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Market segment evaluation based on fuzzy tools

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Abstract: The paper suggests a hybrid model with simplified and extended schemes for evaluating market segments based on strategic diagnostics methods and fuzzy multi-criteria analysis tools. The developed model's novelty and originality consist of forming a system of evaluation criteria based on the GROT criteria of I. Ansoff and the five forces of the M. Porter model (and in the case of an extended calculation scheme – with their decomposition into sets of relevant sub-criteria) and the use of the latest Fuzzy SBWM method (Fuzzy Extension of Simplified Best-Worst Method) to determine their weighting factors. Expert linguistic evaluations on a defined 7-level term set, followed by their transformation into fuzzy numbers with triangular membership functions, are used to evaluate market segments for each identified criteria (sub-criteria). The Fuzzy SAW method determines fuzzy integral estimates of market segments based on these sub-criteria. A practical case of evaluating the confectionery market segments of Ukraine for the simplified calculation scheme is given. The systematic approach makes it possible to determine the attractiveness of market segments for forming strategic recommendations based on the application of portfolio analysis methods, for developing and implementing diversification and logistic strategies.

1 Introduction

Uncertainty, dynamism, and turbulence are characteristic attributes of the modern market environment, which is constantly influenced by various factors that are vague and difficult to predict. This significantly complicates enterprise management processes, especially in a strategic context. Therefore, the management of companies faces the task of developing scientifically based methods of analysis and evaluation and taking into account the trends of the influence of such factors to respond adequately and timely to challenges and use the opportunities generated by the external environment.

Currently, one of the most promising directions of applied research in management, and in particular in strategic management and marketing, is the use of methods and models of the fuzzy-multiple theory, which have a high adaptability to expert data, are sufficiently flexible and adequate to input information.

One of the essential components of management is the evaluation of market segments (MSE) because this characteristic is one of the most critical factors used:

– in the formation of strategic recommendations based on the application of portfolio analysis methods;

– in the development and implementation of diversification and logistic strategies;

– in the formation of investment programs, etc.

As noted by Y. Windand and R. J. Thomas [1], "Market segmentation and evaluation (MSS/MSE) is a critical management decision because all other components of a marketing strategy follow it".

In addition, MSS/MSE plays an essential role in increasing company competitiveness and flexibility in interacting with suppliers in the logistics management of enterprise.

This procedure requires thorough knowledge of logical-causal relationships in the industry and the availability of relevant information about the relevant market segments. As a rule, it is based on expert reasoning and assessments, which have a "blurry", vague character. This, in turn, necessitates revising traditional methods, which need to be more practical considering the nature of available and forecast information and need a more transparent methodology.

2 Literature review

Applying the theory of fuzzy sets and fuzzy logic to solve problems of strategic management and strategic marketing has recently been a growing trend both in scientific literature and in practical activities, significantly expanding the capabilities of classical tools and demonstrating efficiency and flexibility. We will analyze the latest scientific works related to the evaluation of market segments. Authors Duong & Thao [2] propose a TOPSIS model based on entropy and similarity measures for market segment selection and assessment, and a new entropy and similarity measure under a neutrosopic environment is used to evaluate the weights of criteria and the relative closeness coefficient in TOPSIS model.

The proposed fuzzy CODAS method in [3] is applied to an example of market segment evaluation and selection problem under uncertainty. A comparison between fuzzy CODAS and two other MCDM methods (fuzzy EDAS and fuzzy TOPSIS) is performed to verify the results. Multi-objective optimisation based on the ratio analysis (MOORA) method is applied to solve some market segment evaluation problems [4].

In [5], DEMATEL, CODAS, and Fuzzy Competitive Analysis methods determine the most critical factors in assessing market segments and consider competitive aspects. In [6], a hybrid single-valued neutrosophic multi-criteria group decision-making (MCGDM) approach with quality function deployment (QFD) is used to support the MSS/MSE process.

The authors [7] use Gray Relational Analysis to identify critical relationships between market segments, Fuzzy AHP and the COPRAS-G system for MSE. Sarabia F. [8] proposes a Cost-Benefit Method, Segment-Marketing Mix Profit Matrix, for evaluating market segments regarding cost and benefits using cost-benefit analysis. The systematic approach of Dat et al. [9] consists of Kotler's Criteria, which include the classic criteria of the famous marketer Philip Kotler, product-specific variables, decision support systems for analysis, and decision support systems. Mohammadi's A. [10] approach uses DSS with SPACE Matrix, DNP SPACE, and the Dynamic Network Process method. The hybrid MADM Method with AHP and TOPSIS [11] is another hybrid method that uses multi-attribute decision-making (MADM) with AHP and TOPSIS to evaluate market segments. The indexing Approach, Latent Discriminant Analysis (LADI), and Fuzzy Set Model [12] use indexing, latent discriminant analysis and fuzzy models to evaluate market segments. Fuzzy Attractiveness of Market Entry (FAME) uses fuzzy logic to assess the attractiveness of market entry, providing flexibility in decisions related to market segmentation. These methods represent different approaches to analysing market segments, using both traditional statistical methods and modern, more complex techniques that include fuzzy logic and hybrid models to understand better and evaluate market segments, enabling companies to identify the most attractive market segments to enter or expand their activities.

3 Methodology

In this paper, the tools of strategic analysis, fuzzy-multiple theory and fuzzy multi-criteria evaluation are used to achieve the research goals.

Let us consider some crucial relations and assertions of the theory of fuzzy sets, which will be necessary for solving the tasks of this study.

This paper will use the triangular representation of a fuzzy number. In this article, the tools of strategic analysis, fuzzy-multiple theory and fuzzy multi-criteria evaluation are used to achieve the research goals.

Let us consider some crucial relations and assertions of the theory of fuzzy sets, which will be necessary for solving the tasks of this study.

This paper will use the triangular representation of a fuzzy number $\tilde{A} = (a_1; a_2; a_3)$ (Figure 1) with the corresponding membership functions – formula (1). However, a representation, for example, in a trapezoidal form, can also be used.

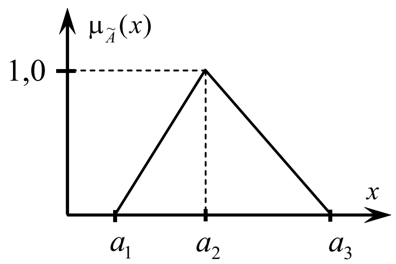

Figure 1 Graphical representation of a fuzzy number with a triangular membership function

$$\mu_{\tilde{A}}(x) = \begin{cases} 0, x < a_1; \\ (x - a_1)/(a_2 - a_1), x \in [a_1; a_2]; \\ (x - a_3)/(a_2 - a_3), x \in [a_2; a_3]; \\ 0, x > a_3. \end{cases} \quad (1)$$

Note that If $\tilde{A} = (a_1; a_2; a_3)$ and $\tilde{B} = (b_1; b_2; b_3)$ – fuzzy numbers, then (2-7):

$$\tilde{A} \oplus \tilde{B} = (a_1; a_2; a_3) \oplus (b_1; b_2; b_3) = (a_1 + b_1; a_2 + b_2; a_3 + b_3), \quad (2)$$

$$\tilde{A}(-)\tilde{B} = (a_1; a_2; a_3)(-)(b_1; b_2; b_3) = (a_1 - b_3; a_2 - b_2; a_3 - b_1), \quad (3)$$

$$\tilde{A} \otimes \tilde{B} = (a_1; a_2; a_3) \otimes (b_1; b_2; b_3) = (a_1 \times b_1; a_2 \times b_2; a_3 \times b_3), \quad (4)$$

$$\tilde{A}(\div)\tilde{B} = (a_1; a_2; a_3)(\div)(b_1; b_2; b_3) = (a_1/b_3; a_2/b_2; a_3/b_1), \quad (5)$$

$$c \times \tilde{A} = c \times (a_1; a_2; a_3) = (ca_1; ca_2; ca_3), c \geq 0, \ c - const, \quad (6)$$

$$c \times \tilde{A} = c \times (a_1; a_2; a_3) = (ca_3; ca_2; ca_1), c < 0, \ c - const. \quad (7)$$

If $\tilde{A}_i = (a_{1i}; a_{2i}; a_{3i}), i = \overline{1,n}$, then (8):

$$\oplus_{i=1}^{n} \tilde{A}_i = \oplus_{i=1}^{n}(a_{1i}; a_{2i}; a_{3i}) = (\sum_{i=1}^{n} a_{1i}; \sum_{i=1}^{n} a_{2i}; \sum_{i=1}^{n} a_{3i}) \quad (8)$$

The ratio of the COA (Center Of Area) method (9) is used for the defuzzification of a fuzzy triangular number $\widetilde{A} = (a_1; a_2; a_3)$:

$$\widetilde{A}^{def} = ((a_3 - a_1) + (a_2 - a_1))/3 + a_1 . \quad (9)$$

The method of fuzzy multi-criteria analysis Fuzzy Extension of Simplified Best-Worst Method (Fuzzy SBWM) [13] is used to solve the problem of calculating weight coefficients of criteria (sub-criteria) for evaluating market segments in this study. Note that BWM was proposed by Rezai J. [14] for multi-criteria decision-making problems based on pairwise comparisons, and in the works of Hafezalkotob A. [15], this method was extended for the theory of fuzzy sets, in particular, using triangular fuzzy numbers.

The integral estimates of market segments are calculated using fuzzy additive weighting (fuzzy SAW method).

I. Ansoff's methodical approach (GROT approach) and P5FM are used to form a system of criteria for evaluating market segments.

4 Result and discussion

To consider subjective, informal, vague input data, opinions and judgments of experts, formulated qualitatively in natural language, a systematic approach developed by the authors is proposed. The main stages are shown in Figure 2.

Let us consider these stages in more detail.

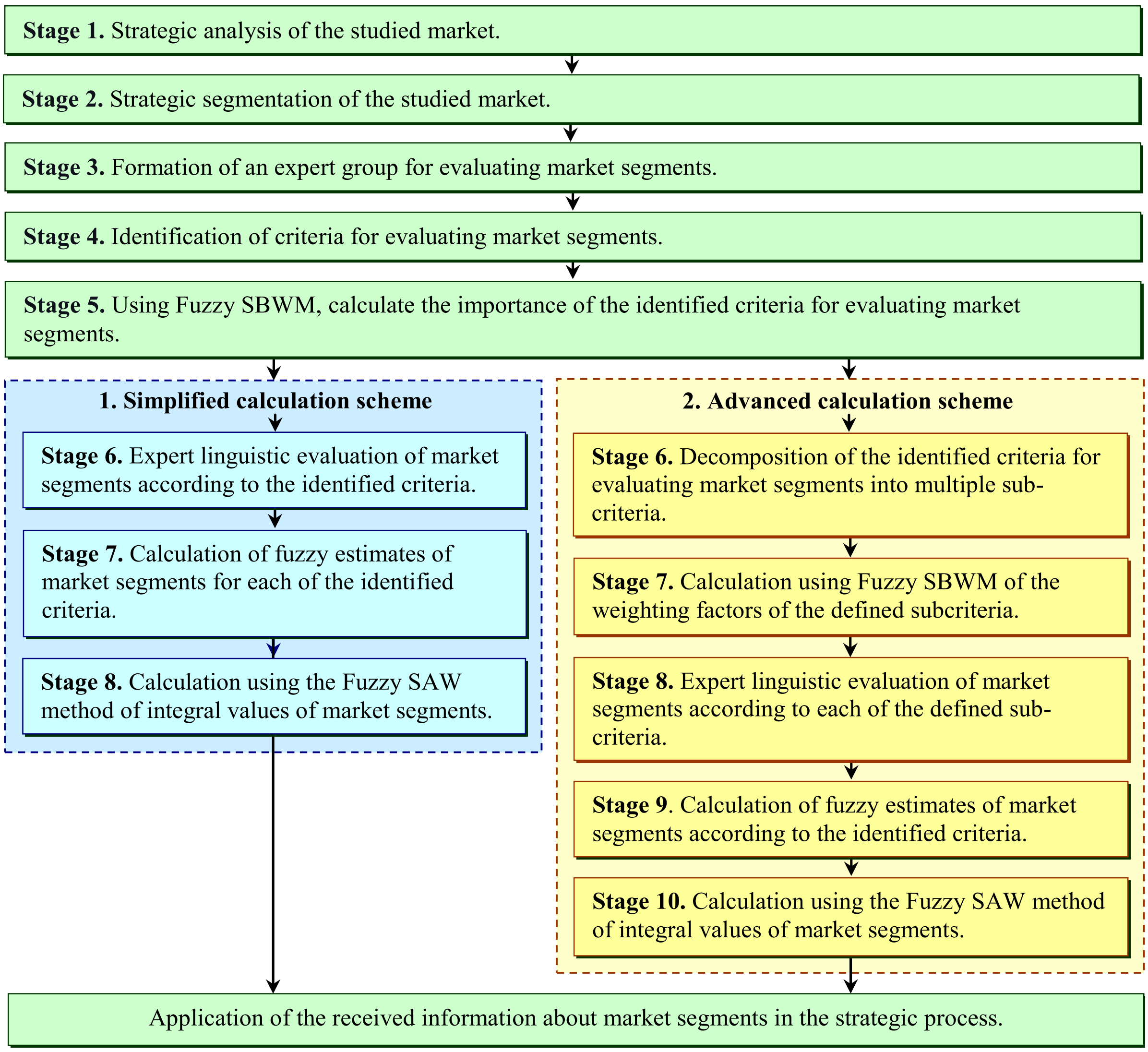

Figure 2 Stages of a methodical approach to the evaluation of market segments
(Source: Authors' own)

At stage 1, the company's specialists and analysts, using appropriate tools, conduct a thorough strategic diagnosis of the analysed market, its features and existing trends.

For strategic market segmentation at stage 2, the strategic marketing toolkit or the approach proposed by I. Ansoff [16]is used based on such parameters as need, technology, type of client, geographic area or their combinations. We denote the set of obtained market segments for evaluation by $S = \{S_1; S_2; \ldots; S_n\}$, where is n – their number.

Stage 3 – forming a working group of experts with professional knowledge and experience. Including external experts with relevant competencies and qualifications in the problem area is also appropriate.

Stage 4. Identification of criteria for evaluating market segments.

One of the most critical problems in evaluating market segments is forming a system of evaluation criteria. Consideration of possible solutions to this problem is given considerable attention in scientific literature. Specifically, according to Ou et al. [17], the list of segment evaluation criteria is formed based on P5FM, and they can be modified based on marketing information and retrospective analysis of the implementation of development strategies. Mohammadi. et al. [10] supplement the P5FM toolkit with SPACE analysis criteria. Sarabia F. [8] suggests applying a system of criteria based on the Kaiser criterion and the VARIMAX rotating factor matrix; in particular, management, strategic and segmental criteria groups are highlighted. Based on the generalisation of information from relevant sources, the authors Aghdaie M. et al. [18] proposed the following evaluation criteria: measurability, accessibility, practicality, competitive advantage, segment size, potential profit, expected growth, competition and business strengths. A similar approach to the formation of a system of criteria, additionally using a survey of experts, was also used in Thao N.[19], the following criteria were highlighted: profitability, the growth of the market, size of the market, likely customer satisfaction, sales volume, likelihood of sustainable differential advantage, development opportunities and the differentiation of products. Söllner A. & Rese M. [20]highlight somewhat different criteria in nature and focus: customer response, measurability, accessibility, materiality, and temporal stability. In a study by Dibb et al. [21], the list of criteria consists of two groups: qualifying criteria that determine the feasibility of investments in a segment and attractiveness that assesses the segment's potential. Three groups of criteria are proposed to be used in Tonks D. [22]: design (construct validity (relevance), content validity (relevance), criterion validity (homogeneity/heterogeneity), familiar, universal, requirements of other management functions, data availability, cost); qualification (measurable, accessible, substantial, actionable, stable, parsimonious, profitable, unique response elasticities) and attractiveness (compatibility with corporate objectives, compatibility with company competencies, resource requirements, sales volume, segment growth, relative market share, competitive intensity, entry and exit barriers, macro-environmental factors).

In this study, the authors suggest using (Figure 3) as evaluation criteria:

✦ Criteria of the systematic approach of I. Ansoff [16]: – growth prospects (*G*); – rentability prospects (*R*); – favorable opportunities (*O*); – adverse opportunities (threats) (*T*) and

✦ Five forces of M. Porter's model [23]: – the bargaining power of customers (*BPC*); – the bargaining power of suppliers (*BPS*); – the threat of new entrants (*TNE*); – the threat of substitute products (*TSP*); – the intensity of competitive rivalry (*ICR*).

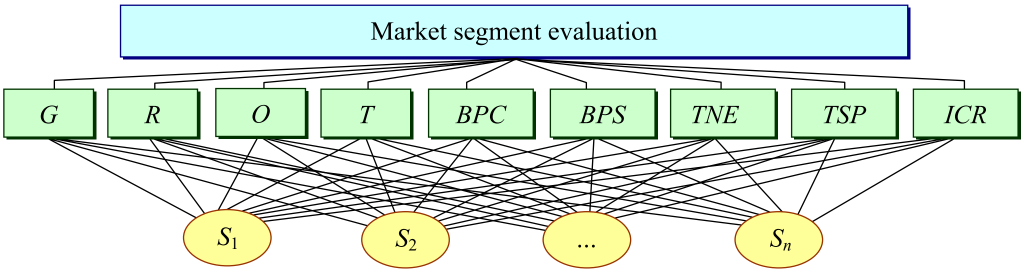

Figure 3 Hierarchy of the problem of evaluating market segments
(Source: Authors' own)

The developed methodological approach involves calculating the importance of the identified criteria for evaluating market segments, which is carried out at stage 5 using Fuzzy SBWM [13; 24]. (Figure 4).

We will redefine the selected criteria for evaluating market segments for the convenience of further application: $G \to C_1$; $R \to C_2$; $O \to C_3$; $T \to C_4$; $BPC \to C_5$; $BPS \to C_6$; $TNE \to C_7$; $TSP \to C_8$; $ICR \to C_9$ and illustrate the application of Fuzzy SBWM in the general case for a set of criteria $C = \{C_1; C_2; \ldots; C_m\}$. It should be noted that the Fuzzy SBWM procedure involves the use of two approaches: the "*best*" approach and the "*worst*" approach, the results of which are combined to determine the integral values of the importance of the investigated criteria (Figure 4).

• Let us first consider the "*best*" approach.

In step 1, it is necessary to determine the most critical (*"best"*) criterion among a set of evaluation criteria. It should be done based on a consensus by a group of experts. Let us denote the "*best*" criterion as follows: C_{best}.

Further, in step 2, each of the K experts provides a linguistic evaluation of the importance (priority) of the "best" criterion compared to the other criteria using the terms listed in the Table 1 with corresponding membership functions (Figure 5). It will result in linguistic assessments $L_{jk}^{best}, j = \overline{1, m};\ k = \overline{1, K}$.

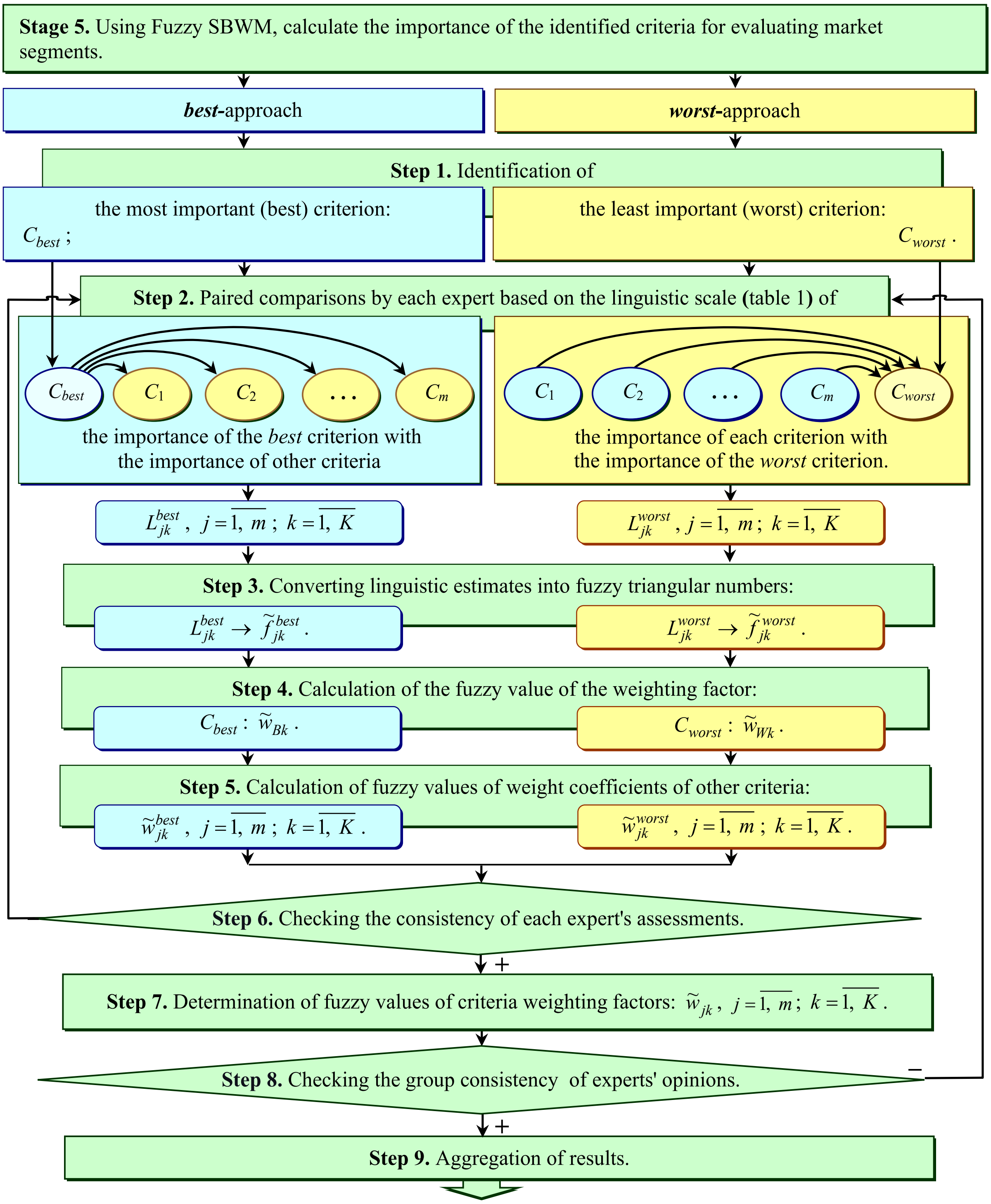

Figure 4 The application scheme of the Fuzzy SBWM method for determining the weighting coefficients of the criteria for evaluating market segments Source: developed by the authors based on [13]

Table 1 Linguistic terms for evaluating the importance of evaluation criteria and corresponding fuzzy numbers [25]

Linguistic terms for evaluating the importance of criteria (sub-criteria)	Designation	Fuzzy Meaning
Equally	EI	(1; 1; 1)
Weakly	WI	(1; 2; 3)
Moderate	MI	(2; 3; 4)
Moderate plus	MP	(3; 4; 5)
Strong	SI	(4; 5; 6)
Strong plus	SP	(5; 6; 7)
Very strong	VS	(6; 7; 8)
Extreme	EX	(7; 8; 9)

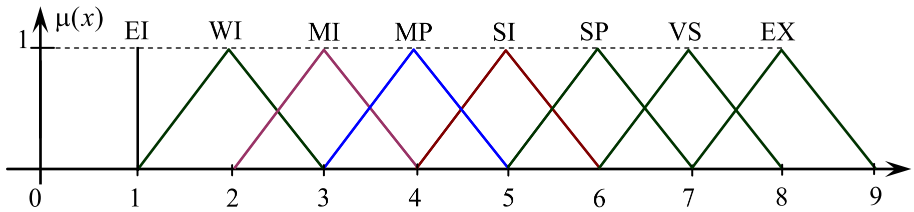

Figure 5 Functions of membership of evaluation terms [25]

Conversion of the obtained estimates L_{jk}^{best} into the corresponding fuzzy triangular numbers (Figure 5) is carried out in step 3 according to the scale of the Table 1 in the form: $\tilde{f}_{jk}^{best} = (\alpha_{jk}^{best};\ \beta_{jk}^{best};\ \gamma_{jk}^{best}), j = \overline{1,\ m};\ \ k = \overline{1,\ K}.$

In step 4, the fuzzy importance value of the "*best*" criterion is calculated using equation (10):

$$\left(\bigoplus_{j=1}^{m}\frac{1}{\tilde{f}_{jk}^{best}}\right)\otimes \tilde{w}_{Bk}^{best} = 1. \tag{10}$$

From here (11):

$$\tilde{w}_{Bk}^{best} = \frac{1}{\bigoplus_{j=1}^{m}\frac{1}{\tilde{f}_{jk}^{best}}} = \left(\frac{1}{\sum_{j=1}^{m}\frac{1}{\alpha_{jk}^{best}}};\frac{1}{\sum_{j=1}^{m}\frac{1}{\beta_{jk}^{best}}};\frac{1}{\sum_{j=1}^{m}\frac{1}{\gamma_{jk}^{best}}}\right) = (x_{Bk}^{best};y_{Bk}^{best};z_{Bk}^{best}) \tag{11}$$

Next, in step 5, since ratios must be performed (12:)

$$\tilde{w}_{Bk}^{best}(-)\tilde{f}_{jk}^{best}\otimes \tilde{w}_{jk}^{best} = 0, \tag{12}$$

then for arbitrary $j = \overline{1, m}$ and for $k = \overline{1,\ K}$ have (13):

$$w_{jk}^{best} = \tilde{w}_{Bk}(\div)\tilde{f}_{jk}^{best} = \left(\frac{x_{Bk}^{best}}{\gamma_{jk}^{best}};\ \frac{y_{Bk}^{best}}{\beta_{jk}^{best}};\frac{z_{Bk}^{best}}{\alpha_{jk}^{best}}\right) = (x_{jk}^{best};y_{jk}^{best};z_{jk}^{best}). \tag{13}$$

• For the ***"worst" approach***, in step 1, the least important ("worst") criterion is also determined among the evaluation criteria based on consensus by a group of experts C_{worst}.

In step 2, each *k-th* expert performs a linguistic evaluation of each criterion's importance (priority) compared C_{worst} to the terms listed in the Table 1. As a result, we will obtain $L_{jk}^{worst}, j = \overline{1,\ m};\ \ k = \overline{1,\ K}.$

In step 3, linguistic assessments are obtained L_{jk}^{worst} transform into corresponding fuzzy triangular numbers according to the scale of the Table 1 in the form $\tilde{f}_{jk}^{worst} = (\alpha_{jk}^{worst};\ \beta_{jk}^{worst};\ \gamma_{jk}^{worst}), j = \overline{1,\ m};\ \ k = \overline{1,\ K}$.

Step 4 calculates the importance of the $\tilde{w}_{Wk}^{worst}$ «*worst*»- criterion from equation (14):

$$\left(\bigoplus_{j=1}^{m}\widetilde{f_{jk}^{worst}}\right)\otimes \tilde{w}_{Wk}^{worst} = 1, \tag{14}$$

From here (15),

$$\tilde{w}_{Wk}^{worst} = 1(\div)\left(\bigoplus_{j=1}^{m}\tilde{f}_{jk}^{worst}\right) = \left(\frac{1}{\sum_{j=1}^{m}\gamma_{jk}^{worst}};\ \frac{1}{\sum_{j=1}^{m}\beta_{jk}^{worst}};\frac{1}{\sum_{j=1}^{m}\alpha_{jk}^{worst}}\right) = (x_{Wk}^{worst};y_{Wk}^{worst};z_{Wk}^{worst}) \tag{15}$$

In step 5, by substituting the weighting factor of the least essential criterion $\tilde{w}_{Wk}^{worst}$ into equation (16), it is possible to calculate the weighting factors of other criteria (17).

$$\tilde{w}_{jk}^{worst}(-)\tilde{f}_{jk}^{worst}\otimes \tilde{w}_{Wk}^{worst} = 0, \text{ for arbitrary } j = \overline{1,\ m};\ \ k = \overline{1,\ K}. \tag{16}$$

$$\tilde{w}_{jk}^{worst} = \tilde{f}_{jk}^{worst}\otimes \tilde{w}_{Wk}^{worst} = \left(\alpha_{jk}^{worst}\times x_{Wk}^{worst};\beta_{jk}^{worst}\times y_{Wk}^{worst};\gamma_{jk}^{worst}\times z_{Wk}^{worst}\right) = = (x_{jk}^{worst};y_{jk}^{worst};z_{jk}^{worst}). \tag{17}$$

So, in this way, the fuzzy values of the weighting coefficients of all evaluation criteria according to the best- and worst approaches, respectively, were obtained: $w_{jk}^{best} = (x_{jk}^{best};y_{jk}^{best};z_{jk}^{best})$ and $\tilde{w}_{jk}^{worst} = (x_{jk}^{worst};y_{jk}^{worst};z_{jk}^{worst}), j = \overline{1,\ m};\ k = \overline{1,\ K}.$

Next, in step 6, it is necessary to check the consistency of the assessments of each expert. For this, you can use the coefficient CR_k, calculated from the ratio (18):

$$CR_k = def\ \left(\oplus_{j=1}^{m}(\widetilde{w}_{jk}^{best}(-)\widetilde{w}_{jk}^{worst})^2\right), \tag{18}$$

or by the deviation coefficient according to the formula (19):

$$TD_k = def\ \left(\oplus_{j=1}^{m}\left(\left(\tilde{f}_{jk}^{best}(-)\frac{\widetilde{w}_{Bk}^{best}}{\widetilde{w}_{jk}^{best}}\right)^2 \oplus \left(\tilde{f}_{jk}^{worst}(-)\frac{\widetilde{w}_{jk}^{worst}}{\widetilde{w}_{Wk}^{worst}}\right)^2\right)\right). \tag{19}$$

If the values of the calculated coefficients are significant enough, experts need to revise their estimates of superiority in pairwise comparisons to reach an acceptable range for these coefficients.

If the experts' assessments agree, then at step 7, the fuzzy values of the weighting coefficients of the criteria are calculated as the arithmetic mean of the fuzzy values of the weighting coefficients obtained based on the best- and worst-approaches according to the formula (20):

$$\widetilde{w}_{jk} = \frac{1}{2}\left(\widetilde{w}_{jk}^{best} + \widetilde{w}_{jk}^{worst}\right) = \left(\frac{1}{2}\left(x_{jk}^{best} + x_{jk}^{worst}\right);\ \frac{1}{2}\left(y_{jk}^{best} + y_{jk}^{worst}\right);\ \frac{1}{2}\left(z_{jk}^{best} + z_{jk}^{worst}\right)\right) =$$
$$= (x_{jk}; y_{jk}; z_{jk}). \tag{20}$$

In step 8, it is necessary to check the group consistency of experts' assessments. For this purpose, it is possible to denazify the received values of the weighting coefficients and calculate the concordance coefficient. If necessary, the Fuzzy Delphi procedure can be applied to achieve satisfactory group consistency.

If the group consistency is satisfactory, then at step 9, the results are aggregated according to formula (21):

$$\widetilde{w}_j = \frac{1}{K}\oplus_{k=1}^{K}\widetilde{w}_{jk} = \frac{1}{K}\oplus_{k=1}^{K}(x_{jk}; y_{jk}; z_{jk}) = \left(\frac{1}{K}\sum_{k=1}^{K}x_{jk};\frac{1}{K}\sum_{k=1}^{K}y_{jk};\frac{1}{K}\sum_{k=1}^{K}z_{jk}\right) = (x_j; y_j; z_j) \tag{21}$$

Therefore, the result of stage 5 is the calculated fuzzy values of the weighting factors of the evaluation criteria of market segments.

Next, we will consider two calculation schemes for evaluating market segments: 1. Simplified calculation scheme and 2. Advanced calculation scheme.

✦ For the **Simplified calculation scheme**, at stage 6, an expert linguistic assessment of market segments S_i $(i = \overline{1, n})$ is carried out according to the identified criteria. For this, you can use the following term set TS = {EL; VL; L; M; H; VH; EH} (Table 2, Figure 6):

Table 2 Linguistic terms for estimating market segments and corresponding fuzzy numbers in triangular form (Source: Authors' own)

Linguistic terms for market segment evaluation	Designation	Fuzzy meaning
Extremely High	EL	(1; 1; 2)
Very Low	VL	(1; 2; 3)
Low	L	(2; 3; 4)
Medium	M	(3; 4; 5)
High	H	(4; 5; 6)
Very High	VH	(5; 6; 7)
Extremely High	EH	(6; 7; 7)

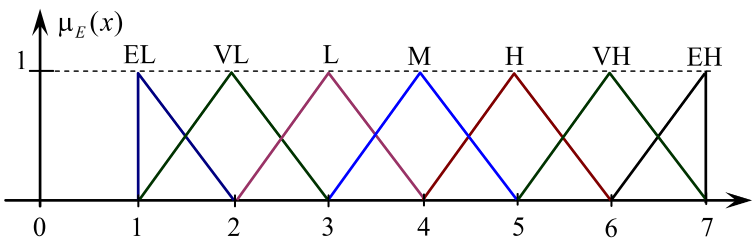

Figure 6 Functions of belonging to the terms of assessment of the level of market segments (Source: Authors' own)

So, let be L_{ijk} – the linguistic assessment by the k-*th* expert of *the* i-*th* market segment according to the j-*th* evaluation criterion. Next, these estimates must be transformed using the triangular form of representation: $L_{ij}^k \rightarrow \tilde{E}_{ij}^k = (a_{ij}^k; b_{ij}^k; c_{ij}^k)$, and check the group consistency of the experts' estimates (for example, by calculating the root mean square deviation); if there are significant differences in them, then it is necessary to revise the corresponding estimates.

At stage 7, the value of market segments according to each of the identified criteria is calculated using the aggregation of the received fuzzy estimates of experts according to the following formula (22):

$$\tilde{E}_{ij} = \frac{1}{K} \oplus_{k=1}^{K} \widetilde{E_{ijk}} = \left(\frac{1}{K}\sum_{k=1}^{K} a_{ijk}; \frac{1}{K}\sum_{k=1}^{K} b_{ijk}; \frac{1}{K}\sum_{k=1}^{K} c_{ijk}\right) = (a_{ij}; b_{ij}; c_{ij}); \quad (22)$$

Further, at stage 8, using the Fuzzy SAW method, we find the integral values of market segment estimates. To do this, first, taking into account the monotonicity of the objective function of each of the criteria (C_1, C_2, C_3 – profit criteria (↗); $C_4, C_5, \dots, C_9$ – cost criteria (↘)), we normalise the obtained fuzzy values according to the formulas (23-24):

$$\tilde{E}_{ij}^{*} = \frac{\tilde{E}_{ij}}{7} = \frac{(a_{ij}; b_{ij}; c_{ij})}{7} = \left(\frac{a_{ij}}{7}; \frac{b_{ij}}{7}; \frac{c_{ij}}{7}\right) = (a_{ij}^{*}; b_{ij}^{*}; c_{ij}^{*}) \text{ – for profit criteria } (j = \overline{1,3}), \quad (23)$$

$$\text{and } \tilde{E}_{ij}^{*} = 1(\div)\tilde{E}_{ij} = 1(\div)(a_{ij}; b_{ij}; c_{ij}) = \left(\frac{1}{c_{ij}}; \frac{1}{b_{ij}}; \frac{1}{a_{ij}}\right) = (a_{ij}^{*}; b_{ij}^{*}; c_{ij}^{*}) \text{ – for cost criteria } (j = \overline{4, \rightleftarrows\ 9}). \quad (24)$$

Integral values of market segment estimates are calculated at stage 8 using the formula (25):

$$\tilde{E}_{i} = \bigoplus_{j=1}^{9} \widetilde{w_j} \otimes \tilde{E}_{ij}^{*} = \bigoplus_{j=1}^{9} (x_j; y_j; z_j) \otimes (a_{ij}^{*}; b_{ij}^{*}; c_{ij}^{*}) = \bigoplus_{j=1}^{9} (x_j \times a_{ij}^{*}; y_j \times b_{ij}^{*}; z_j \times c_{ij}^{*}) = = (A_i; B_i; C_i). \quad (25)$$

✦ For the **Advanced calculation scheme**, at stage 6, the identified criteria for evaluating market segments are decomposed into a set of sub-criteria (Figure 7).

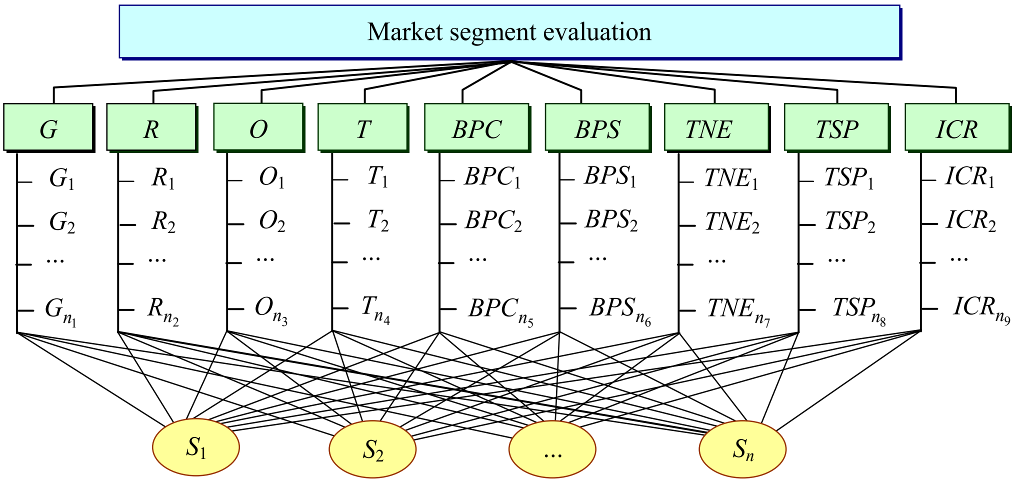

Figure 7 Hierarchy of the problem of evaluating market segments in the Advanced calculation scheme (Source: Authors' own)

Note that the sub-criteria and their number for each evaluation criterion must be determined by the expert group based on the characteristics of the analysed market and its existing trends.

At stage 7, using Fuzzy SBWM, the weighting factors of the defined subcriteria are calculated. Let $\tilde{v}_{jl} = (p_{jl}; q_{jl}; r_{jl})$ be the weighting coefficients of the l-th subcriterion of the j-th evaluation criterion ($l = \overline{1, n_j}$; $j = 1,2,\dots,9$), computed using Fuzzy SBWM.

Stage 8. Expert linguistic assessment of market segments by subcriteria uses the *TS* term set (Table 2). So, let L_{ijlk} be the linguistic assessment by the k-th expert of the i-th market segment according to the l-th subcriterion of the j-th valuation criterion. Next, these estimates must be transformed using the triangular form of representation (Table 2, Figure 6): $L_{ijlk} \rightleftarrows\rightarrow \tilde{E}_{ijk} = (a_{ijlk}; b_{ijlk}; c_{ijlk})$, and the group consistency of experts' estimates. In the case of a satisfactory result, the aggregation of the obtained fuzzy expert assessments is carried out according to the following formula (26):

$$\tilde{E}_{ijl} = \frac{1}{K} \oplus_{k=1}^{K} \tilde{E}_{ijlk} = \left(\frac{1}{K}\sum_{k=1}^{K} a_{ijlk}; \frac{1}{K}\sum_{k=1}^{K} b_{ijlk}; \frac{1}{K}\sum_{k=1}^{K} c_{ijlk}\right) = (a_{ijl}; b_{ijl}; c_{ijl}). \quad (26)$$

Then, at stage 9, using the Fuzzy SAW method, we find the fuzzy integral values of market segment estimates for each criterion (27):

$$\tilde{E}_{ij} = \bigoplus_{l=1}^{n_j} \tilde{v}_{jl} \otimes \tilde{E}_{ijl} = \bigoplus_{l=1}^{n_j} (p_{jl}; q_{jl}; r_{jl}) \otimes (a_{ijl}; b_{ijl}; c_{ijl}) = \bigoplus_{l=1}^{n_j} (p_{jl} \times a_{ijl}; q_{jl} \times b_{ijl}; r_{jl} \times c_{ijl}) = (a_{ij}; b_{ij}; c_{ij})$$

$$i = \overline{1, n}; j = 1,2,\dots,9. \quad (27)$$

Stage 10 of the Advanced calculation scheme is similar to stage 8 of the Simplified calculation scheme. Accordingly, taking into account that C_1, C_2, C_3 – profit criteria, $C_4, C_5, \dots, C_9$ – cost criteria, formulas (23) and (24) are applied, respectively, to normalize the obtained fuzzy values $\tilde{E}_{ij}$ and further, using formula (25), the integral values of market segment estimates are calculated.

For the practical application of the proposed systematic approach to facilitate the computational process, a framework was developed in Excel containing the following basic units (Figure 8).

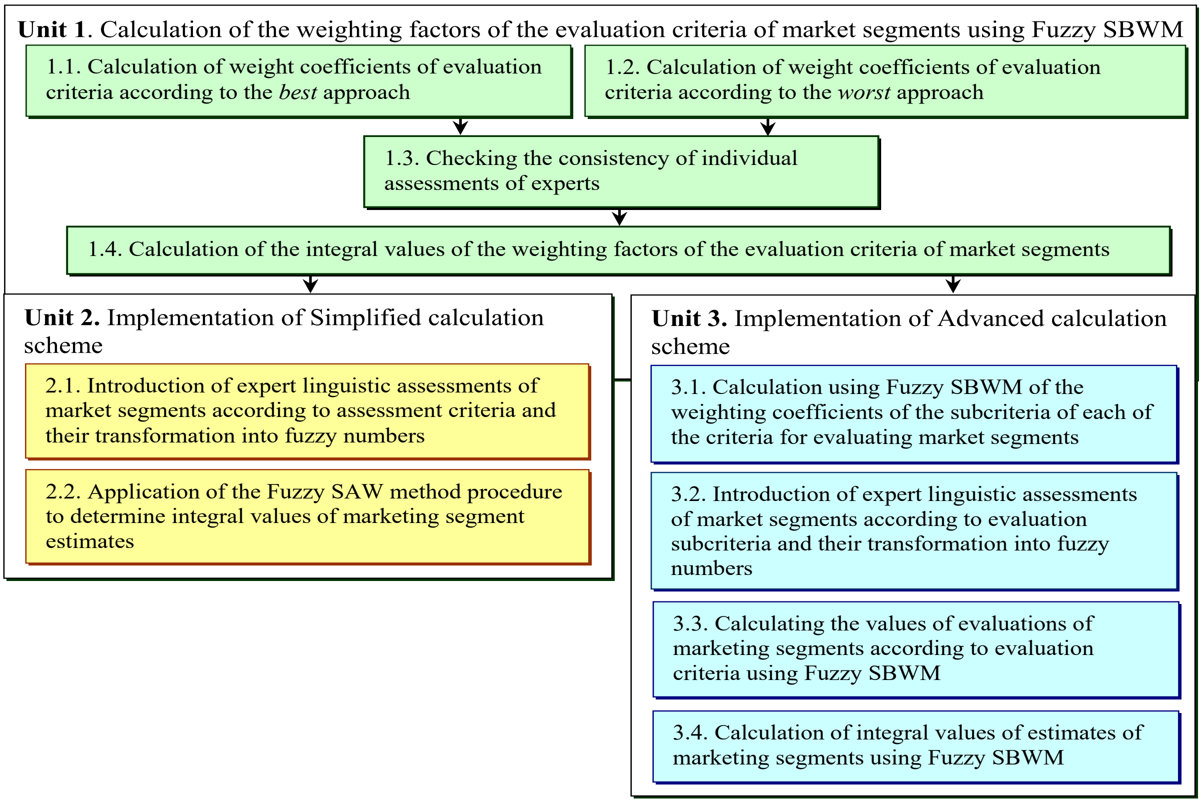

Figure 8 Framework blocks for fuzzy multi-criteria evaluation of market segments (Source: Authors' own)

Case studies. In this study, to illustrate the proposed systematic approach, an evaluation of Ukraine's confectionery market segments will be carried out using the simplified calculation scheme. It should be noted that the Ukrainian confectionery market was formed long ago. A high level of competition characterises it due to many confectionery companies, thanks to which the market has a relatively wide range of constantly updated products that meet consumers' requirements. After the coronavirus pandemic and military aggression conditions, some crucial enterprises in the industry closed. Many enterprises had to reorient to other foreign markets. Moreover, at the same time, due to the decrease in real incomes of the population, its purchasing power decreased, and, as a result, the demand for products fell, which led to a reduction in production volumes. At the same time, trends in the consumption of new products push manufacturers to expand their assortment. The main factors affecting the confectionery market, in addition to those mentioned above, are:

– rising prices for the primary raw materials for confectionery production;
– compliance by manufacturers with higher requirements for production;
– development of the production of promising directions (organic chocolate, diabetic products, etc.);
– reduction of the population in Ukraine;
– expansion of the range of products;
– growth of export orientation in the industry;
– the presence of a significant share of shadow producers on the market;
– the producer's attention to his products and reputation.

In the confectionery market, we will distinguish three main segments: S_1 – the sugary confectionery segment; S_2 – the flour confectionery segment; and S_3 – the segment of cocoa-containing products.

Table 3 shows the linguistic evaluations of five experts according to the scale of the Table 1 of the most critical specified evaluation criteria is in the Table 4 transformed into fuzzy numbers in triangular form.

Table 3 Expert linguistic evaluations of evaluation criteria (Source: Authors' own)

E / *C*	*E₁*		*E₂*		*E₃*		*E₄*		*E₅*	
	best	*worst*	*best*	*worst*	*best*	*worst*	*best*	*worst*	*best*	*worst*
C₁	**best**	SI	**best**	SI	**best**	SI	**best**	SI	**best**	SI
C₂	WI	MP	MI	MI	WI	MP	MI	MI	WI	MP
C₃	MP	WI	MI	MI	MI	MI	MP	WI	MP	WI
C₄	MP	WI	MP	WI	SI	EI	SI	EI	MP	WI
C₅	MI	MI	MP	WI	SI	EI	MP	WI	MP	WI
C₆	WI	MP	MI	MI	MI	MI	WI	MP	WI	MP
C₇	MI	MI	WI	MP	WI	MP	MI	MI	MI	MI
C₈	SI	**worst**	SI	**worst**	SI	**worst**	SI	**worst**	SI	**worst**
C₉	MI	MI	WI	MP	MI	MI	EI	SI	MI	MI

Table 4 Fuzzy evaluations of evaluation criteria when applying best- and worst (Source: Authors' own)

E / *C*	*E₁*		*E₂*		*E₃*		*E₄*		*E₅*	
	best	*worst*	*best*	*worst*	*best*	*worst*	*best*	*worst*	*best*	*worst*
C₁	(1;1;1)	(4;5;6)	(1;1;1)	(4;5;6)	(1;1;1)	(4;5;6)	(1;1;1)	(4;5;6)	(1;1;1)	(4;5;6)
C₂	(1;2;3)	(3;4;5)	(2;3;4)	(2;3;4)	(1;2;3)	(3;4;5)	(2;3;4)	(2;3;4)	(1;2;3)	(3;4;5)
C₃	(3;4;5)	(1;2;3)	(2;3;4)	(2;3;4)	(2;3;4)	(2;3;4)	(3;4;5)	(1;2;3)	(3;4;5)	(1;2;3)
C₄	(3;4;5)	(1;2;3)	(3;4;5)	(1;2;3)	(4;5;6)	(1;1;1)	(4;5;6)	(1;1;1)	(3;4;5)	(1;2;3)
C₅	(2;3;4)	(2;3;4)	(3;4;5)	(1;2;3)	(4;5;6)	(1;1;1)	(3;4;5)	(1;2;3)	(3;4;5)	(1;2;3)
C₆	(1;2;3)	(3;4;5)	(2;3;4)	(2;3;4)	(2;3;4)	(2;3;4)	(1;2;3)	(3;4;5)	(1;2;3)	(3;4;5)
C₇	(2;3;4)	(2;3;4)	(1;2;3)	(3;4;5)	(1;2;3)	(3;4;5)	(2;3;4)	(2;3;4)	(2;3;4)	(2;3;4)
C₈	(4;5;6)	(1;1;1)	(4;5;6)	(1;1;1)	(4;5;6)	(1;1;1)	(4;5;6)	(1;1;1)	(4;5;6)	(1;1;1)
C₉	(2;3;4)	(2;3;4)	(1;2;3)	(3;4;5)	(2;3;4)	(2;3;4)	(1;1;1)	(4;5;6)	(2;3;4)	(2;3;4)

The calculated fuzzy values of the weighting coefficients of the evaluation criteria according to the best and worst approaches of Fuzzy SBWM are shown in Tables 5 and 6. Calculating the coefficients of consistency of each expert's estimates according to formula (18) ($CR_1 = 0.148$, $CR_2 = 0.169$, $CR_3 = 0.132$, $CR_4 = 0.090$, $CR_5 = 0.153$) made it possible to conclude the satisfactory consistency of these estimates $CR_i < CR^* = 0.2$. An expert panel selected the value $CR^* = 0.2$ according to the Fuzzy SBWM methodology.

Table 5 Weighting coefficients of evaluation criteria according to the best approach (Source: Authors' own)

	E₁	*E₂*	*E₃*	*E₄*	*E₅*
C₁	(0.185;0.270;0.335)	(0.037;0.270;0.335)	(0.191;0.278;0.343)	(0.194;0,246;0,280)	(0,191;0.277;0.341)
C₂	(0.062;0.135;0.335)	(0.046;0.090;0.168)	(0.063;0.139;0.343)	(0.048;0,082;0,140)	(0.063;0.138;0.341)
C₃	(0.037;0.068;0.112)	(0.046;0.090;0.168)	(0.048;0.093;0.171)	(0.039;0.061;0.093)	(0.038;0.069;0.114)
C₄	(0.037;0.068;0.112)	(0.037;0.068;0.112)	(0.032;0.056;0.086)	(0.032;0.049;0.070)	(0.038;0.069;0.114)
C₅	(0.046;0.090;0.168)	(0.037;0.068;0.112)	(0.032;0.056;0.086)	(0.039;0.061;0.093)	(0.038;0.069;0.114)
C₆	(0.062;0.135;0.335)	(0.046;0.090;0.168)	(0.048;0.930;0.171)	(0.065;0.123;0.280)	(0.063;0.138;0.341)
C₇	(0.046;0.090;0.168)	(0.062;0.135;0.335)	(0.063;0.139;0.343)	(0.048;0.082;0.140)	(0.048;0.092;0.170)
C₈	(0.031;0.054;0.084)	(0.031;0.054;0.084)	(0.032;0.056;0.086)	(0.032;0.049;0.070)	(0.032;0.055;0.085)
C₉	(0.046;0.090;0.168)	(0.062;0.135;0.335)	(0.048;0.093;0.171)	(0.194;0.246;0.280)	(0.048;0.092;0.170)

Table 6 Weighting coefficients of evaluation criteria according to the worst approach

	E₁	*E₂*	*E₃*	*E₄*	*E₅*
C₁	(0.114;0.185;0.316)	(0.114;0.185;0.316)	(0.129;0.200;0.316)	(0.121;0.192;0.316)	(0.118;0.192;0.333)
C₂	(0.086;0.148;0.263)	(0.057;0.111;0.211)	(0.097;0.160;0.263)	(0.061;0.115;0.211)	(0.088;0.154;0.278)
C₃	(0.029;0.074;0.158)	(0.057;0.111;0.211)	(0.065;0.120;0.211)	(0.030;0.077;0.158)	(0.029;0.077;0.167)
C₄	(0.029;0.074;0.158)	(0.029;0.074;0.158)	(0.032;0.040;0.053)	(0.030;0.038;0.053)	(0.029;0.077;0.167)
C₅	(0.057;0.111;0.211)	(0.029;0.074;0.158)	(0.032;0.040;0.053)	(0.030;0.077;0.158)	(0.029;0.077;0.167)
C₆	(0.086;0.148;0.263)	(0.057;0.111;0.211)	(0.065;0.120;0.211)	(0.091;0.154;0.263)	(0.088;0.154;0.278)
C₇	(0.057;0.111;0.211)	(0.086;0.148;0.263)	(0.097;0.160;0.263)	(0.061;0.115;0.211)	(0.059;0.115;0.222)
C₈	(0.029;0.037;0.053)	(0.029;0.037;0.053)	(0.032;0.040;0.053)	(0.030;0.038;0.053)	(0.029;0.038;0.056)
C₉	(0.057;0.111;0.211)	(0.086;0.148;0.263)	(0.065;0.120;0.211)	(0.121;0.192;0.316)	(0.059;0.115;0.222)

Therefore, since each expert's assessments are agreed upon. the integral fuzzy values of the weighting factors of the assessment criteria can be calculated using formula (20) (Table 7).

Table 7 Integral values of the weighting factors of the evaluation criteria (Source: Authors' own)

	E_1	E_2	E_3	E_4	E_5
C_1	(0.149;0.228;0.325)	(0.076;0.228;0.325)	(0.160;0.239;0.329)	(0.157;0.219;0.298)	(0.154;0.234;0.337)
C_2	(0.074;0.142;0.299)	(0.052;0.101;0.189)	(0.080;0.149;0.303)	(0.054;0.099;0.175)	(0.076;0.146;0.309)
C_3	(0.033;0.071;0.135)	(0.052;0.101;0.189)	(0.056;0.106;0.191)	(0.035;0.069;0.126)	(0.034;0.073;0.140)
C_4	(0.033;0.071;0.135)	(0.033;0.071;0.135)	(0.032;0.048;0.069)	(0.031;0.044;0.061)	(0.034;0.073;0.140)
C_5	(0.052;0.101;0.189)	(0.033;0.071;0.135)	(0.032;0.048;0.069)	(0.035;0.069;0.126)	(0.034;0.073;0.140)
C_6	(0.074;0.142;0.299)	(0.052;0.101;0.189)	(0.056;0.106;0.191)	(0.078;0.138;0.272)	(0.076;0.146;0.309)
C_7	(0.052;0.101;0.189)	(0.074;0.142;0.299)	(0.080;0.149;0.303)	(0.054;0.099;0.175)	(0.053;0.104;0.196)
C_8	(0.030;0.046;0.068)	(0.030;0.046;0.068)	(0.032;0.048;0.069)	(0.031;0.044;0.061)	(0.031;0.047;0.070)
C_9	(0.052;0.101;0.189)	(0.074;0.142;0.299)	(0.056;0.106;0.191)	(0.157;0.219;0.298)	(0.053;0.104;0.196)

Further, stage 6 of the Simplified calculation scheme in Table 8 shows expert linguistic evaluations of selected confectionery market segments in Ukraine according to defined evaluation criteria using a linguistic evaluation scale (Table 1).

Table 8 Linguistic assessments by experts of market segments (Source: Authors' own)

		C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9
E_1	S_1	H	VH	M	M	M	H	M	M	VH
	S_2	VH	VH	M	L	M	H	M	M	VH
	S_3	M	M	VH	VH	L	VH	L	L	H
E_2	S_1	H	VH	L	L	M	M	H	M	H
	S_2	H	H	H	L	L	M	M	H	VH
	S_3	M	VH	H	H	M	H	M	L	M
E_3	S_1	VH	H	H	M	L	L	M	M	H
	S_2	VH	M	M	L	L	M	L	L	H
	S_3	H	M	H	H	L	VH	L	L	M
E_4	S_1	H	VH	M	L	L	M	M	M	VH
	S_2	H	VH	H	VL	M	H	L	M	H
	S_3	M	H	VH	VH	L	H	L	M	M
E_5	S_1	M	H	M	M	L	M	M	M	VH
	S_2	H	H	H	L	L	M	M	L	VH
	S_3	L	H	H	VH	VL	H	L	M	H

Table 9 shows transformed (according to the scale of Table 1) experts' linguistic assessments into triangular fuzzy numbers for each of the areas of analysis.

Table 9 Fuzzy estimates of market segments in a triangular form (Source: Authors' own)

		C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9
E_1	S_1	(4; 5; 6)	(5; 6; 7)	(3; 4; 5)	(3; 4; 5)	(3; 4; 5)	(4; 5; 6)	(3; 4; 5)	(3; 4; 5)	(5; 6; 7)
	S_2	(5; 6; 7)	(5; 6; 7)	(3; 4; 5)	(2; 3; 4)	(3; 4; 5)	(4; 5; 6)	(3; 4; 5)	(3; 4; 5)	(5; 6; 7)
	S_3	(3; 4; 5)	(3; 4; 5)	(5; 6; 7)	(5; 6; 7)	(2; 3; 4)	(5; 6; 7)	(2; 3; 4)	(2; 3; 4)	(4; 5; 6)
E_2	S_1	(4; 5; 6)	(5; 6; 7)	(2; 3; 4)	(2; 3; 4)	(3; 4; 5)	(3; 4; 5)	(4; 5; 6)	(3; 4; 5)	(4; 5; 6)
	S_2	(4; 5; 6)	(4; 5; 6)	(4; 5; 6)	(2; 3; 4)	(2; 3; 4)	(3; 4; 5)	(3; 4; 5)	(4; 5; 6)	(5; 6; 7)
	S_3	(3; 4; 5)	(5; 6; 7)	(4; 5; 6)	(4; 5; 6)	(3; 4; 5)	(4; 5; 6)	(3; 4; 5)	(2; 3; 4)	(3; 4; 5)
E_3	S_1	(5; 6; 7)	(4; 5; 6)	(4; 5; 6)	(3; 4; 5)	(2; 3; 4)	(2; 3; 4)	(3; 4; 5)	(3; 4; 5)	(4; 5; 6)
	S_2	(5; 6; 7)	(3; 4; 5)	(3; 4; 5)	(2; 3; 4)	(2; 3; 4)	(3; 4; 5)	(2; 3; 4)	(2; 3; 4)	(4; 5; 6)
	S_3	(4; 5; 6)	(3; 4; 5)	(4; 5; 6)	(4; 5; 6)	(1; 2; 3)	(5; 6; 7)	(2; 3; 4)	(2; 3; 4)	(3; 4; 5)
E_4	S_1	(4; 5; 6)	(5; 6; 7)	(3; 4; 5)	(2; 3; 4)	(2; 3; 4)	(3; 4; 5)	(3; 4; 5)	(3; 4; 5)	(5; 6; 7)
	S_2	(4; 5; 6)	(5; 6; 7)	(4; 5; 6)	(1; 2; 3)	(3; 4; 5)	(4; 5; 6)	(2; 3; 4)	(3; 4; 5)	(4; 5; 6)
	S_3	(3; 4; 5)	(4; 5; 6)	(5; 6; 7)	(5; 6; 7)	(2; 3; 4)	(4; 5; 6)	(2; 3; 4)	(3; 4; 5)	(3; 4; 5)
E_5	S_1	(3; 4; 5)	(4; 5; 6)	(3; 4; 5)	(3; 4; 5)	(2; 3; 4)	(3; 4; 5)	(3; 4; 5)	(3; 4; 5)	(5; 6; 7)
	S_2	(4; 5; 6)	(4; 5; 6)	(4; 5; 6)	(2; 3; 4)	(2; 3; 4)	(3; 4; 5)	(3; 4; 5)	(2; 3; 4)	(5; 6; 7)
	S_3	(2; 3; 4)	(4; 5; 6)	(4; 5; 6)	(5; 6; 7)	(1; 2; 3)	(4; 5; 6)	(2; 3; 4)	(3; 4; 5)	(4; 5; 6)

Table 10 presents the calculated fuzzy estimates of market segments according to each of the evaluation criteria and their integral values in a triangular form. The defuzzified fuzzy values of market segment estimates according to the COA (Center of Area) method ratios according to formula (9) are also given in Table 10.

Table 10 Fuzzy estimates of market segments by each of the evaluation criteria. their integral and defuzzified values (Source: Authors' own)

	$\widetilde{w}$	S_1	S_2	S_3
C_1	(0.139; 0.230; 0.323)	(0.571; 0.714; 0.857)	(0.714; 0.771; 0.914)	(0.429; 0.571; 0.733)
C_2	(0.067; 0.127; 0.255)	(0.657; 0.800; 0.943)	(0.600; 0.743; 0.886)	(0.543; 0.686; 0.857)
C_3	(0.042; 0.084; 0.156)	(0.429; 0.571; 0.714)	(0.514; 0.657; 0.800)	(0.629; 0.771; 0.943)
C_4	(0.033; 0.061; 0.108)	(0.220; 0.283; 0.400)	(0.267; 0.367; 0.600)	(0.152; 0.180; 0.220)
C_5	(0.037; 0.072; 0.132)	(0.230; 0.300; 0.433)	(0.230; 0.300; 0.433)	(0.257; 0.350; 0.567)
C_6	(0.067; 0.127; 0.252)	(0.203; 0.257; 0.350)	(0.187; 0.230; 0.300)	(0.157; 0.187; 0.230)
C_7	(0.063; 0.119; 0.233)	(0.193; 0.240; 0.317)	(0.220; 0.283; 0.400)	(0.240; 0.317; 0.467)
C_8	(0.031; 0.046; 0.067)	(0.200; 0.250; 0.333)	(0.213; 0.273; 0.383)	(0.230; 0.300; 0.433)
C_9	(0.078; 0.134; 0.235)	(0.152; 0.180; 0.220)	(0.152; 0.180; 0.220)	(0.187; 0.230; 0.300)
	$\tilde{E}$	(0.201; 0.449; 0.965)	(0.223; 0.470; 1.014)	(0.184; 0.425; 0.968)
	$def(\tilde{E})$	**0.539**	**0.569**	**0.526**

Based on the obtained results, it can be concluded that the segment of flour confectionery S2 has the highest rating, followed by the segment of sugary confectionery S1, and even further, the segment of cocoa-containing products S3.

In this study, the Fuzzy Extension of the Simplified Best-Worst Method is used to calculate the weighting factors of the evaluation criteria (their sub-criteria). This method has several advantages compared to other fuzzy methods of multi-criteria analysis that are used to determine the importance of evaluation criteria, in particular Fuzzy AHP, the multiplicative method of F. Lootsma, etc.: ease of application, a much smaller amount of pairwise comparisons of objects, the presence of two approaches to the calculation of weighting factors.

A significant positive feature of this systematic approach is the presence of two calculation schemes, the first of which (Simplified scheme) can be used in the event of a shortage of time to obtain "quick" assessments of market segments, and the second Advanced scheme with the decomposition of each assessment criterion into multiple sub-criteria - for more thorough and detailed analysis of market segments. Another important aspect is the validity of the proposed model, which is ensured by procedures for checking the consistency of individual expert assessments and the group results.

5 Conclusions

Classic tools for strategic diagnostics of the market environment need improvement due to the ever-increasing complexity and turbulence of the processes occurring in most sectors of national economies. Fuzzy modelling technologies are a modern, potent tool for solving strategic management and strategic marketing problems, as they make it possible to consider and process fuzzy input information about the state of endo- and exogenous factors of dynamic and difficult-to-predict environments.

In this article, the authors have developed a systematic approach to evaluating market segments, which is based on applying the toolkit of fuzzy multi-criteria analysis: Fuzzy Extension of Simplified Best-Worst Method (for calculating the weighting coefficients of evaluation criteria (sub-criteria)) and the Fuzzy SAW method (for determining the evaluations of marketing segments). This approach is implemented in two calculation schemes: Simplified calculation scheme and Advanced calculation scheme. It is proposed to use a combination of I. Ansoff's GROT approach criteria and P5FMare essential for evaluating market segments. In the case of using the Advanced calculation scheme, the decomposition of these criteria into sets of corresponding sub-criteria is assumed.

For the practical application of the approach, a framework has been developed in Excel, which makes it possible to carry out simulation simulations depending on the adjustments of the opinions of experts both at the stage of determining the importance of evaluation criteria (sub-criteria) and when directly evaluating market segments according to them.

According to the authors, the systematic approach can be a relatively flexible and effective tool when conducting strategic market analysis, forming strategic recommendations for industry enterprises based on applying portfolio analysis methods, developing and implementing diversification strategies, forming investment programs, etc.

Further research on this topic can be aimed at the approbation of this systematic approach using the Simplified and Advanced calculation schemes for various industries by adapting the subcriteria to the peculiarities of the studied industries on the application of other methods of fuzzy multi-criteria analysis (Fuzzy TOPSIS, Fuzzy COPRAS, Fuzzy VIKOR, etc.) for the comparative assessment of market segments and the implementation of consistency analysis of the obtained results; for the development of a framework and decision support system using specialised applications that implement the possibilities of fuzzy modelling, for example, the Fuzzy Logic Toolbox package of the Matlab computing system.

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