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Application of the new simple weight calculation (SIWEC) method in the case study in the sales channels of agricultural products ☆

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ABSTRACT

In this research is presented a new method for determining the weights of criteria called simple weight calculation (SIWEC) method. The steps of this method are presented in the practical example of determining the importance of criteria for the needs of sales of agricultural products in the Semberija region. During the presentation of this method two methods are elaborated the simple SIWEC method which includes numerical ratings and the fuzzy SIWEC method which includes ratings in the form of linguistic value. In the selected example is presented how to use this method in order to determine the importance of criteria and in both cases the criterion of sales reliability is given the greatest weight. The contribution SIWEC method is reflected in its simplicity, which facilitates decision-making.

- The method presented in this research apart from others is that it uses the evaluation of the criteria by decision makers, so the criteria should not be ranked and compared, but simply evaluated.
- Unlike similar methods, the presented method uses the adjusted steps of the method for ranking the alternatives, and decision makers are given a different importance in the decision-making.

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Background

In order to make a decision that best meets the decision-making objectives, it is necessary to include as many criteria as possible in order to perceive all the possibilities of certain alternatives [1,2]. This kind of decision-making is called multi-criteria decision-making [3], because decision-making is done by applying several criteria [4]. In this type of decision-making, first of all it is necessary to determine the importance of certain criteria, and then to select which of the alternatives best meets the defined goals [5,6]. If one of the criteria is more important, it has a greater influence on the final decision. When determining the importance of criteria, different methods are used [7]. All these methods can be divided into subjective and objective methods. In the case of subjective methods, the determination of the importance of criteria is based on the assessment of decision makers (DM), while the objective methods use the initial decision-making matrix to determine the importance of criteria. In this research, a new method is developed for determining the importance of criteria based on the subjective evaluations of DM, so the focus will be on this type of methods.

The calculation of criteria importance according to subjective methods is done in such a way that DM determine how important a certain criterion is in their opinion [8]. However, they have to determine their opinion differently by applying different methods. Thus, while using the AHP (Analytic Hierarchy Process) and the ANP (Analytic Network Process) methods the DM must compare each and every criterion and determine if every single criterion is better or worse than another criteria. In the SWARA (Stepwise Weight Assessment Ratio Analysis) and the FUCOM (FUll COnsistency method) methods, it is necessary to first rank the criteria and then determine their importance, while in the BWM (Best Worst Method) and PIPRECIA (PIvot Pairwise RElative Criteria Importance Assessment) method it is necessary to compare all criteria with the first one, respectively, with the last criterion. By means of these methods, the job of DM is made more difficult [9]. Newer methods try to simply determine the importance of criteria so that DM do not have to compare or rank methods [10,11]. The examples of these methods are the LMAW (Logarithm Methodology of Additive Weights) and the DIBR (Defining Interrelationships Between Ranked criteria), which use criteria values based on their importance for DM.

In order to facilitate the process of determining the importance of criteria and the calculation of the criteria weights itself, a new simple weight calculation (SIWEC) method is developed, which strives to determine the importance of criteria through a simple evaluation of the criteria and simple steps. In this research, it will be demonstrated the applicatiion of this method in the example of determining the importance of criteria for agricultural product sales channels. The goals of this method are as follows:

- Facilitating the process of determining the importance of criteria for DM where they will evaluate each criteria and will not compare these criteria with each other nor rank them.
- Simplifying the process of criteria weights calculation using simple procedures and steps.
- Bring the process of criteria weight calculation closer to DM and all interested parties in a simple way.

Method details

The SIWEC method is created so as to simplify things first for the DM and then for the persons calculating the criteria weights. This method belongs to the subjective methods for determining the importance of criteria, because the ratings made by DM are used. When applying this method, two forms will be developed, respectively, the simple SIWEC method that uses ratings in the form of crips numbers, and the fuzzy SIWEC method that uses the DM ratings in the form of linguistic values. In this way will be set guidelines for the further development of this method in different forms.

SIWEC method

The steps of the simple SIWEC methode are next:

Step 1. Determining the importance of criteria using the DM ratings. In this step, DM evaluate the given criteria with defined grades that can range from one (1) to five (5), or, from one (1) to seven (7) and in various ways as defined in the research itself. DM grade in such a way that if a criterion is more important than others in their opinion, it gets a higher grade, and vice versa. If the criterion is the most important in their opinion, it gets the highest grade.

Step 2. Forming the initial decision-making matrix. This matrix is formed on the basis of DM grades, where criteria are presented in columns and DM grades are presented in rows for certain criteria.

$$A = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \quad (1)$$

Where x_{ij} present the grades given by DM of certain criteria.

Step 3. Normalization of the initial decision-making matrix. In contrast to the normalization applied in the methods for multi-criteria analysis, here each criterion is divided by the maximum value of all grades and not by the maximum value for certain criteria.

$$n_{ij} = \frac{x_{ij}}{x_{ij\ max}} \quad (2)$$

Where $x_{ij\ max}$ presents the maximum grade of all the criteria by all the DM.

Step 4. Calculation of the standard deviation value for DM ($st.dev_j$). In this step, the standard deviation values for the normalized DM grades are calculated. This step is carried out in such a way that a certain DM is given a higher priority in relation to other DM if his ratings are more diverse where the deviation is greater. If the DM has more diverse ratings, he will gain more importance. This is for the reason to encourage realistic thinking among DM because not all the criteria can be of equal importance, some must be better and some worse than the other criteria.

Step 5. Multiplication of normalized grades with standard deviation values. In this step, the normalized values of the grades of certain DM are multiplied with the values of the standard deviation of the grades of those DM.

$$v_{ij} = n_{ij} \times st.dev_j \tag{3}$$

Step 6. Calculation of the sum of the weights of certain criteria. In this step, all multiplied normalized grades are summed with standard deviation values for certain criteria.

$$s_{ij} = \sum_{j=1}^{n} v_j \tag{4}$$

Step 7. Calculation of final values of the weights of criteria. In this step individual values s_j are divided by summary values s_j, in order to provide the sum of the weights of criteria equal to one (1).

$$w_{ij} = \frac{s_{ij}}{\sum_{j=1}^{n} s_{ij}} \tag{5}$$

Using these steps of the SIWEC method are obtained criteria weights.

Fuzzy SIWEC method

Having explained the steps of the simple SIWEC method that uses numerical ratings of DM, the steps of the fuzzy SIWEC method will now be explained. The specificity of this approach is that the grades are in the form of linguistic values [12]. These values are easier for the DM to determine since it is not necessary to determine which criterion should receive a certain grade, whether it is four or five or three. The question is what to do if a criterion, according to the DM, has an in-between rating, so it is difficult to decide which rating it should be given. For this reason, linguistic evaluations are introduced that are closer to DM's thinking. With these grades, the DM give the ratings in the form of a linguistic scale that goes, for example, from very bad to very good ratings. In this way, it is easier for the DM to provide ratings because they can more easily evaluate what is good or not, rather than decide what numerical value it should have. Based on this, the steps of the fuzzy SIWEC method are as follows:

Step 1. Determining the importance of the criteria using DM's linguistic ratings. In this step, the DM select certain linguistic value that determines the importance of the criteria in their opinion.

Step 2. Transformation of linguistic values into fuzzy numbers. In this step, linguistic values are transformed into corresponding fuzzy numbers using the membership function. The value of these fuzzy numbers is performed through the membership function. Using the example of a triangular fuzzy number, the value of the fuzzy number can be written as follows:

$$\tilde{x}_{ij} = \left(x_{ij}^{l}, x_{ij}^{m}, x_{ij}^{u}\right) \tag{6}$$

Where x_{ij}^{l} is the first fuzzy number, x_{ij}^{m} the second fuzzy number and x_{ij}^{u} the third fuzzy number.

Step 3. Formation of fuzzy initial decision-making matrix. In this step, the initial decision-making matrix is formed based on fuzzy numbers.

$$\tilde{A} = \begin{bmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \cdots & \tilde{x}_{1n} \\ \tilde{x}_{21} & \tilde{x}_{22} & \cdots & \tilde{x}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{x}_{m1} & \tilde{x}_{m2} & \cdots & \tilde{x}_{mn} \end{bmatrix} \tag{7}$$

Where $\tilde{x}_{ij}$ presents the rankings of DM for certain criteria in the form of fuzzy numbers.

Step 4. Normalization of the initial fuzzy decision-making matrix. In this step, all fuzzy values are divided by the maximum value of the third fuzzy number ($\max\ x_{ij}^{u}$) in all the criteria and DM.

$$\tilde{n}_{ij} = \frac{x_{ij}^{l}}{max\ x_{ij}^{u}}, \frac{x_{ij}^{m}}{max\ x_{ij}^{u}}, \frac{x_{ij}^{u}}{max\ x_{ij}^{u}} \tag{8}$$

Step 5. Calculation of the standard deviation value for DM ($st.dev_j$). Here, the value of the standard deviation is calculated for all the values of fuzzy numbers for individual DM.

Step 6. Multiplying normalized ratings with standard deviation values.

$$\tilde{v}_{ij} = \tilde{n}_{ij} \times st.dev_j \tag{9}$$

Table 1
Research criteria.

ID	Criteria	Refs.
C1	Product characteristics	[18,19]
C2	Sales reliability	[20,21]
C3	Finantial situation	[18,22]
C4	Consumers' habits	[22,21]
C5	Sales costs	[23,24]
C6	Geographic concentration	[18,22]
C7	Product range	[25,26]
C8	Delivery method	[27,28]
C9	Delivery volume	[29,30]
C10	Sales sustainability	[31,32]
C11	Respecting ecological standards	[33,34]

Step 7. Calculation of the sum of the weights of individual criteria. Here, all criteria values for all fuzzy numbers are summed.

$$\tilde{s}_{ij} = \sum_{j=1}^{n} \tilde{v}_j \tag{10}$$

Step 8. Calculation of the fuzzy values of the criteria's weights. The individual values $\tilde{s}_{ij}$ are divided by the sum of all values. In such calculation, it is necessary to take into account that the first fuzzy number can be equal to or less than the second fuzzy number, while the second fuzzy number can be less than or equal to the third fuzzy number.

$$\tilde{w}_{ij} = \frac{s_{ij}^{l}}{\sum_{j=1}^{n} s_{ij}^{u}}, \frac{s_{ij}^{m}}{\sum_{j=1}^{n} s_{ij}^{m}}, \frac{s_{ij}^{u}}{\sum_{j=1}^{n} s_{ij}^{l}} \tag{11}$$

The value of the weights obtained in this way can be used in fuzzy form or defuzzification can be performed into crips form, depending on how these will be used in the further calculation. If the ranking of alternatives will be performed using fuzzy method, these weights will be used, and if only the values of the weights are calculated, then it is necessary to perform defuzzification of the weights. This is done in the following way:

$$w_{j\,def} = \frac{w_{ij}^{l} + 4 \times w_{ij}^{m} + w_{ij}^{l}}{6} \tag{12}$$

In the following section the validation of the SIWEC and fuzzy SIWEC method will be performed.

Method validation

During the validation of the SIWEC and fuzzy SIWEC methods will be used the research made in order to determine the importance of the criteria for selecting the sales channels of agricultural products in the territory of the Semberija region in the country of Bosnia and Herzegovina. Semberija is a region located in northeastern Bosnia and Herzegovina and is part of the larger Posavina region. This region is located between the rivers Sava and Drina, and the mountain Majevica. The importance of sales channels is reflected in the fact that agricultural products belong to food assortment with limited shelf life, so it is particularly important to deliver them to the end customers as soon as possible [13]. It is necessary to choose the sales channel that will deliver agricultural products to its customers as quickly and in the best possible way [14]. These channels include all sales channels that connect producers on the one hand with final customers on the other [15]. Due to the growing development of the market and the technologies, sales channels and the ways in which agricultural products are sold and distributed to final customers are changing [16]. Sales through these channels can be made directly or through various intermediaries. The importance of selecting a sales channel for agricultural producers is reflected in the achievement of higher income and sustainable production [17].

In order to select the sales channels, it is necessary to determine the criteria by which these will be observed. For this purpose, a survey is conducted that included professors from agricultural faculties in Bijeljina. First, ten professors from the field of agro-economics who deal with the economic aspects of agricultural production are contacted. In addition, it is important to mention that these professors are from the territory of the Semberija region and are familiar with agricultural production in this region. The reason why only professors are involved and not agricultural producers is to obtain different opinions because most agricultural producers have been using the same sales channels for years. Out of these ten selected professors, seven of them agreed to participate in this research. First thing to be done with these professors was the selecton of the criteria that can be used when choosing channels for selling agricultural products. A total of eleven criteria are selected for the evaluation of sales channels (Table 1). After that, the professors are given a questionnaire where they first evaluated these criteria with a grade from 1 to 10, and then with a grade from Absolutely bad to Perfect in the form of a scale with ten levels (Table 5). If any of the criteria, according to the professors, is not very important, it will receive a lower rating and vice versa. First, the importance of the criteria will be determined by applying numerical grades and then by means of linguistic values, applying the SIWEC method.

Table 2
Initial decision-makinh matrix.

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
DM1	8	10	7	9	9	5	7	9	7	4	4
DM2	9	9	7	8	9	6	7	9	6	4	4
DM3	9	8	7	9	9	5	7	10	5	4	4
DM4	10	8	7	8	9	6	7	8	5	3	4
DM5	9	9	9	8	9	7	7	8	5	5	4
DM6	9	10	8	8	8	7	6	8	4	5	5
DM7	9	10	7	8	9	7	8	8	5	5	3

Table 3
Normalized decision-making matrix.

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	$st.dev_j$
DM1	0.80	1.00	0.70	0.90	0.90	0.50	0.70	0.90	0.70	0.40	0.40	0.209
DM2	0.90	0.90	0.70	0.80	0.90	0.60	0.70	0.90	0.60	0.40	0.40	0.192
DM3	0.90	0.80	0.70	0.90	0.90	0.50	0.70	1.00	0.50	0.40	0.40	0.219
DM4	1.00	0.80	0.70	0.80	0.90	0.60	0.70	0.80	0.50	0.30	0.40	0.214
DM5	0.90	0.90	0.90	0.80	0.90	0.70	0.70	0.80	0.50	0.50	0.40	0.185
DM6	0.90	1.00	0.80	0.80	0.80	0.70	0.60	0.80	0.40	0.50	0.50	0.187
DM7	0.90	1.00	0.70	0.80	0.90	0.70	0.80	0.80	0.50	0.50	0.30	0.209

Table 4
Weigth values obtained by the SIWEC method.

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
s_{ij}	1.273	1.290	1.046	1.174	1.254	0.864	0.992	1.215	0.749	0.602	0.564
w_{ij}	0.116	0.117	0.095	0.107	0.114	0.078	0.090	0.110	0.068	0.055	0.051

Table 5
Linguistic decision-making matrix.

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
DM1	EG	P	G	AG	AG	E	G	AG	G	MB	MB
DM2	AG	AG	G	EG	AG	MG	G	AG	MG	MB	MB
DM3	AG	EG	G	AG	AG	E	G	P	E	MB	MB
DM4	P	EG	G	EG	AG	MG	G	EG	E	B	MB
DM5	AG	AG	AG	EG	AG	G	G	EG	E	E	MB
DM6	AG	P	EG	EG	EG	G	MG	EG	MB	E	E
DM7	AG	P	G	EG	AG	G	EG	EG	E	E	B

The first step in determining the importance of the criteria in the form of the weights is the professors' rating from 1 to 10. Based on that rating, the initial decision-making matrix (Table 2) is formed, which is the second step of this method.

After the formation of the initial decision-making matrix, the normalization of this decision-making matrix is carried out, which is the third step of this method. First, the largest value in the initial decision-making matrix is found (Table 2), and then all the values in the initial decision-making matrix are divided by that value and the normalized decision-making matrix is formed. In the example of the DM 1 and the criterion C1, it is presented as follows: $n_{11} = \frac{8}{10} = 0.80$. Applying the same formula, other values are calculated and the normalized decision matrix is formed (Table 3).

After the DM ratings are normalized, the standard deviation for the ratings of each DM is calculated. The normalized data are then multiplied by the standard deviation values. In the example of the DM1 and for the criterion C1 it is calculated as follows: $v_{11} = 0.80 \times 0.209 = 0.167$, for the DM4 and for the criterion C1 it is calculated as follows: $v_{41} = 1.00 \times 0.214 = 0.214$. In this way, the v_{ij} values are calculated, and then the sum of these amounts is calculated for the individual criteria (Table 4). In order to obtain the final weight value for the criteria, it is necessary to calculate the sum of the values s_{ij} and divide the individual values s_{ij} by that value (as in the expression 5). Using the example of the criterion C1, it is calculated as follows: $w_1 = \frac{1.273}{11.025} = 0.116$.

The results of this method show that the largest weight is given to the criterion C2 ($w_2 = 0.117$), and after that follows the criterion C1 ($w_2 = 0.116$), while the smallest weight is given to the criterion C11 ($w_{11} = 0.051$).

Having explained the simple SIWEC method, the explanaition of the fuzzy SIWEC will follow below. The first step is the evaluation of the criteria using linguistic values by the DM (Table 5). In this step, DM gave ratings in accordance with the defined value scale (Table 6), where the lowest value was Absolutely bad, while the highest value was Perfect. When these values are compared with the previous numerical grades, it can be observed that the DM assigned linguistic values to the corresponding numerical grades

Table 6
Fuzzy linguistic evaluation scale.

Linguistic terms	Membership function
Absolutely bad (AB)	(1,1,1)
Very bad (VB)	(1,2,3)
Bad (B)	(2,3,4)
Medium-bad (MB)	(3,4,5)
Equal (E)	(4,5,6)
Medium-good (MG)	(5,6,7)
Good(G)	(6,7,8)
Extremely good (EG)	(7,8,9)
Absolutely good (AG)	(8,9,10)
Perfect (P)	(9,10,10)

Table 7
Normalized fuzzy decision-making matrix.

	C1	C2	C3	C4	…	C11	$st.dev_j$
DM1	(0.7, 0.8, 0.9)	(0.9, 1.0, 1.0)	(0.6, 0.7, 0.8)	(0.8, 0.9, 1.0)	…	(0.3, 0.4, 0.5)	0.214
DM2	(0.8, 0.9, 1.0)	(0.8, 0.9, 1.0)	(0.6, 0.7, 0.8)	(0.7, 0.8, 0.9)	…	(0.3, 0.4, 0.5)	0.204
DM3	(0.8, 0.9, 1.0)	(0.7, 0.8, 0.9)	(0.6, 0.7, 0.8)	(0.8, 0.9, 1.0)	…	(0.3, 0.4, 0.5)	0.223
DM4	(0.9, 1.0, 1.0)	(0.7, 0.8, 0.9)	(0.6, 0.7, 0.8)	(0.7, 0.8, 0.9)	…	(0.3, 0.4, 0.5)	0.218
DM5	(0.8, 0.9, 1.0)	(0.8, 0.9, 1.0)	(0.8, 0.9, 1.0)	(0.7, 0.8, 0.9)	…	(0.3, 0.4, 0.5)	0.197
DM6	(0.8, 0.9, 1.0)	(0.9, 1.0, 1.0)	(0.7, 0.8, 0.9)	(0.7, 0.8, 0.9)	…	(0.4, 0.5, 0.6)	0.194
DM7	(0.8, 0.9, 1.0)	(0.9, 1.0, 1.0)	(0.6, 0.7, 0.8)	(0.7, 0.8, 0.9)	…	(0.2, 0.3, 0.4)	0.214

Table 8
Obtaining final values of the criteria by using fuzzy SIWEC method.

	C1	C2	C3	…	C11
$\tilde{s}_{ij}$	(1.17, 1.32, 1.44)	(1.19, 1.33, 1.42)	(0.94, 1.08, 1.23)	…	(0.44, 0.58, 0.73)
$\tilde{w}_{ij}$	(0.091, 0.115, 0.147)	(0.092, 0.117, 0.145)	(0.073, 0.095, 0.125)	…	(0.034, 0.051, 0.074)

Table 9
Defuzzified value of the weights of criteria.

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11
w_j	0.117	0.117	0.096	0.108	0.115	0.080	0.091	0.111	0.069	0.056	0.052

or vice versa. This is positive because it can then be examined how applying a different approach can affect the weight values of the criteria.

Having finished the evaluation of the criteria with linguistic values, it is necessary to transform these values into appropriate fuzzy numbers. This is done in accordance with the set membership function (Table 6). Thus, the value Perfect (P) gets the value of a fuzzy number (9,10,10), the value Absolutely good (AG) gets the value of a fuzzy number (8,9,10). Applying this function (Table 6), all linguistic values are transformed into fuzzy numbers and the initial fuzzy decision-making matrix is formed.

After that, the highest value of the third fuzzy number for all DM and criteria is found, and all fuzzy numbers are divided by that value. In this way, DM ratings are normalized. In the example of the first DM and the first criterion, it is calculated as follows: $\tilde{n}_{11} = \frac{7}{10} = 0.7, \frac{8}{10} = 0.8, \frac{9}{10} = 0.9$. Applying this principle, a normalized fuzzy decision-making matrix is formed (Table 7). Based on the data from this matrix, the standard deviation values for each DM are also calculated.

The next step in the application of this method is to multiply the normalized data with the corresponding standard deviation values, and calculate the sum of these values for the corresponding criteria. On the basis of these values, the fuzzy weights of the criteria are obtained. It is necessary to take care that the first fuzzy number is less than or equal to the second, and the second fuzzy number is less than or equal to the third fuzzy number. This is calculated using the example of the first criterion (C1) as follows (Table 8): $\tilde{w}_1 = \frac{1.17}{12.91} = 0.091, \frac{1.32}{11.40} = 0.115, \frac{1.44}{9.79} = 0.147$.

Since these weights will not be used further when ranking the alternatives, defuzzification of these values will be performed. Defuzzification is done on the basis of the expression 12. The results show that even in this way the highest weight value is obtained by the criterion C2 ($w_2 = 0.117$), and the next is the criterion C1 ($w_1 = 0.117$), while the smallest weight has the criterion C11 ($w_{11} = 0.052$) (Table 9).

Applying the SIWEC method in a specific example showed that when choosing a sales channel for agricultural products, the most important thing was the reliability of the sales and the characteristics of the product, and the selection must be made respecting these more than other criteria. However, this research showed that according to DM, respecting environmental standards and sustainability of sales were not important criteria for decision-making. In this way, it can be concluded that the ecological or sustainable dimension

in agricultural production in Semberija is not supported. However, these dimensions must be more involved in the selection of sales channels [35].

When conducting this research, two forms of the SIWEC method are used, the classic one that uses numerical ratings, and the fuzzy one that uses linguistic values. The obtained results of implementing the simple SIWEC and fuzzy SIWEC methods show that there is no major deviation between the results, because almost the same ratings are used. The DM used certain grades and only transformed others into corresponding numbers or linguistic values. This way is shown that if the alternatives are not shown in the fuzzy number, it is not necessary to use the fuzzy form, but it is possible to transform the linguistic values into crips numbers and implement the simple SIWEC method. In the end, approximately the same result will be obtained with small deviations.

Through the given example, the SIWEC method appeared as innovative and flexible. Usually with subjective methods (AHP, FUCOM, SWARA, PIPRECIA...) normalization is not done but a simple comparison of criteria. This method showed that it can use normalization to calculate criteria weights. However, simple normalization is not used, but adjusted one so that the total maximum value of all ratings is used. The reason for this is the fact that in this way all criteria are viewed in the same way and that the structure of DM ratings does not change. By performing classic normalization, the maximum value within the criteria would be taken, and the individual values of the criteria would be divided by that value. Thus, the criteria that received lower ratings would be equated with those that received higher ratings, and evaluating made by DM would not make sense. In this research, the criteria C9, C10 and C11 were given lower ratings by DM, so these would be equated with other criteria.

The next step is also different from other similar methods, which is the calculation of standard deviation. By applying this indicator, the DM themselves gain a certain importance in the evaluation. Which, for example, is not the case in the LMAW method, because it uses the Bonferroni aggregator operator and thus harmonizes the DM opinions. The SIWEC method gives preference to certain DM when determining the importance of criteria, but this preference is done in an objective way using standard deviation, avoiding the subjectivity of giving preference to some DM over other DM. The final steps of the SIWEC method are not so innovative but rather common, such as adding the values within the criteria and dividing so that the total value is one (1).

Limitations

Not applicable.

Ethics statements

Not applicable.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Adis Puška: Conceptualization, Methodology, Writing – original draft, Supervision. **Miroslav Nedeljković:** Conceptualization, Visualization, Investigation, Data curation, Project administration. **Dragan Pamučar:** Validation, Formal analysis, Writing – review & editing. **Darko Božanić:** Validation, Formal analysis, Writing – original draft. **Vladimir Simić:** Supervision, Data curation.

Data availability

Data will be made available on request.

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