by 61 places too.

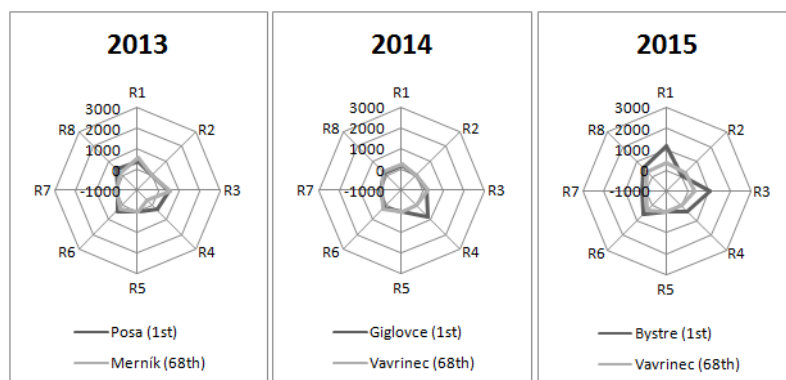


Figure 3. Graphic comparison of municipalities in Vranov nad Toplou district in individual years (own processing)

Municipalities were evaluated for the period of three years together emphasizing the last gained data (as in previous districts). The best evaluated municipality was Giglovice that reached the best results in individual years of the monitored period. But we cannot consider this municipality as a municipality as the best regarding its economy according to selected criteria). Thanks for the balanced positions in each year, Posa ranked on the second place. The difference in evaluation of the first and the second municipality is minimal ( $\Delta c_i = 0,007$ ). The best evaluated municipality with the number of inhabitants of more than 1,000 was Vevec ranking 7<sup>th</sup>.

### Comparison of Results

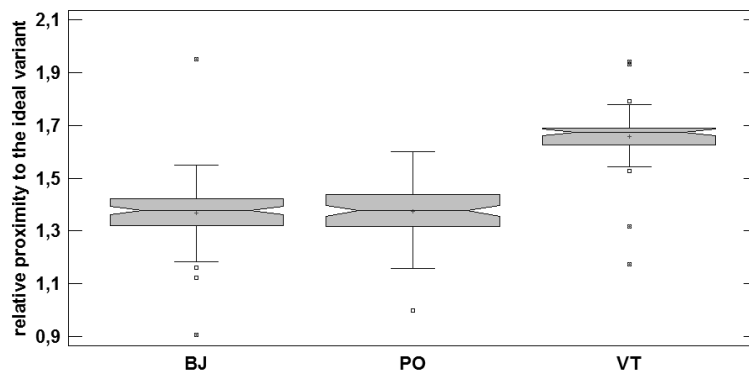
From the perspective of municipalities' economy, it is impossible to clearly evaluate one or the other district as a group of better or more balanced managing municipalities. In all three years, there are symptomatic significant differences between the best and worst managing municipalities that are often further strengthened by the dominant position of the highest ranking municipality (Table 1). Simultaneously, it is possible to observe the imbalance in municipalities' economy (significant inter-annual changes in rankings of a municipality) which can also be caused by minimum absolute differences of the evaluative indicator ( $c_i$ ).

Table 1. Comparison of the variation margin

district	2013	2014	2015
Bardejov district	0.546*	0.666	0.312
Presov district	0.487*	0.241	0.375
Vranov nad Toplou district	0.301	0.797*	0.324

\* extreme value of the first municipality ( $\Delta c_i \geq 0.10$ )





BJ - Bardejov district, PO - Presov district, VT - Vranov nad Toplou district  
**Figure 4. Comparison of the variation margin in whole period** (own processing)

Municipalities were compared on the basis of 8 identified criteria and the relation of these criteria and the result (the relative proximity to the PIS) can be denoted as independent from the belonging of the number of inhabitants. The common trend in each district is the lower share of foreign resources, the higher result of economy per inhabitant and the higher profitability of assets of higher ranking municipalities.

**Table 2. Confirmed correlations between results and selected criteria**

	year	R1	R2	R3	R4	R5	R6	R7	R8
Bardejov district	2013		-		+	+		-	
	2014	-	-		+	+		-	
	2015	-	-		+	+	-	-	
Presov district	2013		-		+	+		-	
	2014		-		+	+		-	
	2015	-	-		+	+		-	
Vranov nad Toplou district	2013		-		+	+		-	
	2014	-	-	-	+	+	-	-	-
	2015	+	-	+	+	+	+	-	+

at  $\alpha < 0,05$  calculated by Kendall rank coefficient

Despite of the demonstration of common trends and correlations in selected districts (Table 2) it is important to mention the difference in absolute values of monitored indicators.

### Summary

Public administration and local government in particular, which also includes municipalities in individual countries, is in the context of the economic crisis a very topical and widely discussed issue. The management of municipalities is subject to increasing control by the public, the state and the municipalities

themselves. Municipalities' economy is governed by a number of regulations that directly affect the function of the municipality in the Slovak Republic as well as in other countries. This article offers the TOPSIS technique as an alternative to the legally established framework for the evaluation of the function of municipality based on the previously selected set of criteria. This alternative offers a more complex evaluation that is possible to be modified and thus adapt to conditions in both countries.

The application of this method allows for the evaluation of economies in districts of Bardejov, Presov and Vranov nad Toplou as similar. The common sign is an already mentioned imbalance of municipalities' economy or the high variation margin of results that is to a certain extent compensated through the evaluation in a time period longer than one year. Municipalities in these districts exhibit the same fixed linking to selected criteria (except of Vranov nad Toplou district in three criteria).

We consider the TOPSIS method to be a suitable multi-criterion assessment tool for the use of which it is necessary to have financial indicators (which in some cases may limit its use). Its use is also conditioned by the appropriate selection of the monitored indicators and their weighting, which significantly determines the overall results. The verification of above achieved conclusions and assumption can be based on the application of the TOPSIS technique on a larger sample of municipalities in every district in Presov region or the Slovak republic as whole.

## Appendix

Supported by the Scientific Grant Agency of the Ministry of Education (Project VEGA no. 1/0139/16).

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### WIELOKRYTERIALNA EWALUACJA GMIN NA SŁOWACJI - STUDIUM PRZYPADKU W WYBRANYCH REJONACH

**Streszczenie:** W Republice Słowackiej, gospodarką gminy rządzą przepisy prawa uznające zadłużenie gminy (udział zasobów obcych w aktywach) za główne kryterium. Celem artykułu jest zaproponowanie alternatywy dla prawnej perspektywy oceny gmin w Republice Słowackiej. W artykule opisano technikę TOPSIS jako potencjalnie odpowiednią alternatywę dla złożonej oceny gospodarki gmin w wybranych krajach. Badania przeprowadzono, na próbie 91 gmin w powiecie preszowskim, 85 gmin w powiecie Bardejov i 68 gmin w rejonie Vranov nad Toplou. Metoda TOPSIS jest stosowana na podstawie 8 wcześniej ustalonych kryteriów. Wyniki zastosowania są następnie badane w celu zidentyfikowania korelacji pomiędzy wynikiem i badanymi kryteriami, jak również identyfikacji różnic (podobieństw) w gospodarkach gmin w okręgach referencyjnych. Jako wynik naszej analizy można wymienić nierównowagę gospodarki gminnej w każdym rejonie, wysoki margines zmienności uzyskanych wyników lub fakt, że gminy wykazują takie same stałe powiązanie z wybranymi kryteriami.

**Słowa kluczowe:** powiat Bardejowski, powiat Presov, rejon Vranov nad Toplou, technika TOPSIS, porównanie

#### 斯洛伐克市的多標準評估 – 某地區案例研究

**摘要:** 在斯洛伐克共和國，本市的經濟受到以市（負債佔國外資源的份額）為主要標準的法律的管轄。本文的目的是提出斯洛伐克共和國市鎮評估法律觀點的替代方案。本文將TOPSIS技術描述為對某些國家城市經濟綜合評估的一種可能的合適替代方法。在Presov地區的91個城市，Bardejov地區的85個城市以及Vranov nad Toplou地區的68個城市的樣本中，根據之前設定的8個標準應用TOPSIS方法。應用結果進一步研究，以確定研究結果和標準之間的相關性，以及確定參考地區的城市經濟的差異（相似性）。由於我們分析的結果可以提到各地區市鎮經濟的不平衡，所取得的成果的變化幅度很大，或者說市鎮與選定的標準具有相同的固定關聯。

**關鍵詞:** Bardejov區, Presov區, Vranov和Toplou區, TOPSIS技術