TOPSIS Technique and its use in Local Self-Government: A Review of Methodological Literature

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Across the academic community, there is an increasing pressure to publish articles in journals indexed in the Web of Science database. The main objective of the research is to introduce TOPSIS technique (from both theoretical and practical perspective) as a suitable tool for decision making in the conditions of local self-government. This objective is achieved through four specific objectives, using a considerable number of sources and in the form of practical application in the conditions of local government in Slovakia. The results of our "review-based" research indicate that the TOPSIS technique is one of the basic and very popular MCDM methods. Its application in various areas is associated with the Entropy method and the pair comparison

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method or various objective methods for determining the importance of criteria. We are observing a growth trend in the application of this methodological approach in local government, which indicates its attractiveness and suitability for use in this area.

Keywords: TOPSIS technique, literature review, computation procedure, local self-government

1. Introduction

In the era of increasing global competition, which can be defined as broader than the 21st century, it is necessary to pay more and more attention to the efficient use of financial resources (Hsieh & Fu, 2014) or alternative sources identification and selection (Wu, Hsieh & Chang, 2013). The topic of Multiple Criteria Decision Making (MCDM) is gaining popularity, and its applications can be found in various areas of the private as well as the public sector. According to Govindan and Jepsen (2016), decision-making represents an important part of most activities of people, regardless of whether they are carried out on a daily basis or performed as part of a professional activity. Some of these decisions could be relatively simple, especially if the consequences of a poor decision are insignificant or small, while others can be very complex/important and have significant effects. In particular, the ranking of several evaluated alternatives, in order to select the best one available according to conflicting criteria, is a decisive factor in decision making (Cardoso & Sousa, 2015). Decision analysis is widely accepted as a sound normative theory (Zavadskas & Turskis, 2011). Terek (2007, p. 112) identifies the main problem of multicriteria decision making as "deciding how an improvement in the value of one criterion can be substituted for a deterioration in the value of another criterion". Thus, the problem addressed by MCDM methods is to find and evaluate "the best option from all of the feasible alternatives" (Jahanshahloo, Hosseinzadeh Lotfi & Izadikhah, 2006, p. 1544). According to Stanujkic, Đorđević and Đorđević (2013), these methods represent a process of selection and choice of one alternative from the available options based on a predefined set of criteria with different importance. Čereška and colleagues (2018, p. 9) add that their intention is to "combine the criteria values and weights to obtain a single point of reference for evaluation". The preferences of the person responsible for the decision

(decision maker) are taken into account and thus the actual outcome, ranking or recommendation may change depending on these preferences (Cinelli et al., 2020). On the other hand, MCDM can also be considered a "complex and dynamic process performed at two levels: first, an engineering level, which may be labelled a decision-making aid phase; and the second, a managerial level of acceptance of the solution" (Duckstein & Opricovic, 1980, p. 14).

Decision making as such is part of everyday processes in various spheres of personal, professional, and public life. The research question that this study aims to answer is as follows:

– Is it possible to use the TOPSIS technique : (technique for Order of Preference by Similarity to Ideal Solution) to evaluate local government entities?

According to Pandev, Komal and Dincer (2023, p. 18015), the TOPSIS technique is "an MCDM approach that ranks and chooses the appropriate alternative from a group of alternatives by using a number of criteria". Our intention is to present the basic theoretical principles of this method. At the same time, we strive to present a complete methodological framework necessary for the application of the TOPSIS technique in own research. The purpose of the research question is fulfilled through the main objective of the research, which is to introduce TOPSIS technique (from both a theoretical and practical perspective) as a suitable tool for decision making in the conditions of local self-government.

The main objective is achieved through four specific objectives (SO), which are formulated as follows:

SO1: To identify the position of the TOPSIS technique in the system of MCDM methods, based on a comprehensive theoretical overview.

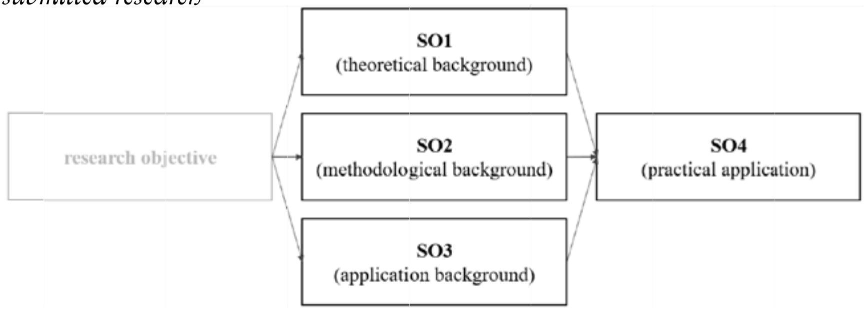
SO2: To provide a comprehensive methodological framework for calculating the TOPSIS technique, including a description of the individual steps.

SO3: To present the application of the TOPSIS technique in local government across different countries (and conditions).

SO4: To illustrate the application of the TOPSIS technique using a simple example (case study).

The issue of multicriteria decision making is quite broad. For easier orientation, it is necessary to get an overview of the methods, their classification and the computation itself (SO1). Using the acquired theoretical knowledge, the procedure for calculating the TOPSIS technique is presented with a description of the individual steps (SO2). The third specific objective (SO3) presents previous uses of this decision tool that can serve as an inspiration and argument for method selection. The last one (SO4) is the practical application of theoretical and practical knowledge gained in the previous specific objectives. By fulfilling all specific objectives, we believe that this will provide a sufficient introduction to this interesting method, allowing its use for own further research of students or other researchers.

Figure 1: *Linking individual specific objectives within the framework of the submitted research*



Source: Author.

In order to fulfil the main objective and the specific objectives, the structure of this paper is as follows: the first section, i. e. the Introduction, identifies the need and interest for the implementation of MCDM, based on appropriate methods working with multiple criteria. The second section offers a brief classification and overview of MCDMs, focusing on identifying the position of the TOPSIS technique. The third section presents the actual computation process of this method, with emphasis on selected approaches to determine the importance of the criteria under consideration. The content of the fourth section presents empirical studies that have used this decision-making tool for their own research needs in the field of local government. This section also includes a case study of the application of TOPSIS techniques in Slovak conditions, using the knowledge gained in the previous sections. The conclusion summarizes the findings and outlines options for further research.

2. Identification of the Position of TOPSIS Technique in the Classification of MCDM Methods

Multicriteria decision making (MCDM), as described by Vincke (1992), is characterized by a set of multicriteria methods. The origin of MCDM methods can be attributed to the research of authors such as De Borda (1781), Edgeworth (1881) and others. The abbreviation MCDM was first used in research by Zeleny (1975). Particularly relevant and significant results on the MCDM issue can also be found in the research of Keeney and Raiffa (1976), and Zeleny (1982). The most sensitive and important point of MCDM methods is the extraction and interpretation of the decision maker's preferential information. According to Greco, Matarazzo and Slowinski (1999, p. 64), "this kind of preferential information seems to be close to the natural reasoning of the decision maker. He/she is typically more confident exercising his/her comparisons than explaining them".

MCDM methods are also becoming increasingly popular in economic decision making due to the "multidimensionality" of sustainability goals and the complexity of socio-economic, environmental and governmental systems (Zavadskas & Turskis, 2011). According to Mardani and colleagues (2016), these methods are developed to aid decision making by either classifying a known set of alternatives to solve a problem or selecting from this set when considering conflicting criteria. According to Turskis (2008, p. 225), multi-criteria decision making is defined by "processes that involve designing the best alternative or selecting the best one from a set of alternatives, that has the most attractive overall attributes, and that involves the selection of the optimal alternative".

According to Zavadskas and Turskis (2011), there are two streams of thought in the field of MCDM on which human choice is based: the French school and the American school.

The French school has developed several approaches, including ELECTRE methods that use "outrating" relationships (Roy, 1973), as well as methods that use a piecewise linear approximation of utility or value functions (Jacquet-Lagreze & Siskos, 1982). According to Keeney and Raiffa (1976), the American school is based on multi-attribute value functions and multi-attribute utility theory (MAUT).

The MCDM methods of one group of authors (Kahraman, Onar & Ostaysi, 2015) can be divided into two main categories:

- discrete MCDM or MADM (Multi Attribute Decision Making) methods, (Hwang & Yoon, 1981);
- optimization methods for continuous multi-objective decision making (MODM), (Hwang & Masud, 1979).

A more complex classification is used by Ustinovichius, Zavadskas and Podvezko (2007), Brauers and colleagues (2008), who use the following classification:

- ordinal correlation methods consisting of rank summation;
- methods based on quantitative measurements using several criteria to compare alternatives (comparative preference method), e. g. ELECTRE, PROMETHEE;
- methods based on an initial qualitative assessment, the results of which take a quantitative form at a later stage, e. g. AHP, ANP;
- methods based on a reference point or target, e.g. TOPSIS, VIKOR, MOORA.

A similar classification of MADM methods by type of information is offered by Larichev (2000). His classification is as follows:

- methods based on quantitative measurements, e.g. TOPSIS, SAW, LINMAP, COPRAS;
- methods based on qualitative initial measurements, e.g. AHP, fuzzy set theory methods;
- comparative preference methods based on pairwise comparison of alternatives, e.g. ELECTRE, PROMETHEE I and II;
- methods based on qualitative measurements not transformed into quantitative variables, involving verbal decision analysis.

Based on the literature review, we can conclude that the TOPSIS technique is one of the basic MCDM methods. A more comprehensive description, distribution and theoretical overview is captured by the research of Ustinovichius, Zavadskas and Podvezko (2007), Brauers and colleagues (2008), Karabasevic and colleagues (2018), or Sałabun, Wątróbski and Shekhovtsov (2020).

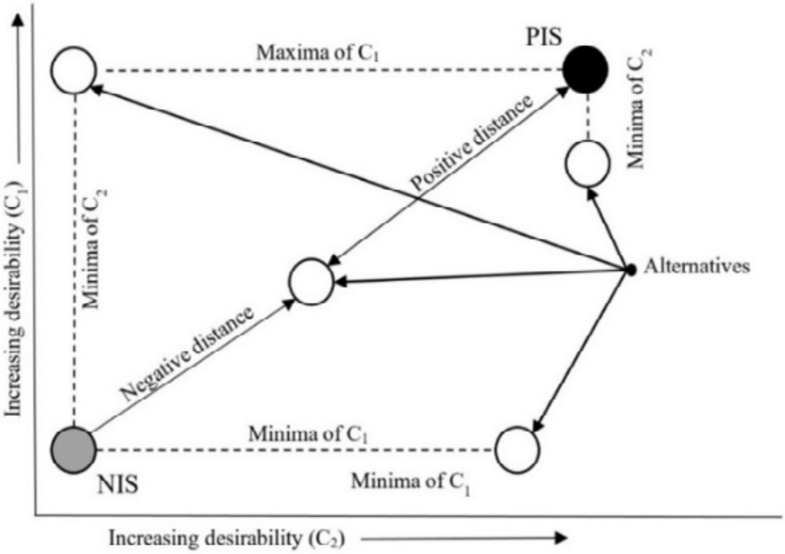
3. Methodological Basis for Calculation of TOPSIS Technique

MacCrimmon (1968) was the first researcher who focused on the comparison of MCDM methods and the importance of their selection for different research purposes. There are several studies that address this issue (Arslan & Aydin 2009; Brauers & Zavadskas, 2009; Hui, Lau & Lo, 2009). Guitouni and Martel (1998) proposed a methodological approach to select the appropriate MCDM method for a specific decision-making situation. Subsequently, other studies that have been published comparing the appropriateness of using different MCDM methods, e.g. Zanakis and colleagues (1998), or Olson (2001). Most of the evaluated approaches had one attribute in common: they are associated with the decision maker's preferences or are designed to address problems with unique structural characteristics, e.g., many (qualitative) criteria and few alternatives or few quantitative criteria and many alternatives. In general, selecting the most appropriate technique/approach is highly challenging (Olson, Fliedner & Currie, 1995; Van Huylenbroeck, 1995) and relies on the particular circumstances of the decision-making situation.

TOPSIS is a fundamental method in multicriteria decision making, primarily applied to address diverse types of decision problems. Zavadskas and colleagues (2016) identified this method as one of the most widely used, alongside potential alternatives such as the AHP, ANP, or PROMETHE methods. An overview of its applications is provided by e.g. Tramarico and colleagues (2015), and Ilbahar, Cebi and Kahraman (2019). They observed a growing number of studies and manuscripts each year featuring applications not limited to the TOPSIS technique. Its applications can be found in several research areas like environmental science (Rozentale & Blumberga, 2019; Siksnelyte et al., 2019), transport (Djordjevic & Krmac, 2019), logistics (Chu, 2020), local self-government (Kilic & Yalcin, 2021; Alvarenga, Pareira & Salgado, 2023), culture (Jasiulewicz-Kaczmarek et al., 2022; Lu & Lin, 2023), social (Zhang et al., 2019; Juan, Hsu & Chang, 2021), health (Zhao et al., 2023; Dai et al., 2023; Zhang, Bai & Hong, 2022), agriculture (Li, 2023; Chang & Liang, 2023; Wang et al., 2022) and many others.

Tramarico and colleagues (2015) demonstrate the principle of the TOPSIS technique through the figure shown above (Figure 1). Each white ball indicates a specific alternative, representing an evaluated subject. The grey ball represents the Negative Ideal Solution (NIS) alternative, i.e. the real or hypothetical alternative (subject) possessing the worst values of each criterion. The black ball represents the Positive Ideal Solution (PIS) alternative, i.e. the real or hypothetical alternative (subject) having the best values of each criterion. The best ranked alternative (one of the white balls) is the one farthest from the grey ball (NIS) and closest to the black ball (PIS).

Figure 2: *Principle of operation of TOPSIS technique*



Source: Author based on Tramarico et al. (2015).

As mentioned above, a key factor influencing the outcome of the MCDM analysis is the determination of the importance of the criteria. The following subsection presents an overview of various approaches for weight determination used in combination with the TOPSIS technique.

3.1. Weight Determination Methods in Association with the TOPSIS Technique

Assessing the importance of the criteria used is a crucial aspect in the application of any MCDM method (Brans & Mareschal, 1994). According to Yalcin and Unlu (2018), the application itself mainly depends on the calculation of the weights of the criteria. Pekár and Furková (2014, p. 147) regard the process of determining the importance of the evaluated criteria as highly significant, since "the weights influence the final arrangement, and a poor determination of the weights can lead to a change in the arrangement and a preference for other alternatives".

Tzeng, Chen and Wang (1998) categorize methods as objective or subjective based on the extent to which the decision-maker's is included in the weighting of the criteria. Liu and Yin (2019) categorize these methods into two groups, Dutta and colleagues (2021) into three groups, while Keršuliene, Kazmieras and Zavadskas (2010) use four groups of methods to determine weights, which represent extensions of previous classifications. The groups in question include the following:

– subjective;
– expert;
– objective;
– integrated.

Subjective methods reflect the decision maker's personality and his/her individual preferences, with the criterion's weight determined by personal judgment. Expert evaluation is carried out by a smaller number of experts in the field, with past applications offered by Kendall (1970), Fisher and Yates (1963) or Zavadskas (1987). The use of expert panel using pairwise comparison of criteria can be found in the research of Diaz and Cilinskis (2019), Polikarpova and colleagues (2019), or Amorocho and Hartmann (2022). The third group, comprising objective methods, assigns weights to criteria using a specific mathematical model tailored to each method. Consequently, the decision maker does not directly influence the determination of criteria importance but chooses based on the preferred characteristics of the data used, such as variability or relationships between the criteria. In this group, we can find methods such as MW method (Indzere et al., 2019; Paradowski et al., 2021), SD method (Yalcin & Unlu, 2018; Ouerghi, Mourali & Zagrouba, 2018), Mahalanobis-Taguchi System method (Yuan & Luo, 2019), Entropy method (Aouadni, Rebai & Turskis, 2017), λ bi-capacity model (Zhang et al., 2020), CV method (Singla, Singh Ahuja & Singh Sethi, 2018; Xue, Zhao & Gou, 2008), linear regression model (Hatefi, 2023), KEMIRA-M method (Ay, Can & Toktas, 2023), MOWSCER method (Davoudabadi et al., 2023), N-CRITIC method (Adali et al., 2023), BWM method (Dawood et al., 2023), SMART approach (Pöyhönen & Hämäläinen, 2001), PAPRIKA method (Hansen & Ombler, 2008), and others. The last group consists of integrated methods, combining the approaches mentioned earlier.

Various methods are employed to determine the weights of each criterion in conjunction with the TOPSIS technique. Subjective methods are represented by pairwise comparisons of individual criteria, as shown in the following table (Table 1). The pairwise comparison technique is widely used to deal with subjective and objective judgments about qualitative and/or quantitative criteria in multi-criteria decision making (Kou et al., 2016), which is also used by Cavallo and D'Apuzzo (2011) or Erguand colleagues (2013). As far as objective methods are concerned, a relatively wide range of methods can be added to those used with the TOPSIS technique, with a marked dominance of one of them, as shown in Table 1.

Table 1: *Overview of methods for determining criterion importance in conjunction with the TOPSIS technique.*

Author	Subjective methods	Objective methods
Harmancioglu, Fedra & Barbados (2008); Afshar et al. (2011); Guo & Yu (2011); Gallego-Ayala (2012); Mahalakshmi & Ganesan (2013); Wu, Hsieh & Chang (2013); Yal & Akgün (2014); Zolfani & Antucheviciene (2012); Noryani, Sapuan & Mastura (2018); Hajduk (2021), Amorocho & Hartmann (2022); Vrabková, Vaňková & Moškořová (2023)	pair comparison/ expert group	
Deng, Yeh & Willis (2000); Srdjevic, Mederios & Faria (2004); Milani, Shanian & El-Lahham (2008); Zhang et al. (2011); Yazdanbakhsh (2015); Aouadni, Rebai & Turskis (2017); Hajilou et al. (2018); Li, Yi & Zhang (2018); Gu et al. (2020); Luo et al. (2020); Izadi, Vardanjani & Varesi (2021); Wang et al. (2021); Xu et al. (2021); Wang, Caballero & Elvambuena (2022); Zhang et al. (2022); Wang et al. (2022); Dai et al. (2023); Guo et al. (2023); Li et al. (2023); Zhao et al. (2023)		entropy method
Deng, Yeh & Willis (2000); Xue, Zhao & Gou (2008); Singla, Singh Ahuja & Singh Sethi (2018); Yalcin & Unlu (2018); Akcan & Tas (2019); Zhang et al. (2019); Ozkaya & Erdin (2020); Juan, Hsu & Chang (2021); Wang et al. (2022); Zhang, Bai & Hong (2022); Ertemel, Menekse & Akdag (2023); Chang & Liang (2023); Lu & Lin (2023); Pinochet et al. (2023)		SD, MW, CV, CRITIC, ANP, AHP, DARIA, SWARA

Source: Author.

The TOPSIS technique is used in the primary part of the abovementioned studies in combination with an objective method for determining the importance of criteria, i.e. the Entropy method. Pairwise comparison is preferred in the case of a preference for an expert perspective on the criteria included in the analysis, e. g. in the form of the Fuller method.

3.2. Calculation of TOPSIS Technique in Individual Steps

According to Jablonský (2007), the actual calculation of the TOPSIS technique involves the following steps:

The first step of the TOPSIS technique is the computation of the normalized criterion matrix. This matrix normalizes the criterion values of all the variants so that they can be equivalently compared. Denoting the original criterion matrix containing the criterion values of each variant by a matrix *R* in which the criteria are written in columns (j = 1, 2, 3, ... k) and the variants in rows (i = 1, 2, 3, ... n), the computation of the elements of this normalized criterion matrix R_N can be given by the following formula:

$$r_{ij} = \frac{y_{ij}}{\sqrt{\sum_{i=1}^{p} y_{ij}^2}} \quad (1)$$

where: r_{ij} – component of the i-th row and j-th column of the normalized criterion matrix R_N
y_{ij} – component of the i-th row and j-th column of the original matrix R
p – total number of rows (of different variants) of the matrix R

When minimization criteria are present, their nature is converted to maximization using the following formula:

$$y_{ij} = -y_{ij} \quad (2)$$

where: y_{ij} – component of the i-th row and j-th column of the original matrix R

To calculate the normalized weighted criterion matrix R_{NV}, the matrix R_N is multiplied by the weight matrix *V*, i.e. the criterion values of each variant are multiplied by the weight of the criterion. The weight matrix *V* must contain the weights of all criteria and at the same time the weights must form a unit length vector, i.e. their total sum is equal to one. The formula is shown as follows:

$$w_{ij} = v_j r_{ij} \quad (3)$$

where: w_{ij} – component of the i-th row and j-th column of the normalized weighted criterion matrix R_{NV}
v_j – component of the j-th column of the matrix (vector) of weights V
r_{ij} – component of the i-th row and j-th column of the normalized criterion matrix R_N

After obtaining the normalized weighted criterion matrix R_{NV}, it can be proceeded to calculate the distances from the Positive Ideal Solution (PIS). If the condition of maximization criteria is met, the ideal variant can be identified as the maximum value for a given criterion (values in the columns of the R_{NV} matrix). Thus, a matrix (vector) of ideal variants H will be found according to the following formula.

$$H_j = max_i(w_j) \tag{4}$$

where: H_j – component of the j-th column of the matrix (vector) of ideal variants
$max_i()$ – function finding the i-th row (variant) with the maximum value (in a specific column)
w_j – j-th column of the normalised weighted criterion matrix R_{NV}

Once the matrix of ideal variants H is found, it will be possible to calculate the distance of each variant from the ideal variants for all criteria. This distance is calculated according to the following formula.

$$.d_i^+ = \sqrt{\sum_{j=1}^{k} \left(w_{ij} - H_j\right)^2} \tag{5}$$

where: d_i^+ – total distance of the i-th variant from the ideal variants of all criteria
w_{ij} – component of the i-th row and j-th column of the normalised weighted criterion matrix R_{NV}
H_j – component of the j-th column of the matrix (vector) of ideal variants

The next step is to find the basal variants. If the condition of maximization criteria is used, the basal variant can be identified as the minimum value for the criterion (the values in the columns of the R_{NV} matrix). Thus, a matrix (vector) of basal variants D will be found according to formula.

$$D_j = min_i(w_j) \tag{6}$$

where: D_j – component of the j-th column of the matrix (vector) of basal variants
$min_i()$ – function finding the i-th row (variant) with the minimum value (in a specific column)

w_j – j-th column of the normalised weighted criterion matrix R_{NV}

After finding the matrix of basal variants D, it will be possible to calculate the distance of each variant from the basal variants for all criteria. This distance is calculated according to formula.

$$d_i^- = \sqrt{\sum_{j=1}^{k} \left(w_{ij} - D_j\right)^2} \qquad (7)$$

where: d_i^- – total distance of the i-th variant from the basal variants of all criteria

w_{ij} – component of the i-th row and j-th column of the normalised weighted criterion matrix R_{NV}

D_j – component of the j-th column of the matrix (vector) of basal variants

In the last step, the total distances of specific variants from the PIS and NIS variants (and) are used to calculate an indicator of the relative distance of the variants from the basal variant $\mathbf{c_i}$ according to the following formula.

$$c_i = \frac{d_i^-}{d_i^+ + d_i^-} \qquad (8)$$

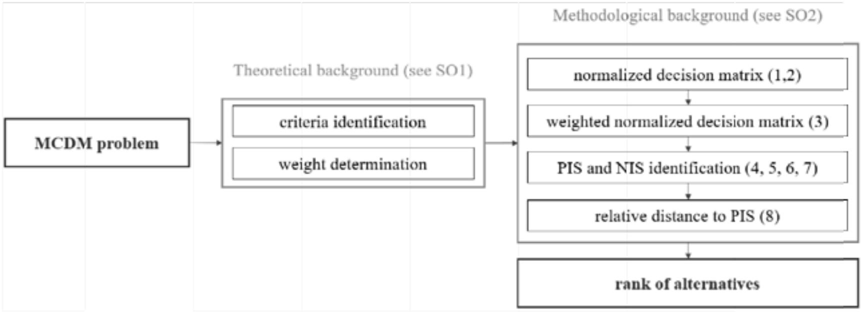
where: c_i – indicator of the relative distance from the basal variant of the i-th variant

– total distance of the i-th variant from the ideal variants of all criteria (PIS)

– total distance of the i-th variant from the basal variants of all criteria (NIS)

The best ranked subject is the subject with the highest value of relative distance to the PIS alternative (c_i), which ranges from 0 to 1. In the case of a value of 1, the subject has the best values in all the monitored criteria. The opposite is the case for a value of 0, where the subject has the worst values in all criteria considered. Only in these cases does the NIS and PIS alternative represent a specific subject. In other cases, these alternatives are only hypothetical. Using individual formulas, the TOPSIS technique calculation process can be illustrated as follows:

Figure 3: *Flowchart of TOPSIS technique*



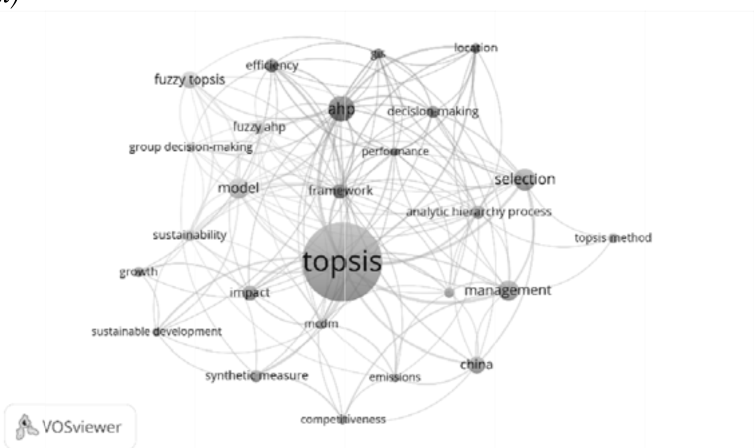
Source: Author.

*** note: numbers in parentheses represent individual formulas*

4. Overview of TOPSIS Technique Applications in Local Government Conditions in 2025

In the previous sections, the TOPSIS technique was discussed from both a theoretical and methodological perspective, by identifying its position across the MCDM method and its calculation method. This section presents the successful applications of this methodological approach in the field of territorial self-government in recent years.

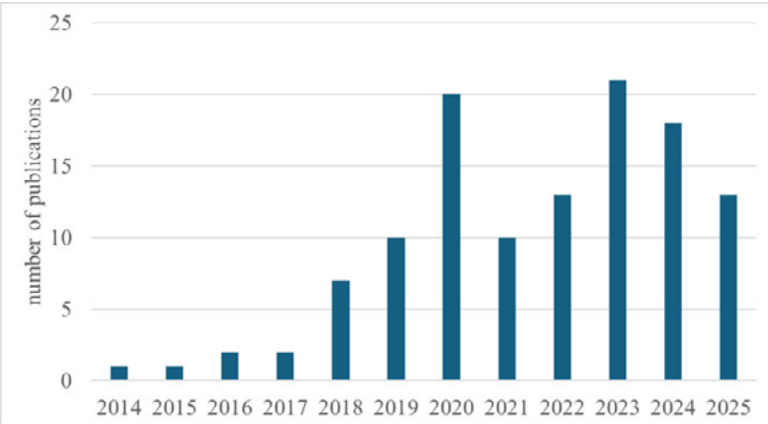
Figure 4: *Visualization of bibliometric networks (keywords: TOPSIS, local government)*



Source: Author.

Using an analytical tool and a pair of keywords (TOPSIS, local government), a total of 136 publications are identified in the WoS database. Individual publications can be recorded since 2004, while research manuscripts (118) have been published in journals since 2014 in the following numbers.

Figure 5: *Number of publications in journals indexed in the WoS database (keywords: TOPSIS, local government)*



Source: Author.

Throughout the period under review, we observe a clear growth trend in the number of research papers published in journals indexed in the WoS database. In 2025 alone, research in this area is directed as follows:

Wang and colleagues (2025) used the TOPSIS technique in combination with the AHP method and 13 criteria. The empirical results obtained were largely consistent with the priorities of local governments. The model results "indicated that priority should be given to the county government, township government, ecologically sensitive areas, and administrative villages near tourist attractions." The study of Zhang and colleagues (2025, pp. 997) employed this methodological approach to "analyse panel data from 99 cities in the Yellow River Basin (YRB) from 2006 to 2019". Tian and colleagues (2025) focused "on avian species, using an Ensemble Species Distribution Model to identify bird distribution hotspots and accordingly proposed conservation key areas in Baiyangdian." Two methods for weight determination were used, namely AHP and EWM. The research of Yildirim and Sisman (2025, p. 1) aimed to "identify the most suitable locations for emergency assembly points, which play a critical role in sustainable disaster management." 41 emergency assembly places were evaluated using 10 criteria. The main objective of the Kaynak and Gümüş, (2025, p. 12193) study was to "determine the most suitable locations for establishing biogas energy facilities in **Şanlıurfa** province." They assessed 24 alternative locations for facility establishment using 13 criteria weighted by the AHP method. The TOPSIS technique was used also by Chen (2025), who aimed to "explore how the rural digital economy impacts China's new-type urbanization from direct, heterogeneous, and indirect perspectives." The study of Joo and Moon (2025, p. 1) presented "a comprehensive evaluation of the suitability of administrative districts containing designated evacuation shelters" in the Republic of Korea, and 3 criteria were used for this purpose. The research of Drozdowski and colleagues (2025) used the CRITIC-TOPSIS technique and aimed to "analyse and assess the spatial variation of pre-entrepreneurship in powiats in Poland in the context of green economy." Roszkowska (2025) combined the Belief Structure framework with the TOPSIS technique. Her research showed that this combination "enhances both the clarity and depth of survey analysis, making a methodological contribution to the evaluation of ordinal data and offering empirical insights into public perceptions of local city administration". Shao and colleagues (2025) aimed to "explore whether rural restructuring mitigates or exacerbates existing regional disparities, and to assess the degree of coordination among economic, social, and spatial restructuring dimensions." For this purpose, 12 criteria were selected and weighted by the Entropy method. Liu et al. (2025, p. 1) used 14 criteria and assessed "urban resilience in China's seven major river basins." Xu and colleagues (2025) analysed "the policy effect of the establishment of ecological civilization pilots on the index" at the level of 30 provincial-level administrative regions in China. The research of Li and colleagues (2025) aimed to "inform more effective policies for alleviating energy poverty." They evaluated 130 Chinese provinces and found that "government intervention reduces energy poverty in nearby areas through a "demonstration effect, in addition to improving local energy poverty."

The year 2025 alone offers several interesting applications of the TOPSIS technique in the context of local government. The following table provides an overview of these applications.

Table 2: *Overview of TOPSIS technique applications in journals indexed in the WoS database in 2025*

Authors	Criteria	Variants (units)	Weighted by	Area
Wang et al. (2025)	13	130	AHP	China
Zhang et al. (2025)	12	99	GRA	China
Tian et al. (2025)	25	75	AHP-EWM	China
Yildrim & Sisman (2025)	10	41	AHP	Turkey
Kaynak & Gümüş (2025)	13	24	AHP	Turkey
Chen (2025)	20	31	Entropy	China
Joo & Moon (2025)	3	5	Entropy	Republic of Korea
Drozdowski et al. (2025)	30	379	CRITIC	Poland
Roszkowska (2025)	5	83	BS-TOSIE	Europe
Shao et al. (2025)	12	66	Entropy	China
Liu et al. (2025)	14	27	Entropy	China
Xu et al. (2025)	29	30	Entropy	China
Li et al. (2025)	4	30	Entropy	China

Source: Author.

4.1. Practical Application of the TOPSIS Technique in the Conditions of Slovak Local Government

The result of specific objectives SO1, SO2, and SO3 is the practical application and presentation of the TOPSIS technique calculation process using real data. The basic and research set of evaluated units consists of regional capitals in Slovakia. Slovakia was chosen due to the long-term focus of our own research on this territory. Public data available on the INEKO portal (2025) was used for this purpose. Regional capitals in Slovakia (8) are evaluated using the following four criteria:

- C1: Current budget revenues per capita in EUR,
- C2: Capital budget revenues per capita in EUR,

– C3: Current budget expenditures per capita in EUR,
– C4: Capital budget expenditures per capita in EUR.

The individual criteria represent the basic classification of revenues (C1, C2) and expenditures (C3, C4) by sort. The TOPSIS technique calculation procedure corresponds to the procedure described in Section 3.2. The case study is divided into individual steps corresponding to the steps described in this section.

The basic starting point is a criterion matrix, which represents a record of the monitored criteria at the level of individual alternatives (evaluated entities).

Table 3: *Original criterion matrix of the case study*

Variant (unit)	C1	C2	C3	C4
character	**benefit**	**benefit**	**cost**	**cost**
Banská Bystrica	930.97	23.92	882.47	75.48
Bratislava	792.83	130.73	774.81	135.09
Košice	824.72	2.84	797.15	38.54
Nitra	1017.50	27.74	903.44	105.10
Prešov	957.25	22.42	919.48	130.38
Trenčín	951.15	38.36	781.40	120.91
Trnava	1013.12	38.93	856.45	127.34
Žilina	997.03	22.73	880.72	64.67

Source: Author.

Since criteria C3 and C4 are of a minimising nature, they are modified using formula no. 2 (see Section 3.2).

Table 4: *Original criterion matrix of the case study using formula no. 2*

Variant (unit)	C1	C2	C3	C4
Banská Bystrica	930.97	23.92	-882.47	-75.48
Bratislava	792.83	130.73	-774.81	-135.09

Košice	824.72	2.84	-797.15	-38.54
Nitra	1017.50	27.74	-903.44	-105.10
Prešov	957.25	22.42	-919.48	-130.38
Trenčín	951.15	38.36	-781.40	-120.91
Trnava	1013.12	38.93	-856.45	-127.34
Žilina	997.03	22.73	-880.72	-64.67

Source: Author.

The first step of the TOPSIS technique is the computation of the normalized criterion matrix using formula no. 1. For the purposes of this case study, vector normalization is used, i.e., the classic normalization used in the original version of the TOPSIS technique. This step normalizes the original values, i.e., all criteria are converted into a uniform form.

Table 5: *Normalized criterion matrix of the case study using formula no. 1*

Variant (unit)	C1	C2	C3	C4
Banská Bystrica	0.35	0.16	-0.37	-0.25
Bratislava	0.30	0.87	-0.32	-0.45
Košice	0.31	0.02	-0.33	-0.13
Nitra	0.38	0.19	-0.38	-0.35
Prešov	0.36	0.15	-0.38	-0.44
Trenčín	0.36	0.26	-0.32	-0.41
Trnava	0.38	0.26	-0.36	-0.43
Žilina	0.38	0.15	-0.37	-0.22

Source: Author.

In the next step, the importance of individual criteria is taken into account (see Section 3.1), i.e. the values are multiplied by the weight of each criterion. For the purposes of this case study, the criteria monitored are equivalent, i.e. they have the same weight/importance (Equal Importance Method is used).

CROATIAN AND COMPARATIVE PUBLIC ADMINISTRATION

Table 6: *Normalized weighted criterion matrix of the case study using formula no. 3*

Variant (unit)	C1	C2	C3	C4
Banská Bystrica	0.09	0.04	-0.09	-0.06
Bratislava	0.07	0.22	-0.08	-0.11
Košice	0.08	0.00	-0.08	-0.03
Nitra	0.10	0.05	-0.09	-0.09
Prešov	0.09	0.04	-0.10	-0.11
Trenčín	0.09	0.06	-0.08	-0.10
Trnava	0.10	0.06	-0.09	-0.11
Žilina	0.09	0.04	-0.09	-0.05

Source: Author.

In the next step, it is necessary to identify variant H, i.e. PIS.

Table 7: *Positive Ideal Solution (PIS) using formula no. 4*

	C1	C2	C3	C4
PIS ()	0.10	0.22	-0.08	-0.03

Source: Author.

Using PIS, the distance of each variant is then calculated, see Table 8.

Table 8: *Distance of each variant from the PIS using formula no. 5*

Variant (unit)	d^+
Banská Bystrica	0.18
Bratislava	0.08
Košice	0.21
Nitra	0.18

Prešov	0.20
Trenčín	0.17
Trnava	0.17
Žilina	0.18

Source: Author.

A similar procedure is applied to identify variant D, i.e. NIS, and calculate distances from it.

Table 9: *Negative Ideal Solution (NIS) using formula no. 6*

	C1	C2	C3	C4
NIS ()	0.07	0.00	-0.10	-0.11

Source: Author.

Table 10: *Distance of each variant from the NIS using formula no. 7*

Variant (unit)	d^-
Banská Bystrica	0.06
Bratislava	0.21
Košice	0.08
Nitra	0.05
Prešov	0.04
Trenčín	0.06
Trnava	0.06
Žilina	0.07

Source: Author.

In the final step, the relative distance to the PIS alternative is calculated based on a combination of the results from the previous two steps.

Table 11: *Relative distance of each variant to the PIS using formula no. 8*

Variant (unit)	c_i
Banská Bystrica	0.26
Bratislava	0.72
Košice	0.28
Nitra	0.23
Prešov	0.16
Trenčín	0.27
Trnava	0.27
Žilina	0.28

Source: Author.

It is precisely the relative distance to the PIS alternative that represents the criterion on the basis of which the final ranking of the evaluated variants (entities) is created.

Table 12: *Final ranking of evaluated variants (units)*

Rank	Variant (unit)	c_i
1.	Bratislava	0.72
2.	Žilina	0.28
3.	Košice	0.28
4.	Trenčín	0.27
5.	Trnava	0.27
6.	Banská Bystrica	0.26
7.	Nitra	0.23
8.	Prešov	0.16

Source: Author.

The informative value of the above results can be verified using sensitivity analysis, e.g., using Weight Sensitivity Analysis (WSA), Full Range Weight Sensitivity Analysis (FRWSA), weight tuning, or simulation. However, this is not part of the TOPSIS technique calculation itself, but rather an extension that reinforces the credibility of its results.

These results should be interpreted in the context of the research limitations, which include a) the use of data from a single year (no longer period is monitored) and b) the approach to determining the importance of criteria, which considers these criteria to be equivalent, see Section 3.1.

5. Conclusions

Decision-making based on the use of all available information is gaining popularity. This is accompanied by an increase in interest in using methods appropriate for working with this information. Our intention was to present the basic theoretical principles of this method. At the same time, we strived to present a complete methodological framework necessary for the application of the TOPSIS technique in own research. The main objective of the "review-based" research was to introduce TOPSIS technique (from both a theoretical and practical perspective) as a suitable tool for decision making in the conditions of local self-government. Within SO 1, the research presented its position in the hierarchy of MCDM methods as a method based on a reference point or target, or a method based on quantitative measurements. The research also described the procedure for calculating the TOPSIS technique in individual steps (SO2). In this way, our research presented the TOPSIS technique from both a theoretical and methodological perspective, using a considerable number of sources. The applicability of this methodological approach was illustrated using an overview of research published in journals indexed in the WoS database in 2025 (SO3). To make the research complete, in its final part (see Section 4.1), the findings are transformed into a simple case study (SO4). This represents the application of the TOPSIS technique in the conditions of Slovak local government using four criteria.

When interpreting the above, it is necessary to take into account the limitations of the research conducted. These include the focus on the TOPSIS technique in its basic form and the area of local government as the only application level. In any further research, the intention is to focus more closely on the TOPSIS technique, and its modifications brought about by academic practice. A comparison of this methodological approach with other ones or methods for determining the importance of criteria certainly deserves attention as well.

By conducting the research in the form presented, we consider the main objective of the research fulfilled and the research question answered. We firmly believe that the information summarized in this way will make this method more available to students or researchers who will use it for their own research needs.

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TOPSIS TECHNIQUE AND ITS USE IN LOCAL SELF-GOVERNMENT: A REVIEW OF METHODOLOGICAL LITERATURE

Summary

Decision making as such is part of everyday processes in various spheres. The research question that this study aims to answer is: Is it possible to use the TOPSIS technique to evaluate local government entities? The research question is addressed through the main objective of the research, which is to introduce TOPSIS technique (from both a theoretical and practical perspective) as a suitable tool for decision making in the conditions of local self-government. The main objective is achieved through four specific objectives (SO) focused on theoretical background (SO1), methodological framework (SO2), application background (SO3), and practical application in the field of local government (SO3). The theoretical section offers a brief classification and overview of MCDMs, focusing on the identification of the position of the TOPSIS technique. Over 120 relevant publications were used for this purpose. The methodological part presents the actual computation process of this method, with emphasis on selected approaches to determine the importance of the criteria under consideration. The paper also presents an overview of methods for determining the importance of criteria in combination with the TOPSIS technique. The most used methods include the Entropy method and evaluation by an expert group (paired comparison method). The fourth section offers empirical studies that have used this decision-making tool for their own research needs in the field of local government. 136 publications from the WoS database since 2014 have been identified using the analytical tool VOSviewer. The last part of the manuscript presents a case study of the application of TOPSIS techniques in Slovak conditions. 8 regional cities are evaluated using 4 criteria. The presented research can serve as a basic starting point for familiarizing oneself with this method and its use, not only in the context of local government.

Keywords: *TOPSIS technique, literature review, computation procedure, local self-government*

TEHNIKA TOPSIS I NJEZINA PRIMJENA U LOKALNOJ SAMOUPRAVI: PREGLED METODOLOŠKE LITERATURE

Sažetak

Donošenje odluka sastavni je dio svakodnevnih procesa u različitim područjima. Istraživačko pitanje na koje se ovim radom nastoji odgovoriti glasi: Je li tehniku TOPSIS moguće primijeniti za evaluaciju jedinica lokalne samouprave? Istraživačko pitanje razmatra se kroz glavni cilj istraživanja, koji se sastoji u predstavljanju tehnike TOPSIS, kako iz teorijske tako i iz praktične perspektive, kao prikladnog alata za donošenje odluka u uvjetima lokalne samouprave. Glavni cilj ostvaruje se kroz četiri posebna cilja (PC) usmjerena na teorijski okvir (PC1), metodološki okvir (PC2), pregled područja primjene (PC3) i praktičnu primjenu u području lokalne samouprave (PC3).

Teorijski dio donosi sažetu klasifikaciju i pregled metoda višekriterijskog odlučivanja (MCDM) s naglaskom na utvrđivanje položaja tehnike TOPSIS među tim metodama. U tu je svrhu korišteno više od 120 relevantnih publikacija. U metodološkom dijelu prikazan je konkretan postupak izračuna primjenom ove metode s posebnim naglaskom na odabrane pristupe određivanju važnosti razmatranih kriterija. U radu se također daje pregled metoda za određivanje važnosti kriterija u kombinaciji s tehnikom TOPSIS. Među najčešće korištenim metodama nalaze se metoda entropije i vrednovanje koje provodi skupina stručnjaka (metoda usporedbe u parovima).

U četvrtom dijelu prikazane su empirijske studije u kojima je ovaj alat za donošenje odluka primijenjen za potrebe istraživanja u području lokalne samouprave. Pomoću analitičkog alata VOSviewer identificirano je 136 publikacija iz baze podataka Web of Science (WoS) objavljenih od 2014. nadalje. U završnom dijelu rada prikazana je studija slučaja primjene tehnike TOPSIS u slovačkom kontekstu. Osam regionalnih gradova vrednuje se na temelju četiriju kriterija. Predstavljeno istraživanje može poslužiti kao polazište za upoznavanje s ovom metodom i mogućnostima njezine primjene ne samo u kontekstu lokalne samouprave.

Ključne riječi: *tehnika TOPSIS, pregled literature, postupak izračuna, lokalna samouprava*