Chapter 20
Effectiveness of Use of MCDM Methods in the Terms of Local Self-Government

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Abstract The public administration perceived as executive action of the state, i.e., basic statutory subject in the Slovak Republic consists of two parts—state administration and self-government. The basic unit of self-government is the municipality. The basic unit of government is the municipality. The municipality is an economic entity and basic self-governing unit of local self-government, which manages its own property under the Law, disposes with own financial resources, and prepares its own budget. Municipal indebtedness significantly determining its action constitutes a single criterion laid down by law for evaluating its financial performance and necessity to establish a recovery mode or receivership in the municipality. The contribution discusses the selected methods of multi-criteria decision making, which are based on determining of the ranking according to the identified criteria which have a direct impact on the overall result. On the basis of previous utilization of describing methods in the various fields of the economy, the contribution explores the possibility of their use in the evaluation of the management of municipalities, i.e., the application in terms of local self-government. By choosing the right methodology it is possible to evaluate the quality of municipalities management and provide a way for a more efficient use of public funds. This analysis provided the space for comparison of these methods and confirmed their possible use in local self-government in the evaluation of management of municipalities.

Keywords MCDM methods • Local self-government

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20.1 Public and Local Self-Government in the Slovak Republic

According to various authors to determine and define the public administration is very difficult. The possible reason behind this might be that the science of the administrative law with its rural approach and the perspective of a single department was and still is not able to comprehensibly embrace such a complex topic as the public administration. The term public administration was coined in the time of the Roman law. According to Frumanova (2012) at that time, the term public administration represented the administration of the human society in a state with a state system. A key role in public administration has the effective use of public funds to provide public services (Tej and Jakubek 2015).

According to Pekova (2004), the public administration stands for a total of various executive bodies on individual levels of the government with different job descriptions, responsibilities. Currently, the public administration presents the representative of a community of citizens, their interests, and preferences. At the same time, it represents the plurality of the democratic system in the given municipality and participates on the creation of conditions for the social economic development of the municipality and maximizing of the economic prosperity in the scope of the given area.

Several authors (Provaznikova 2009; Siegl et al. 2011) consistently use the following scheme as an illustration of the constitution of the public administration (Fig. 20.1).

Municipality is considered to be the basic unit as is defined by the law (Act on municipal establishment) as "independent local self-governing and administrative unit of the Slovak Republic." It associates individuals residing on the territory. It is a legal entity managing its own property, own income which has its competencies (Bondor and Muresan 2012).

In the scope of the Slovak Republic, the economy of municipalities is amended by the law (Act on budgetary rules of local government), which considers the indebtedness of the municipality as the only economy evaluating criterion and that obliges the municipality by the following condition: "The municipality is obliged to establish a recovery mode, if the sum of its overdue liabilities exceeds 15 % of actual current income of the municipality of the previous financial year and, if did

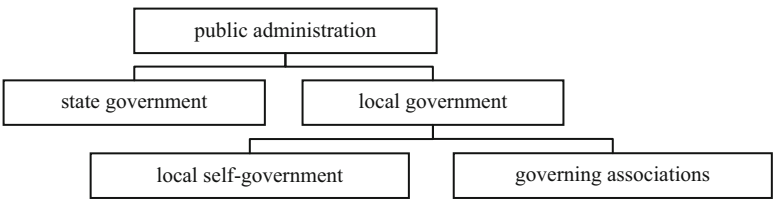

Fig. 20.1 Narrow concept of the public administration

not pay any recognized liability within 60 days from the date of its maturity." The absence of a complex system in the economy of municipalities presents a basis for the analysis of the possible introduction of such evaluation.

20.2 Efficiency of Units of the Local Self-Government

The increasing of the quality on the level of municipalities and thus the efficiency as well is possible according to Provaznikova (2009) apart from procedures and practices below with the help of the competition, the improvement of budgetary economy, and the public monitoring.

The literature mentions several ways of measuring of the effectiveness of the public administration, with different authors focusing one individual method alone, or in a group. One of these authors is Soukopova (2011), who divides the methods used for evaluating the effectiveness into two groups—empirical methods and theoretical methods. The latter group is subsequently divided into quantitative methods (statistical methods) and qualitative methods, which include the group of single-criterion and multi-criteria methods.

This part of article identifies the list of individual methods of the measuring of the efficiency, or its profits (the most important include their short description). This division is based on the complexity of used methods and identifies five categories of methods:

1. Single-criterion assessment method,
2. Multi-criteria assessment method,
3. Comparative methods,
4. Management assessment method,
5. Further selected assessment methods.

Single-criterion methods of evaluation, as the name suggests, are based on the assessment of a single selected criterion (indicator). This assumption offers this method as easily realized, however, it also the most misinterpreted. These methods include the financial indicators and the "input–output" methods.

These methods were created for requirements of the private sector, i.e., businesses, but their modification is possible to be used for the assessment of the efficiency of the public sector. Financial indicators (described also as methods of monetary assessment of investments in literature) are divided into dynamic and static based on the application of the temporal aspect during its calculation (add another two groups—uncertainty methods and non-profit oriented methods) (Jencova and Litavcova 2012). The common characteristic of "input–output" methods is the assessment of costs, in monetary terms; these methods (CMA, CBA, CEA, CUA) are described in detail by Vavrek et al. (2014).

The assessment of the efficiency based on multi-criteria presents a more complicated variant, but on the other hand, this assessment states more about the real status of the efficiency of the private or public sector. The primary advantage of

these methods is considered the fact that they do not force to reduce the non-economic criteria into economic criteria for the price of sensitive, sometimes even controversial operations (Rektorik et al. 2007). These methods include: 1. Scale and range (can be used individually or as a part of another method), 2. Methods for the determination of weights (method of equal importance, method of ranking, scoring method, Fuller method, and Saaty method), 3. Methods based on partial evaluation of variations (weighted sum approach method, base variant method), and 4. Methods based on pairwise comparisons of variations (lexicographical method, the AHP method, and the TOPSIS method).

The method of equal importance is unable to determine a higher or lower importance of assessed criteria, i.e., all criteria are assessed equally. The method of ranking is based on the information of the ordinal nature, where individual indicators are ascribed a point value on the basis of their preferences. The scoring method is similar to the previously mentioned one; however, it operates with cardinal variables of preferences of individual indicators. The principle of the Fuller method is based on the allocation of points to each pair member of assessed indicators and on the following sum of gained points. The Saaty method has a similar basis as the Fuller method, with the distinction of assessing the size of the preference and not only the direction of the preference of pairs of criteria. The weighted sum approach method is suitable mainly for the determination of quantitative criteria; it further implies a linear functionality of profits on criteria (indicators). The basis of the base variant method is the determination of the best, or beforehand desired values and the subsequent calculation of the profit function of each alternative. The lexicographical method is based on the assumption that the most important criterion has the highest impact. In case of the concordance, the second or next-in-line criterion is taken into account. The AHP method takes into consideration all elements that influence the result (ties between them and the intensity of their mutual influence) in the problem solving. The TOPSIS method is based on the selection of a variant that is closest to the beforehand set ideal variant and at the same time is the furthest from the base variant.

Comparative methods present the basis of management methods. According to Pekova (2004), these are based on the local or institutional comparison of costs of the production of public estates. Their use presupposes a correct selection of comparative values. The highest possible objectivity of the comparison requires that comparative values are of the same scope and are applied to the same constant (comparison in time, space). Management methods are known to the private sector for a long time. They are used for the increase of the quality of leadership, which together with modernization represents the main premise of the increased efficiency of the utilization of financial resources (benchmarking, BSC, CAF model, SWOT analysis, etc.), that are studied by, for example, Horvathova and Suhanyiova (2012); Kiselakova (2010).

In the next part, as further possible tools for utilization of the assessment of efficiency of the economy of municipalities methods of WSA and TOPSIS were analyzed as representatives of multi-criteria assessment methods.

20.3 Multi-Criteria Assessment Methods

Multi-criteria assessment methods might present a suitable tool in situation in which the decision on the application of the variant or its assessment is based on several criteria. Through the utilization of these methods it is possible to identify the best variant, rank variants from the best to the worst, or evaluate their efficiency (Soukopova 2011)

The objective of the multi-criteria decision making is according to Listiak (2012) on the basis of selected criteria to choose one variant that reaches the most acceptable characteristics. However, the fulfillment of this objective requires a vast amount of data that may not be available. Individual methods differ inter alia in whether they provide ordinal or cardinal information on the ranking of individual variants (or the importance of individual criteria) and whether they require ordinal or cardinal information on individual variants towards individual criteria (or the preference of individual criteria by the contractor) for its utilization. A different objective of these methods is described by Faltova et al. (2012), according to whom the objective is to lead the decision maker to the best alternative. Specifically implemented possibilities from which the selection is made are labeled variants and perspectives, according to which these variants are assessed are labeled as criteria. Individual methods of multi-criteria assessment were utilized in various spheres that include health care, business environment, analysis and selection of financial products, analysis of the planning of traffic building, environmental sphere, or at the assessment of the lighting of public open spaces. In the scope of multi-criteria methods, the following were selected WSA method (weighted sum approach method) and TOPSIS method.

20.3.1 Weighted Sum Approach Method (WSA Method) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS Method)

The WSA method represents a method suitable especially for comparative criteria. Minarik (2010) considers its main asset the maximization of profits of individual variants. The method is based on the construction of a linear function of profits on the scale of 0–1 (0—zero profits, 1—the highest profits). Overall profits represent the weighted sum of partial profits according to individual criteria. The procedure of the utilization of the method is described by Fiala et al. (1994) in these steps: 1. Compilation of the criterion matrix and vector weights construction, 2. Transformation of maximization criteria into minimization ones, 3. Calculation of profits of the alternative according to the selected criterion, and 4. Calculation of overall profits of the alternative.

The TOPSIS method represents the rational and relatively simple method whose basic assumption is that the alternative that is the most preferred does not have to

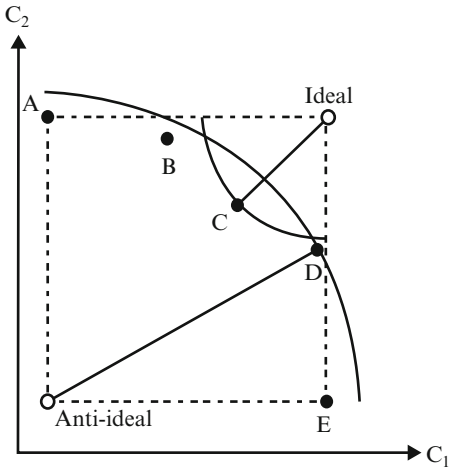

Fig. 20.2 Graphical representation of the TOPSIS method

represent the alternative that is closest to the so-called ideal solution. The basis is also the highest distance from the base (anti-ideal) variant thus the worst variant (Yilmaz and Harmancioglu 2010) (Fig. 20.2).

To illustrate, the above presented graph describes five alternatives (A, B, C, D, and E) as results of the decision on the basis of two criteria. The graph also identifies the ideal and base (anti-ideal) variant. It is clear that in the case of the utilization of the Euclidian distance ($p = 2$) while maintaining same weights of assessed indicators, the C point is the closest to the ideal variant and the D point is the farthest one. The TOPSIS method further addresses the dilemma of the selection of the suitable alternative in these cases.

Just as the WSA method, this method is based on cardinal information and consists of the determination of the minimum distance from the ideal variant. The procedure of the TOPSIS method is similarly described by Vavrek et al. (2014); Vavrek et al. (2015) and main steps can be identified as follows.

The first step in the application of the TOPSIS is the creation of the criterial matrix that represents the ranking of alternatives according to respective criteria that were defined prior (characteristics):

$$D = \begin{pmatrix} & X_1 & X_2 \ldots & X_j \ldots & X_n \\ A_1 & x_{11} & x_{12} \ldots & x_{1j} \ldots & x_{1n} \\ A_2 & x_{21} & x_{22} \ldots & x_{2j} \ldots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ A_i & x_{i1} & x_{i2} \ldots & x_{ij} \ldots & x_{in} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ A_m & x_{m1} & x_{m2} \ldots & x_{mj} \ldots & x_{mn} \end{pmatrix} \tag{20.1}$$

with: $A_i = i$ alternative,

x_{ij} = value of the j criteria that is reached by the i alternative

In the next step, the matrix is normalized with the use of the equation:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{j=1}^{j} x_{ij}^2}} \tag{20.2}$$

The obtained matrix of data is multiplied by the weight of respective criteria through the equation.

$$v_{ij} = w_{ij} \times r_{ij} \tag{20.3}$$

with: v_{ij} = weight normalized value
w_{ij} = weight of criterion

This obtained normalized matrix includes values that allow determining PIS and NIS. These variants may represent actual alternatives as well as hypothetical alternatives (composed of the best or worst gained results, respectively). The identification of PIS and NIS is possible to chart through the equation:

$$\mathrm{H}_j = \max\ \left(w_{ij}\right), \mathrm{D}_j = \min\ \left(w_{ij}\right) \tag{20.4}$$

with: H_j = PIS, D_j = NIS

The distance between the obtained PIS and NIS is calculated according to:

$$d_i^+ = \left[\sum_{j=1}^{k} \left(w_{ij} - H_j\right)^2,\right]^{1/2},\ d_i^- = \left[\sum_{j=1}^{k} \left(w_{ij} - D_j\right)^2,\right]^{1/2} \tag{20.5}$$

with: d^+ = distance from the PIS
d^- = distance from the NIS

From the perspective of alternatives, there is the minimum desired distance from PIS (d^+) and the maximum distance from NIS (d^-).

The main criterion according to which the ranking of alternatives is made is represented by the relative distance (proximity) from PIS that with the use of the equation below takes into account both identified distances from the previous step.

$$c_i = \frac{d_i^-}{d_i^- + d_i^+} \tag{20.6}$$

with: c_i = relative proximity to the PIS

The last step is the ranking based on the actual relative proximity of the alternative to PIS. The best evaluated alternative (municipality) is the alternative with the highest value reached.

20.3.2 *Advantages and Disadvantages of Multi-Criteria Assessment Methods?*

The advantage of multi-criteria methods is considered by Soukopova (2011) the possibility to reach apart from the economic perspective, even social, cultural, etc., perspective. In the case of criteria of a non-market character, multi-criteria methods seem as more suitable. The important is specifically the character of selected criteria that determines the utilization of the selected method.

The objective of selected criteria in the ideal case is to describe and monitor the system as a whole and offer basic information to the decision maker and the public. In general, there are recognized three important criteria functions (Listiak 2012):

- The set of criteria has to be able to describe the status and the performance of the analyzed system (the object of the assessment),
- Individual evaluations, applications should lead to the increase of the information value of the set of criteria,
- The set of criteria should be able to detect changes (economic, environmental, social, and cultural).

Criteria should be selected and defined taking into account the higher mentioned functions. In case of incorrect selection of criteria it is possible that the evaluation of incorrect parameters, functionalities of incorrect assumptions, intentional distortion even falsification of results, redirection of attention, or excessive confidence in the object of assessment can be made.

20.4 Conclusion and Discussion

This article presented a short description and inclusion of municipalities as basic units of local self-government, and it identified selected methods of multi-criteria decision making for the application of their assessment (Table 20.1).

The above-mentioned methods (TOPSIS method, WSA method) offer a possible alternative, however, for their meaningful utilization there are several questions to be answered:

Table 20.1 Pro and cons of WSA method and TOPSIS method

	+ (Positive)	− (Negative)
WSA method	Maximization of profits Accounted results min, max	Linear function of profits Distorting extreme values
TOPSIS method	Ideal solution and anti-ideal solution Complexity	Maximization character of criteria Calculation scale

- How to verify results gained through methods of multi-criteria assessment?
- How to choose suitable criteria that would be acceptable for individual municipalities, the state or other subjects?
- What should be the requirements for such set of criteria? (from the perspective of municipalities, the state, or other subjects)
- How to correctly determine the weight of criteria in case of their selection? Is a uniform distribution appropriate, so should all indicators of the same weight?

The aim of the future research is to answer these stated questions through application of selected methods at assessment of the economy of municipalities, and to compile a set of criteria for a complex verification of the economy of municipalities in the Slovak Republic.

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