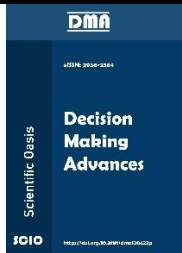




SCIENTIFIC OASIS

Decision Making Advances

Journal homepage: [www.dma-journal.org](http://www.dma-journal.org)  
ISSN: 2956-2384



## Evaluation of Customer Loyalty Using the Fuzzy Multi-Criteria Decision-Making Model

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### ARTICLE INFO

#### Article history:

Received 4 February 2026  
Received in revised form 7 March 2026  
Accepted 30 March 2026  
Available online 27 April 2026

#### Keywords:

IMF SWARA; Fuzzy MARCOS; Oriental perfumes; Designer perfumes; Loyalty; Marketing.

### ABSTRACT

Customer loyalty is a crucial aspect for maintaining competitiveness in a turbulent market that is exposed to the influence of intense changes on a daily basis. In order for companies to retain loyal customers and potentially attract new ones, it is necessary to monitor their own performance and maintain daily communication with their customers. The aim of this paper is to determine the level of customer loyalty across six age groups for two types of perfumes: oriental and designer. Through performed questionnaire with experts in the field and a review of relevant literature, nine criteria were defined based on which customer loyalty was evaluated. IMF SWARA (Improved Fuzzy Stepwise Weight Assessment Ratio Analysis) integrated with the Fuzzy Bonferroni operator was used to determine the weighting coefficients of the criteria. The Fuzzy MARCOS (Measurement Alternatives and Ranking according to Compromise Solution) method, due to its methodological framework and expert preferences, was used to determine the level of loyalty of age groups for both types of perfumes. The results show that the youngest category (aged 15-25) is the most loyal to oriental perfumes, while the group aged 26-35 demonstrates the highest loyalty to designer perfumes. The findings were tested through several additional analyses, like sensitivity analysis, comparative analysis, and correlation tests, which confirmed the obtained results.

## 1. Introduction

Consumer habits depend on a wide range of factors that keep their attention toward purchasing certain products, based on intuition, personal preferences, or even by inertia. The period from two or more decades earlier could not be directly compared with the contemporary context characterized by “open global doors”, which offer a wide range of easily accessible products in a short time, even when they are located on different continents, or extremely far away. The development and growth

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<https://doi.org/10.31181/dma412026159>

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of information and communication technologies contribute to the rapid increase in social media users, and thus to the acquisition of various target groups that regularly or occasionally follow posts (traditional or sponsored) published on social platforms, with the ultimate goal of attracting new and retaining existing consumers [1]. There is a growing transition from traditional written communication channels to digital media. Advertising through flyers and similar paper-based forms is gradually shifting to a digital format, where the consumer receives special attention, creating the impression that the message is directed solely at them, as if no other individuals are in focus. Therefore, the brand delivering the advertising message to the consumer contributes to building trust, initially in the short term, and subsequently long term, if it can find a "trigger" that keeps the consumer's attention. As the number of Internet users, and consequently social media users, continues to grow [2], it has become easier than ever for sellers to reach a wider circle of potential customers with their brand-promoting messages.

There is a wide range of social media platforms, each carrying a specific type of message. The most important are those platforms that can reach a larger target group [3], encompassing various age groups, from the youngest users to those in more mature stages of life. *Brand loyalty* should provide not only a strong visual message (through digital and marketing channels) but also a tangible one. This actually means that strong marketing persuasion encouraging consumers to purchase "that particular product" should also carry the same message at the point of sale, for example, in a perfumery. Research has shown that as the price of a product promoted by a certain brand increases – specifically referring to highly selective products – consumer perception also increases, strengthening their sense of belonging to that brand [4], which also leads to higher sales in the target market. The consumer believes that price "dictates" product quality, which creates a sense of belonging, especially when it comes to renowned, designer brands. This further leads to the conclusion that consumers will continue to perceive the same brand positively in the future, as their trust in the brand increases. Therefore, the continuous return of consumers and the repeated purchase of products from a particular brand, in the long term, increases profit for sellers through product sales and reduces the need for aggressive marketing campaigns. This is reflected in lower long-term investment costs in marketing, but only on the condition that existing marketing activities and the selection of appropriate promotional channels have been successful and timely.

The importance of reverse logistics and the circular economy has contributed to the efficiency and satisfaction for both consumers and sellers. The wide range and availability of highly selective products are no longer limited to developed markets in Europe and worldwide, but are increasingly gaining prominence in developing countries as well. Consumers in transitional economies tend to "adopt" the purchasing habits of those in developed countries regarding preferences for selective perfume brands, with a particular focus on *designer and oriental perfumes*.

The challenge faced by the perfume industry, in the last decade, has undergone a significant transformation, especially with the aggressive appearance of oriental perfumes on the market. Traditional designer brands have gained a serious market competitor, especially among the younger population (age 15-25). The younger population has become increasingly demanding when it comes to perfume preferences. Long-lasting perfume notes from the Middle East have taken a larger market share, gradually pushing out designer brands. The turbulent perfume market of designer perfumes, with the increasing dominance of orientals, has become a top topic among perfume lovers.

A designer perfume [5] is often defined as a fragrance that belongs to a fashion house, recognized for its global and broadband reach, intended for a broad "audience", featuring an established brand style and a highly recognizable logo and visual identity. An oriental [6] is defined as a rich blend of oriental spices, with particularly high proportions of resin and amber, characterized by exceptional longevity on the skin and a high level of oil concentration in the fragrance. Oriental perfumes are

distinguished by their unique, and often one-of-a-kind composition, giving the impression that the perfume is a masterpiece, created exclusively for an individual with an exceptionally refined style.

### 1.1 Significance of the research

The *significance of this research* lies in presenting the current situation in Bosnia and Herzegovina regarding the key factors that influence the choice of a particular perfume brand and attachment to it, due to the increasing "division" between consumers who prefer traditional designer perfumes and the increasingly popular, highly long-lasting oriental fragrances. The aim is to identify potential differences in the perception of value, quality, and brand identity by comparing the attitudes, expectations, and experiences that consumers have with perfume brands. The results obtained in this study, based on the opinions of 15 prominent experts in the field from Bosnia and Herzegovina, will contribute to better brand positioning, guiding key marketing strategies, and the distribution of perfumes that foster loyalty in line with the preferences of modern consumers.

### 1.2 Research motivation

The motivation for this study stems from a very "curious" need, which is to understand the motives of consumers when choosing designer rather than oriental perfumes, or vice versa, and to identify the key factors that influence their loyalty. Over the past ten years in Bosnia and Herzegovina, oriental perfumes have been gaining increasing popularity compared to traditional designer perfumes. Their exceptional longevity on the skin and clothing, as well as the sophistication of their fragrance notes, has increasingly encouraged traditional designer producers to create more innovative fragrance compositions aimed at capturing the hearts of particularly younger target groups, who hold the most significant market share in purchasing oriental perfumes. This research is motivated by a genuine desire to identify the criteria that lead to sincere consumer loyalty to perfume brands in Bosnia and Herzegovina. The benefits of this study will also extend to all distributors marketing a particular brand in Bosnia and Herzegovina, regardless of which of the two perfume categories it belongs to, with the ultimate goal of enabling more efficient and faster adaptation to the highly sophisticated demands of users and their changing preferences.

### 1.3 Research gap and contribution

On the other hand, the *research gap* addressed by this paper lies in the fact that previous studies and literature lack an analysis comparing consumer loyalty to designer and oriental perfumes, particularly from the perspective of the factors that shape their perception and create long-term "attachment" to a brand. For this reason, this study fills that gap, providing a contribution based on expert opinions with decades of international experience in marketing management and digital marketing, as well as master experts from the perfume industry. These expert insights and perspectives will form clear guidelines for "shaping the market" regarding both categories of perfumes studied, not only for brand positioning in the market but also for developing a more precise strategic framework tailored to the sophisticated demands of modern consumers. The application of a fuzzy MCDM model for evaluating customer loyalty is rare because previous studies were more often oriented to statistical descriptions and analytics. Also, models for assessment of customer satisfaction offer operational analysis, while this study creates additional values, taking into account different age groups and the large experience of experts involved in the research.

### 1.4 Paper structure

A brief description of the structure of the paper is as follows. After defining the significance, motivation, research questions, and contributions, the paper is divided into five additional sections.

Section 2 presents the current state of the field, with a focus on oriental and designer perfumes. Section 3 introduces the methodological framework, detailing the steps of the IMF SWARA method, the Fuzzy Bonferroni operator, and the Fuzzy MARCOS method. Section 4, as the core part of this study, defines the setup of MCDM model, provides a description of the experts involved in group decision-making, presents the method for calculating customer loyalty and shows the results obtained for both types of perfumes. Section 5 contains additional analyses that confirmed the stability of the obtained results. Finally, Section 6, the conclusion, provides the summary considerations of the paper.

## 2. Literature review

It was often stated that beauty was priceless and that confident individuals exhibited more refined attitudes when making decisions, as well as during leadership processes in organizations or other segments of society [7]. *This raises the question: what is the correlation between beauty and self-confidence?* The answer is quite simple – self-confidence enhances the value of every individual, whether referring to inner or outer beauty. Self-confidence provides a sense of security in decision-making or in taking key steps in developing personal traits. Using a funnel approach and narrowing the rhetorical question posed at the beginning of the chapter, it was concluded that one element of personal security was identification with the status of prestige or luxury [8], a sense that had been created by the fashion industry and, in this specific case, by perfume brands.

Consumers are becoming increasingly curious when purchasing luxury products, with the ultimate goal of achieving personal psychological satisfaction, which further contributes to social success [9]. *Brand loyalty* [10-12], *brand image* [13], and *social reputation* [14] create a special sense of belonging to a particular segment of society [15]. A satisfied consumer creates a wider circle of like-minded individuals who are likely to return to the initial point of their purchase, namely repurchasing the same product or a similar one from the offered portfolio [16], which represents the so-called *behavioral* purchase. The strength and power of a brand are evident in the extent to which consumers can connect with the brand, or with the personality promoting it, specifically the product being purchased [17], which represents so-called *attitudinal brand* loyalty. Research [18-20] has shown that consumer satisfaction with a brand is achieved either through physical interaction at the point of sale or indirectly through strong marketing and digital communication channels in the virtual world [21]. According to Peng *et al.* [22], digitalization has led to a broader context in which a satisfied consumer and buyer of a luxury product immediately has the opportunity to share their satisfaction with a wider audience, which, in a short time, may perceive the awareness of strengthening loyalty to that product or brand – or may not. On the other hand, according to Keller [23], brand awareness represents the consumer's ability to remember the brand (logo, product symbols, and visual associations based on the principle of "recall") and to identify it in a way that gives the brand another chance and preference in the future, even if a substitute appears. Consumers are highly curious, and in their curiosity, they often experiment with their preferences for other brands; however, they ultimately return to their initial point of preference – the brand they favor the most [24].

Consumers often prefer brands that are well-known and have a strong image and reputation in the global market, whether due to their personal habits and perceptions or because of the guarantee of quality and popularity. When discussing brand recognition in a given market, this also corresponds to a higher purchase affinity and buying power from consumers, compared to brands that enter the market slowly and sporadically [25]. Brand recognition precedes brand loyalty [26], just as the retail store where, for example, prestigious designer perfumes are sold contributes to the retailer's recognition, which indirectly influences and ultimately enhances the final sale.

In an era of globalization and the extremely rapid transformation of consumer habits and behaviors – considering in the context of luxury perfumes – new standards are constantly being set regarding consumer perception and sophisticated demands. Luxury brands [27] have embraced the challenges of social media and aggressive campaigns conducted through these platforms, especially in the form of short video messages by well-known influencers. Social media particularly conveys a sense of belonging, luxury, high-quality perfume products, significantly higher prices compared to standard products of this type, their specific distribution channels, and more. Greater brand recognition in the market, fostering a sense of loyalty and the habit of purchasing by inertia, distinguish a brand from its competitors, ultimately aiming to generate extra profit.

On the other hand, the latest available research [28] has shown remarkable growth and the expansion of so-called "niche" perfumes in the global market, including Bosnia and Herzegovina. Niche perfumes represent a form of artistic expression within the perfume industry. They are characterized by the originality of their fragrance notes, bottles, and visual perfume signature. At the same time, they are concentrated perfumes that, unlike designer perfumes, are produced in very small series, often described as handcrafted. In addition to smaller and limited production, they are also characterized by specialized operations [29], being exclusively oriented toward perfumeries, without affiliation to fashion and cosmetics. High-quality, often organic ingredients give this perfume luxury a distinctive character. Niche perfumes belong to the *oriental* sphere of the perfume industry. They are often described as perfumes that do not follow fashion style and trends, but are unique, one-of-a-kind, and personalized. Due to their exceptionally limited series and high fragrance concentration, perfumes in this category are up to 60% more expensive than traditional designer perfumes and are available only in limited quantities in specifically authorized perfumeries.

The young generation seeks an individual and powerful signature, capable of reflecting a high level of their authenticity and style [30]. A personal signature, an original bottle produced in exceptionally limited series, attracts this generation to change their previous preferences and style. *Would you buy a perfume in a uniquely or luxuriously equipped perfumery that offers only a few bottles of a rarely available perfume?* The answer to this question aligns with the "wandering" of Generation Z and their aspiration for a new concept in building a unique style and perception of loyalty in the perfume industry. Therefore, the members of this generation serve as a kind of benchmark in researching the issue of this study, along with a proposal for market transformation today, under conditions of increasing and rapidly changing consumer demands [31].

While designer perfumes build a recognizable, broad-spectrum reputation in the market in terms of luxury, power, and prestige, oriental perfumes differentiate their perfume niche by establishing a long-term leadership position within the same market but with the distinctive mark of recognizable fragrance ingredients that exude luxury, such as resins, oriental spices, incense, amber, and others. For decades, designer perfume producers did not face significant competition in the market game. Strong distribution channels, mass media attention, and the purchase of all "prime time" slots in digital promotional channels, as well as through social media, were the key to maintaining a leading position in the global market.

However, over the past decade, a strong breakthrough, along with the clustering of oriental perfume producers from Europe and the Middle East, has contributed to a remarkably fierce market competition for designer perfume opponents. *Why have oriental perfumes become so important in the perfume industry and among the increasingly large target groups of consumers?* The reason is quite simple. The exceptional concentration of organic ingredients found in these perfumes is attracting a growing group of potential buyers, who value the culture of natural and organic products [32], i.e., ingredients that are not harmful, not only to human health but also to the environment [33]. Environmentally conscious producers of luxury perfumes are gaining increasing significance

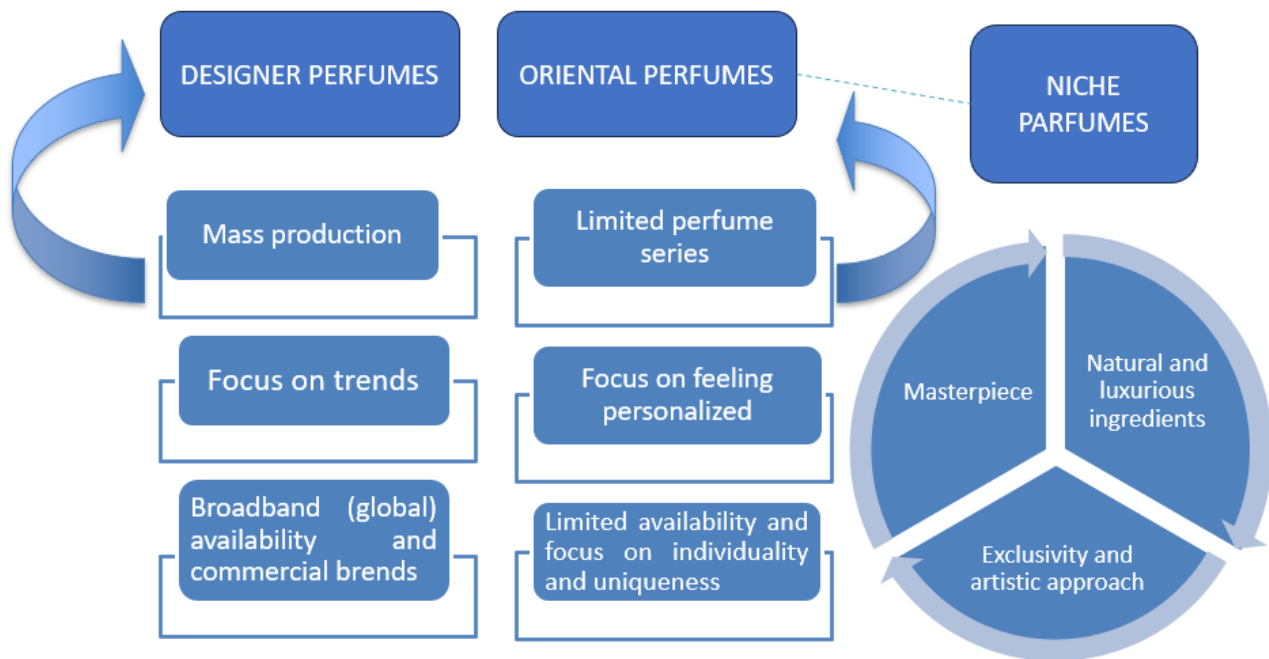
[28]. Marketing experts work daily on developing various initiatives aimed at fostering awareness of environmentally sustainable and acceptable perfume products. The goal is for consumers to adopt the suggestions of these experts, turning toward a green perfume transition that will, in the long term, build not only consumer awareness and perception [34] but also stable and sustainable profit [35].

The market capitalization of the perfume industry, particularly in the segment of designer and oriental perfumes, according to the most recent reports [36], amounted to \$34.86 billion, with a tendency for growth. The production and market share of oriental perfumes are increasingly becoming dominant in one of the most important markets – Europe. The perfume industry has become an extremely powerful tool for "manipulating" specific target groups that are sensitive to the advertising messages conveyed by a fragrance, with a particular emphasis on creating consumer satisfaction and loyalty. Even when the price and quality of a product are significantly above average, consumer preference emerges if the marketing message regarding brand sustainability and its primary market focus is sufficiently strong and influential [37].

Digitalization and e-commerce, as an online sales channel, are becoming increasingly important in today's business environment [38], particularly for those consumers who prefer to remain anonymous in the "tangible" market or who belong to younger generations [39], which are increasingly relying on digital communication channels. Research [40-42] has shown that this form of shopping enhances consumers' perception, as an expression of commitment and style status.

It was often heard from consumers who were loyal to a particular brand and continuously purchased a specific perfume that the scent had changed or was not 100% identical to the one they used to buy. Research [43,44] has shown that the luxury perfume market is facing certain difficulties and obstacles, particularly due to the impact of climate change, disruptions in supply chains, as well as various economic factors. On the other hand, due to the exceptionally high "flooding" of various high-selective perfumes and the competition for every individual customer, it is difficult to maintain market differentiation without a strong visual brand identity, which is a result of innovation. Particularly for younger generations, these technological innovations in the perfume industry bring forth a need to create innovative models that, through a digital (online) approach, enable potential customers to virtually "experience" the scent [45]. In this way, customers can develop a subjective feeling in real time, clearly defining the top notes, the heart of the perfume, and even the base notes. The combination of a strong marketing campaign about the product and digital imagination that conveys its refined fragrance notes to the customer creates an innovative way of attracting target groups and achieving differentiation in the perfume market. Figure 1 presents a brief comparison between designer and oriental perfumes.

Therefore, the state of the luxury perfume sector (designer and oriental) represents a challenging yet *growing sector* of the industry. Designer perfumes represent so-called "mass" luxury, as they are widely available to a larger group of potential customers, with an easily recognizable identity linked to the brand they promote. On the other hand, oriental perfumes are less geographically accessible but are enriched with more intense fragrance notes and are available to wealthy population. Their popularity has been growing year by year at an accelerated pace. The key to perfume luxury lies in its sustainability, digital sales, and perfume (technological) innovations, where increasingly higher financial investments are required to maintain long-term profit.



**Fig. 1.** Designer vs. oriental perfumes, including the niche category  
 Source: Authors

### 3. Methods

This paper defines the application of an MCDM model in fuzzy form with an additional use of the Bonferroni operator to obtain unique criterion weights following the evaluation by 15 experts. Therefore, it involves a combination of the IMF SWARA method and the Fuzzy Bonferroni operator for calculating the weighting coefficients of the criteria, as well as the Fuzzy MARCOS method for the evaluation and ranking of user age groups for both types of perfumes. The individual algorithms of the MCDM model are presented below.

#### 3.1 IMF SWARA

The advantages of applying this method, which emerged a few years ago within the framework of scientific critique [46, 47], lie in the small number of comparisons, its simplicity from the perspective of the overall algorithm that accounts for uncertainties in the decision-making process, adaptability to experts in group decision-making, and so on. The procedure for defining the weighting values of the criteria begins by ranking the criteria according to their significance in decision-making, i.e., from the most to the least significant. Afterward, it is necessary to define a value  $\bar{\rho}_j$  indicating how much less significant criterion  $C_j$  is compared to  $C_{j-1}$ , based on the scale shown in Figure 2.

Linguistic Variable	Abbreviation	TFN Scale
Absolutely less significant	ALS	1.000 1.000, 1.000
Dominantly less significant	DLS	0.500 0.667, 1.000
Much less significant	MLS	0.400 0.500 0.667
Really less significant	RLS	0.333 0.400 0.500
Less significant	LS	0.286 0.333 0.429
Moderately less significant	MDLS	0.250 0.286 0.333
Weakly less significant	WLS	0.222 0.250 0.286
Equally significant	ES	0.000 0.000 0.000

**Fig. 2.** Scale for IMF SWARA [48]

Then the following steps are applied [49]:

Define the fuzzy coefficient  $\overline{\mathfrak{S}}_j$ :

$$\overline{\mathfrak{S}}_j = \begin{cases} \overline{\mathbf{1}} & j = 1 \\ \overline{\mathfrak{S}}_j \oplus \overline{\mathbf{1}} & j > 1 \end{cases} \quad (1)$$

Define the obtained weights  $\overline{\mathfrak{K}}_j$ :

$$\overline{\mathfrak{K}}_j = \begin{cases} \overline{\mathbf{1}} & j = 1 \\ \frac{\overline{\mathfrak{K}}_{j-1}}{\overline{\mathfrak{S}}_j} & j > 1 \end{cases} \quad (2)$$

$\overline{\mathfrak{S}}_j$  marks the fuzzy coefficient given in the previous step.

Compute the fuzzy weight coefficients:

$$\overline{w}_j = \frac{\overline{\mathfrak{K}}_j}{\sum_{j=1}^n \overline{\mathfrak{K}}_j} \quad (3)$$

where the fuzzy relative weight of the criteria  $j$  is denoted by  $\overline{w}_j$ , and the number of criteria is denoted by  $n$ .

### 3.2. Bonferroni operator

The Fuzzy Bonferroni aggregation [50,51] was used.

$$\tilde{a}_{ij} = (a_{ij}^l, a_{ij}^m, a_{ij}^u) = \begin{cases} a_{ij}^l = \left( \frac{1}{e(e-1)} \sum_{\substack{i,j=1 \\ i \neq j}}^e a_i^{lp} \otimes a_j^{lq} \right)^{\frac{1}{p+q}} \\ a_{ij}^m = \left( \frac{1}{e(e-1)} \sum_{\substack{i,j=1 \\ i \neq j}}^e a_i^{mp} \otimes a_j^{mq} \right)^{\frac{1}{p+q}} \\ a_{ij}^u = \left( \frac{1}{e(e-1)} \sum_{\substack{i,j=1 \\ i \neq j}}^e a_i^{up} \otimes a_j^{uq} \right)^{\frac{1}{p+q}} \end{cases} \quad (4)$$

$e$  is the number of experts, while  $p, q \geq 0$  are non-negative numbers.

### 3.3. Fuzzy MARCOS

Fuzzy MARCOS was created by Stanković *et al.* [52], and the algorithm of the Fuzzy MARCOS method which has been used in many studies in various forms [53-56] is shown below.

Step 1: Defining the initial and extended fuzzy decision matrix:

$$\tilde{X} = \begin{matrix} \tilde{A}(AI) & \tilde{C}_1 & \tilde{C}_2 & \dots & \tilde{C}_n \\ \tilde{A}_1 & \begin{bmatrix} \tilde{x}_{ai1} & \tilde{x}_{ai2} & \dots & \tilde{x}_{ain} \\ \tilde{x}_{11} & \tilde{x}_{12} & \dots & \tilde{x}_{1n} \\ \tilde{x}_{21} & \tilde{x}_{22} & \dots & \tilde{x}_{2n} \\ \dots & \dots & \dots & \dots \\ \tilde{A}_m & \begin{bmatrix} \tilde{x}_{m1} & \tilde{x}_{m2} & \dots & \tilde{x}_{mn} \\ \tilde{x}_{id1} & \tilde{x}_{id2} & \dots & \tilde{x}_{idn} \end{bmatrix} \end{matrix} \end{matrix} \quad (5)$$

$\tilde{A}(AI)$  and  $\tilde{A}(ID)$  are obtained as follows:

$$\tilde{A}(AI) = \min_i \tilde{x}_{ij} \quad \text{if } j \in B \quad \text{and} \quad \max_i \tilde{x}_{ij} \quad \text{if } j \in C \quad (6)$$

$$\tilde{A}(ID) = \max_i \tilde{x}_{ij} \quad \text{if } j \in B \quad \text{and} \quad \min_i \tilde{x}_{ij} \quad \text{if } j \in C \quad (7)$$

where  $B$  is a set of *max* type, and  $C$  is a set of *min* type.

Step 2: Defining the normalized fuzzy matrix:

$$\tilde{n}_{ij} = (n_{ij}^l, n_{ij}^m, n_{ij}^u) = \left( \frac{x_{ij}^l}{x_{ij}^u}, \frac{x_{ij}^m}{x_{ij}^m}, \frac{x_{ij}^l}{x_{ij}^l} \right) \quad \text{if } j \in C \quad (8)$$

$$\tilde{n}_{ij} = (n_{ij}^l, n_{ij}^m, n_{ij}^u) = \left( \frac{x_{ij}^l}{x_{id}^u}, \frac{x_{ij}^m}{x_{id}^m}, \frac{x_{ij}^u}{x_{id}^l} \right) \quad \text{if } j \in B \quad (9)$$

where  $x_{ij}^l, x_{ij}^m, x_{ij}^u$  i  $x_{id}^l, x_{id}^m, x_{id}^u$  comprise the elements of the matrix  $\tilde{X}$ .

Step 3: Determination of the weighted fuzzy matrix  $\tilde{V} = [\tilde{v}_{ij}]_{m \times n}$ :

$$\tilde{v}_{ij} = (v_{ij}^l, v_{ij}^m, v_{ij}^u) = \tilde{n}_{ij} \otimes \tilde{w}_j = (n_{ij}^l \times w_j^l, n_{ij}^m \times w_j^m, n_{ij}^u \times w_j^u) \quad (10)$$

Step 4: Computation of fuzzy matrix  $\tilde{S}_i$ :

$$\tilde{S}_i = \sum_{j=1}^n \tilde{v}_{ij} \quad (11)$$

Step 5: Computation of the utility degree of alternatives  $\tilde{K}_i$ :

$$\tilde{K}_i^- = \frac{\tilde{S}_i}{\tilde{S}_{ai}} = \left( \frac{s_i^l}{s_{ai}^u}, \frac{s_i^m}{s_{ai}^m}, \frac{s_i^u}{s_{ai}^l} \right) \quad (12)$$

$$\tilde{K}_i^+ = \frac{\tilde{S}_i}{\tilde{S}_{id}} = \left( \frac{s_i^l}{s_{id}^u}, \frac{s_i^m}{s_{id}^m}, \frac{s_i^u}{s_{id}^l} \right) \quad (13)$$

Step 6: Computation of the fuzzy matrix  $\tilde{T}_i$ :

$$\tilde{T}_i = \tilde{t}_i = (t_i^l, t_i^m, t_i^u) = \tilde{K}_i^- \oplus \tilde{K}_i^+ = (k_i^{-l} + k_i^{+l}, k_i^{-m} + k_i^{+m}, k_i^{-u} + k_i^{+u}) \quad (14)$$

in order to calculate a new fuzzy number  $\tilde{D}$ :

$$\tilde{D} = (d^l, d^m, d^u) = \max_i \tilde{t}_{ij} \quad (15)$$

and after that, defuzzification of the number  $\tilde{D}$  is performed using the following Eq. (16):

$$df_{crisp} = \frac{l+4m+u}{6} \quad (16)$$

obtaining a regular number  $df_{crisp}$ .

Step 7: Determination of the utility functions of the AI  $f(\tilde{K}_i^+)$  and AAI  $f(\tilde{K}_i^-)$  solution:

$$f(\tilde{K}_i^+) = \frac{\tilde{K}_i^-}{df_{crisp}} = \left( \frac{k_i^{-l}}{df_{crisp}}, \frac{k_i^{-m}}{df_{crisp}}, \frac{k_i^{-u}}{df_{crisp}} \right) \quad (17)$$

$$f(\tilde{K}_i^-) = \frac{\tilde{K}_i^+}{df_{crisp}} = \left( \frac{k_i^{+l}}{df_{crisp}}, \frac{k_i^{+m}}{df_{crisp}}, \frac{k_i^{+u}}{df_{crisp}} \right) \quad (18)$$

In the next step, defuzzification should be made for  $\tilde{K}_i^-, \tilde{K}_i^+, f(\tilde{K}_i^+), f(\tilde{K}_i^-)$ .

Step 8: Determination of the utility function of alternatives  $f(K_i)$ :

$$f(K_i) = \frac{K_i^+ + K_i^-}{1 + \frac{1-f(K_i^+)}{f(K_i^+)} + \frac{1-f(K_i^-)}{f(K_i^-)}} \quad (19)$$

Step 9: Classification of alternatives.

#### 4. Case Study

The aim of this study was to examine the opinions and attitudes of key stakeholders in Bosnia and Herzegovina with many years of experience in the perfume industry, particularly in the segments of procurement, distribution, and the sale of luxury perfumes. A key aspect of this study was to establish a clear correlation in the preferences for designer versus oriental perfumes by creating an unbreakable connection between customers and sellers, i.e., loyalty to the preferred brand. It was also important to monitor market factors in Bosnia and Herzegovina, such as the availability of luxury perfumes, target groups, the impact of digital promotion channels on consumer preferences and habits, the strengthening of brand loyalty principles, and the growing popularity of niche perfumes and oil-based fragrance notes.

##### 4.1. MCDM model setup

The data collection method was conducted through multiple expert questionnaires with demographic segmentation, which required approximately 15 minutes to complete. The research was carried out from July 3 to November 11, 2025. The questionnaire consisted of nine criteria, which included the following:

- C1 - Ease of communication with the brand via digital platforms,
- C2 - Brand loyalty,
- C3 - Brand image (reputation) on the market,
- C4 - Repeat purchase due to habit and satisfaction,
- C5 - Emotional connection and trust in the perfumes the brand launches to the market (seasonal: spring-summer, autumn-winter),
- C6 - Purchase justifies the purpose (the consumer receives justified or greater value for their money),
- C7 - Loyalty program (special gifts and free products as rewards for purchase loyalty – VIP customers),
- C8 - Influence of celebrities and influencers on the choice of a promoted brand,
- C9 - Continuous discounts by perfume brands (monthly promotions and national campaigns).

To successfully model customer loyalty, experts, drawing on their experience, skills, knowledge, and communication with customers, were required to determine which customer group is the most loyal to oriental perfumes according to the nine criteria listed above, and then, in the same way, for designer perfumes. A total of six customer groups (variants to be evaluated - customer groups by age) were defined as follows: 15-25 years, 26-35 years, 36-45 years, 46-55 years, 56-65 years, and 65 + years. After a detailed analysis and review of the literature of similar, previous research, the selection of criteria was initiated, based on the real needs of the company. The criteria were also formed in consultation with experts in this field. In the first phase, there were 15 criteria, however, through a system of elimination in terms of their importance, nine key criteria were identified, the selection of which was optimal for further analysis.

#### 4.2. Description of experts involved in the group decision-making process

The study involved 15 experts (Table 1) from across Bosnia and Herzegovina. The criteria for selecting the experts included years of professional experience (at least 15 years) in the perfume industry with a particular focus on digital marketing, distribution and supply chain, academic affiliation with scientific contribution, as well as experience in retail and wholesale, along with professional knowledge of the designer and oriental perfume markets. The distribution of experts according to their professional background was as follows: 5 experts were key account managers; 5 experts were specialists in digital marketing and communications; 3 experts were from the academic community (university professors) and 2 experts were directors of the largest perfumery chains in Bosnia and Herzegovina.

**Table 1**  
 Overview of the expert team with key performance attributes

Expert	Specific scientific (business) field	Years of experience
Key Account Manager	Responsible for monitoring the sales of designer perfumes in retail chains in Bosnia and Herzegovina, particularly in the segment of luxury-oriented perfumes	32
Key Account Manager	Sales promoter in retail stores (perfumeries) with a particular focus on designer and oriental perfumes (selected exclusive perfumeries in major cities of Bosnia and Herzegovina with over 50,000 inhabitants)	28
Key Account Manager	Responsible for monitoring consumer preferences in perfumeries in the segment of luxury, designer, and niche perfumes	25
Key Account Manager	Sales promoter for luxury oriental perfumes in perfume retail chains, with a focus on the target group aged 15–45	25
Key Account Manager	Sales promoter in retail stores (perfumeries) with a particular focus on luxury, designer, and oriental perfumes	22
Specialist in Digital Marketing and Communications	Analytics and monitoring of customer behavior in perfumeries, and promotion of loyalty programs for special customers (so-called VIP customers)	18
Specialist in Digital Marketing and Communications	Encourages repeat purchase programs by defining special, personalized offers for particularly preferred fragrance types (designer vs. oriental)	17
Specialist in Digital Marketing and Communications	Monitors perfume reviews, tracks repurchase habits, and collaborates with influencers to strengthen advertising messages that encourage repeat purchases	17
Specialist in Digital Marketing and Communications	Follows market trends, analyzes consumer buying habits, and interprets customer behavior on digital platforms	15
Specialist in Digital Marketing and Communications	Evaluates marketing strategies for target customer segmentation; expert in product branding and positioning; conducts professional analysis and assessment of market trends	15

**Table 1**  
 Continued

Expert	Specific scientific (business) field	Years of experience
University Professor (specialization: marketing management and digital marketing)	Expert in tracking customer behavior, brand perception, and interpreting digital trends	25
University Professor (specialization: theoretical economics – marketing)	Provides theoretical support in analyzing consumer behavior (designer vs. oriental perfumes); analyzes the methods and mechanisms for determining the degree of customer loyalty to a brand through professional analysis of influencing factors	20
Director of Distribution for the Perfume Sector	Maintains timely distribution channels for luxury perfumes; plans the procurement budget for current designer and oriental perfumes based on the preferences of existing customers; defines loyalty programs for special customer groups who are the most loyal buyers	21
Director of a Perfume Retail Chain	Continuously analyzes premium perfume sales across all cities in Bosnia and Herzegovina; motivates sales staff with “Employee of the Month” awards including personal (material) benefits; optimizes the sales assortment across the four annual quarters; plans staff training and creates promotional and loyalty programs, specifically for designer and oriental perfumes	18

The expert team provided a comprehensive and in-depth insight into the state of the luxury perfume sector across Bosnia and Herzegovina. It was composed of top professionals from the selective perfume industry, as well as those with theoretical knowledge that is transformed into the real sector through spin-offs. The expert team was selected from the most expert people from all over Bosnia and Herzegovina in terms of assessing consumer loyalty in the context of the perfume industry. Direct data from consumers could be subject to subjective preferences and current attitudes, while experts provide a broader picture based on theoretical and practical experiences. Key buyer managers continuously monitor consumer preferences in the field through a clear plan of visiting key perfumeries, observational studies and direct contacts with consumers, forming a clear picture of the real situation in the perfume industry. In this way, they draw a parallel between the demand for perfume products in the field in relation to digital media and the remaining media campaign, which helps them in analyzing the results through marketing strategies. Mutual coordination of the remaining experts, with the above, leads to a circular flow and filtering of useful information with the aim of creating a real picture of the situation in the field of designer and oriental perfumes. Although this approach had potential limitations, including the risk of expert bias, the limited number of respondents, and possible differences between expert opinion and actual consumer behavior over the observed period, the use of such a model allowed for the interpretation of loyalty trends, particularly in contexts where direct data were difficult to obtain or insufficiently reliable.

#### 4.3. Determination of weights using the IMF SWARA method and the Bonferroni operator

As previously explained, this group decision-making process involved 15 experts who evaluated the criteria based on the scale shown in Figure 2. After collecting the data related to the definition of criterion weights, these were processed and calculated using the IMF SWARA method. Due to the nature of this method and the experts’ preferences, it was necessary to define a total of 15 models of the IMF SWARA models, one for each expert individually. An example for the first expert is presented in Table 2.

**Table 2**  
 Example of criterion weight calculation based on DM1 preferences

Criteria	$s_j$	$k_j$	$q_j$	$w_j$
C <sub>4</sub>		(1,1,1)	(1,1,1)	(0.27,0.293,0.324)
C <sub>2</sub>	(0.286,0.333,0.4)	(1.286,1.333,1.4)	(0.714,0.75,0.778)	(0.193,0.22,0.252)
C <sub>6</sub>	(0.222,0.25,0.286)	(1.222,1.25,1.286)	(0.556,0.6,0.636)	(0.15,0.176,0.206)
C <sub>9</sub>	(0.4,0.5,0.667)	(1.4,1.5,1.667)	(0.333,0.4,0.455)	(0.09,0.117,0.147)
C <sub>7</sub>	(0.333,0.4,0.5)	(1.333,1.4,1.5)	(0.222,0.286,0.341)	(0.06,0.084,0.11)
C <sub>5</sub>	(1,1,1)	(2,2,2)	(0.111,0.143,0.17)	(0.03,0.042,0.055)
C <sub>8</sub>	(0.5,0.667,1)	(1.5,1.667,2)	(0.056,0.086,0.114)	(0.015,0.025,0.037)
C <sub>3</sub>	(0,0,0)	(1,1,1)	(0.056,0.086,0.114)	(0.015,0.025,0.037)
C <sub>1</sub>	(0.25,0.286,0.333)	(1.25,1.286,1.333)	(0.042,0.067,0.091)	(0.011,0.02,0.029)
			(3.089,3.417,3.698)	

In this way, the weight values of all criteria were obtained for the remaining 14 models (DM2-DM15). Their values, sorted from the first to the ninth criterion as indicated above, are shown in Table 3.

**Table 3**  
 Weighting coefficients for each expert using the IMF SWARA method and the final averaged values with the fuzzy Bonferroni operator

DM	w <sub>1</sub>	w <sub>2</sub>	w <sub>3</sub>	w <sub>4</sub>	w <sub>5</sub>
E <sub>1</sub>	(0.011,0.02,0.029)	(0.193,0.22,0.252)	(0.015,0.025,0.037)	(0.27,0.293,0.324)	(0.03,0.042,0.055)
E <sub>2</sub>	(0.011,0.024,0.04)	(0.185,0.215,0.252)	(0.014,0.029,0.049)	(0.259,0.286,0.324)	(0.086,0.114,0.147)
E <sub>3</sub>	(0.019,0.032,0.045)	(0.065,0.079,0.095)	(0.177,0.188,0.202)	(0.177,0.188,0.202)	(0.127,0.141,0.157)
E <sub>4</sub>	(0.026,0.039,0.052)	(0.072,0.086,0.101)	(0.036,0.052,0.067)	(0.178,0.188,0.201)	(0.178,0.188,0.201)
E <sub>5</sub>	(0.099,0.115,0.134)	(0.19,0.202,0.218)	(0.066,0.082,0.1)	(0.037,0.05,0.064)	(0.049,0.064,0.08)
E <sub>6</sub>	(0.055,0.067,0.081)	(0.12,0.135,0.15)	(0.12,0.135,0.15)	(0.07,0.084,0.099)	(0.043,0.054,0.066)
E <sub>7</sub>	(0.139,0.15,0.162)	(0.179,0.187,0.198)	(0.139,0.15,0.162)	(0.108,0.12,0.133)	(0.037,0.046,0.057)
E <sub>8</sub>	(0.162,0.177,0.196)	(0.208,0.222,0.239)	(0.122,0.138,0.156)	(0.053,0.067,0.082)	(0.032,0.043,0.055)
E <sub>9</sub>	(0.168,0.174,0.182)	(0.168,0.174,0.182)	(0.126,0.135,0.146)	(0.055,0.066,0.076)	(0.029,0.038,0.048)
E <sub>10</sub>	(0.164,0.182,0.202)	(0.128,0.145,0.165)	(0.099,0.116,0.135)	(0.06,0.074,0.091)	(0.047,0.06,0.074)
E <sub>11</sub>	(0.1,0.117,0.134)	(0.193,0.204,0.218)	(0.078,0.093,0.11)	(0.061,0.075,0.09)	(0.047,0.06,0.073)
E <sub>12</sub>	(0.127,0.135,0.143)	(0.163,0.168,0.175)	(0.163,0.168,0.175)	(0.06,0.069,0.079)	(0.033,0.041,0.05)
E <sub>13</sub>	(0.119,0.132,0.148)	(0.153,0.166,0.18)	(0.153,0.166,0.18)	(0.049,0.062,0.075)	(0.025,0.034,0.045)
E <sub>14</sub>	(0.202,0.216,0.234)	(0.202,0.216,0.234)	(0.032,0.046,0.062)	(0.019,0.031,0.044)	(0.075,0.092,0.112)
E <sub>15</sub>	(0.128,0.138,0.149)	(0.17,0.177,0.186)	(0.17,0.177,0.186)	(0.091,0.103,0.116)	(0.026,0.035,0.045)
f.	(0.093,0.107,0.122)	(0.157,0.171,0.188)	(0.094,0.109,0.124)	(0.093,0.107,0.124)	(0.053,0.066,0.08)
DM	w <sub>6</sub>	w <sub>7</sub>	w <sub>8</sub>	w <sub>9</sub>	
E <sub>1</sub>	(0.15,0.176,0.206)	(0.06,0.084,0.11)	(0.015,0.025,0.037)	(0.09,0.117,0.147)	
E <sub>2</sub>	(0.144,0.172,0.206)	(0.058,0.082,0.11)	(0.014,0.029,0.049)	(0.029,0.049,0.074)	
E <sub>3</sub>	(0.09,0.106,0.122)	(0.065,0.079,0.095)	(0.032,0.048,0.063)	(0.127,0.141,0.157)	
E <sub>4</sub>	(0.092,0.108,0.124)	(0.139,0.151,0.165)	(0.026,0.039,0.052)	(0.139,0.151,0.165)	
E <sub>5</sub>	(0.029,0.04,0.052)	(0.19,0.202,0.218)	(0.066,0.082,0.1)	(0.148,0.162,0.178)	
E <sub>6</sub>	(0.033,0.043,0.054)	(0.199,0.21,0.225)	(0.155,0.168,0.184)	(0.09,0.105,0.12)	
E <sub>7</sub>	(0.047,0.058,0.07)	(0.063,0.075,0.087)	(0.108,0.12,0.133)	(0.081,0.093,0.106)	
E <sub>8</sub>	(0.041,0.053,0.067)	(0.091,0.107,0.125)	(0.091,0.107,0.125)	(0.071,0.086,0.102)	
E <sub>9</sub>	(0.041,0.051,0.061)	(0.071,0.082,0.093)	(0.168,0.174,0.182)	(0.094,0.105,0.117)	
E <sub>10</sub>	(0.036,0.048,0.061)	(0.036,0.048,0.061)	(0.219,0.234,0.253)	(0.077,0.093,0.111)	
E <sub>11</sub>	(0.028,0.037,0.048)	(0.193,0.204,0.218)	(0.15,0.163,0.179)	(0.035,0.046,0.059)	
E <sub>12</sub>	(0.046,0.055,0.064)	(0.099,0.108,0.117)	(0.163,0.168,0.175)	(0.077,0.086,0.096)	
E <sub>13</sub>	(0.037,0.048,0.06)	(0.089,0.103,0.118)	(0.196,0.207,0.221)	(0.069,0.082,0.097)	
E <sub>14</sub>	(0.144,0.162,0.182)	(0.112,0.129,0.149)	(0.032,0.046,0.062)	(0.045,0.062,0.08)	
E <sub>15</sub>	(0.068,0.08,0.093)	(0.051,0.063,0.074)	(0.17,0.177,0.186)	(0.038,0.049,0.059)	
f.	(0.064,0.078,0.093)	(0.097,0.112,0.128)	(0.098,0.111,0.127)	(0.078,0.093,0.109)	

Based on the results obtained using the IMF SWARA method and the Fuzzy Bonferroni operator, the most significant criterion is the second criterion (brand loyalty), followed by two criteria with equal values: C7 – loyalty program, and C8 – influence of celebrities and influencers on the choice of a promoted brand. Considering the large number of experts involved in the decision-making process, the probability of two criteria having the same value is very low, which demonstrates that a relevant set of influential criteria was selected. The fourth most significant criterion is C3 – brand image (reputation) on the market, with only a very small difference compared to C4 – repeat purchase due to habit and satisfaction, and C1 – ease of communication with the brand via digital platforms. Slightly less significant criteria are C9 – continuous discounts by perfume brands, C6 – purchase justifies the purpose, and C5 – emotional connection and trust in the perfumes the brand launches to the market.

4.4. Evaluation of customer loyalty using the Fuzzy MARCOS method

In this section, the age groups of users were evaluated for two types of perfumes: oriental and designer. The experts separately evaluated the age groups of users according to perfume types, as presented below. An example of the linguistic evaluation by the first expert for oriental perfumes is shown in Table 4 and for designer perfumes in Table 5.

**Table 4**  
 Evaluation of customer loyalty for oriental perfumes by E1

	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>	C <sub>7</sub>	C <sub>8</sub>	C <sub>9</sub>
15-25	VG	P	G	VP	EP	MG	MP	EG	M
26-35	VG	P	G	VP	EP	MG	MP	EG	M
36-45	VG	P	G	VP	EP	MG	MP	EG	M
46-55	G	P	M	EG	EP	MG	MP	VG	MP
56-65	G	P	M	VG	EP	MG	VP	MP	EG
65 +	M	P	MP	VG	EP	MG	G	VP	EG

EG - extremely good, VG - very good, G - good, MG - medium good, M - medium, MP - medium poor, P - poor, VP - very poor, EP - extremely poor.

**Table 5**  
 Evaluation of customer loyalty for designer perfumes by E1

	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>	C <sub>7</sub>	C <sub>8</sub>	C <sub>9</sub>
15-25	VG	EP	G	VP	P	M	MP	EG	MG
26-35	G	MG	VG	M	EP	MP	P	EG	VP
36-45	EP	VG	VP	EG	MP	G	M	P	MG
46-55	EP	EG	P	VG	G	MP	VP	MG	M
56-65	EP	EG	P	VG	G	VP	MG	VP	M
65 +	EP	EG	P	VG	G	VP	MG	VP	M

Using the same method, the age groups of users were evaluated by all experts. Subsequently, the linguistic values were quantified for each expert individually. By transforming the linguistic values into fuzzy triangular numbers, a total of 30 initial matrices were obtained (15 for each type of perfumes). Since a unified initial decision matrix is required for modeling purposes, the geometric mean was applied to average the values from the group decision-making, enabling the application of the Fuzzy MARCOS algorithm. The initial fuzzy decision matrix based on expert ratings and averaging is shown in Table 6.

**Table 6**  
 Initial Fuzzy MARCOS matrix extended with AAI and AI

Alt.	C1	C2	C3	C4	C5
AAI	(2.396,3.6,4.563)	(3.142,4.746,5.313)	(3.037,3.936,5.196)	(5.046,5.872,7.155)	(2.623,3.81,4.192)
A1	(6.693,7.871,8.703)	(4.991,6.537,7.351)	(6.257,7.118,8.277)	(5.104,6.14,7.475)	(4.562,5.221,5.938)
A2	(6.693,7.569,8.703)	(5.163,6.182,7.518)	(6.399,7.8.417)	(5.281,6.14,7.645)	(4.513,5.221,5.872)
A3	(6.399,7.198,8.417)	(4.827,6.322,7.149)	(5.983,6.96,8.004)	(5.163,5.872,7.518)	(3.896,4.937,5.309)
A4	(4.829,6.399,6.882)	(4.216,5.845,6.5)	(4.263,5.85,6.327)	(6.693,8.139,8.703)	(3.896,4.586,5.309)
A5	(3.939,5.344,5.983)	(3.559,5.225,5.779)	(3.936,4.996,6.015)	(5.079,6.322,7.274)	(3.09,4.216,4.613)
A6	(2.396,3.6,4.563)	(3.142,4.746,5.313)	(3.037,3.936,5.196)	(5.046,6.58,7.155)	(2.623,3.81,4.192)
AI	(6.693,7.871,8.703)	(5.163,6.537,7.518)	(6.399,7.118,8.417)	(6.693,8.139,8.703)	(4.562,5.221,5.938)
Alt.	C6	C7	C8	C9	
AAI	(4.718,6.081,6.804)	(4.825,5.679,6.919)	(2.479,3.09,4.667)	(5.716,6.537,7.782)	
A1	(6.544,7.483,8.559)	(6.114,7.351,8.183)	(7,8.559,9)	(5.845,6.921,7.914)	
A2	(6.544,7.237,8.492)	(6.114,7.27,8.183)	(6.616,8.23,8.654)	(5.978,7.278,8.047)	
A3	(5.983,6.921,8.004)	(5.978,6.686,8.047)	(6.616,7.564,8.654)	(5.716,7.038,7.782)	
A4	(5.85,6.806,7.871)	(5.716,6.575,7.782)	(5.312,6.469,7.522)	(5.978,6.537,8.047)	
A5	(5.05,6.327,7.116)	(4.827,5.679,7.149)	(3.42,4.337,5.529)	(6.469,7.959,8.51)	
A6	(4.718,6.081,6.804)	(4.825,6.653,6.919)	(2.479,3.09,4.667)	(6.252,7.522,8.322)	
AI	(6.544,7.483,8.559)	(6.114,7.351,8.183)	(7,8.559,9)	(6.469,7.959,8.51)	

When the steps of the Fuzzy MARCOS method described above are fully applied, the results are presented in Table 7. It is important to note that all influential parameters (criteria) are of the benefit type, and in this case, only one equation is applied in the fuzzy modeling as a consequence of a single criterion orientation.

**Table 7**  
 Model results for both types of perfumes

OR	fK+	DFK-	DFK+	DF-fK-	DF-fK+	Ki	Rank
A1	(0.29,0.56,1.09)	1.576	1.014	0.391	0.607	0.808	1
A2	(0.3,0.55,1.1)	1.558	1.003	0.386	0.601	0.788	2
A3	(0.28,0.53,1.06)	1.499	0.964	0.372	0.578	0.720	3
A4	(0.26,0.51,0.99)	1.421	0.914	0.352	0.548	0.638	4
A5	(0.22,0.45,0.88)	1.247	0.802	0.309	0.481	0.475	5
A6	(0.19,0.41,0.81)	1.136	0.730	0.281	0.438	0.386	6
DS	fK+	DFK-	DFK+	DF-fK-	DF-fK+	Ki	Rank
A1	(0.29,0.57,1.02)	1.480	0.978	0.395	0.597	0.766	2
A2	(0.3,0.57,1.03)	1.492	0.986	0.398	0.602	0.781	1
A3	(0.29,0.54,1.01)	1.430	0.945	0.381	0.577	0.708	3
A4	(0.26,0.5,0.95)	1.327	0.876	0.354	0.536	0.596	4
A5	(0.24,0.48,0.89)	1.252	0.827	0.334	0.505	0.523	5
A6	(0.21,0.43,0.82)	1.138	0.751	0.303	0.459	0.422	6

The results of the Fuzzy MCDM model, which includes the IMF SWARA method and Fuzzy Bonferroni operator for determining the significance of criteria, as well as the Fuzzy MARCOS model, indicate that the youngest population (the first two age groups) represents a loyal group of users for both types of perfumes, with only a slight difference depending on the perfume type. Specifically, as explained in the literature review [9,30], the young generation is a generation that still does not have a "formed attitude" when it comes to decision-making and preferences, independently and without the influence of aggressive digital platforms. In line with this, the research also showed that this generation was the most loyal to oriental perfumes, while the second age group (26–35 years) was the most loyal to designer perfumes. In the case of oriental perfumes, the picture is even more

pronounced, both because of the symbol of prestige that these perfumes carry, as well as the strength of their fragrance notes, their uniqueness, and their longevity on the skin. Thus, younger generations seek an expression of power and prestige. They are increasingly influenced by trends rapidly "served" by globalization, creators of social platforms, and influencers. The rankings of the remaining five age groups show a gradual decline in loyalty, which is justified, as with increasing age, clearer and more mature attitudes are formed, leading to preferences for less dominant perfume compositions and a tendency toward subtler fragrances. On the other hand, the group aged 26-35 still maintains relatively high stability in the choice of perfume brands, although with a less pronounced strength of preferences, while, for example, the groups over the age of 45 show decreasing loyalty to the highlighted perfume categories. The results showed that the group over 65 years of age demonstrated the least pronounced differentiation of scents, as well as reduced loyalty to specific perfume types, which fully corresponded with the ranking obtained from the model. The summary of this study indicates that the strength of a perfume brand, viewed through the intensity of fragrance notes, longevity, luxury and market reputation, points to the construction of a personal perfume style, which is a key factor in the loyalty of different age categories.

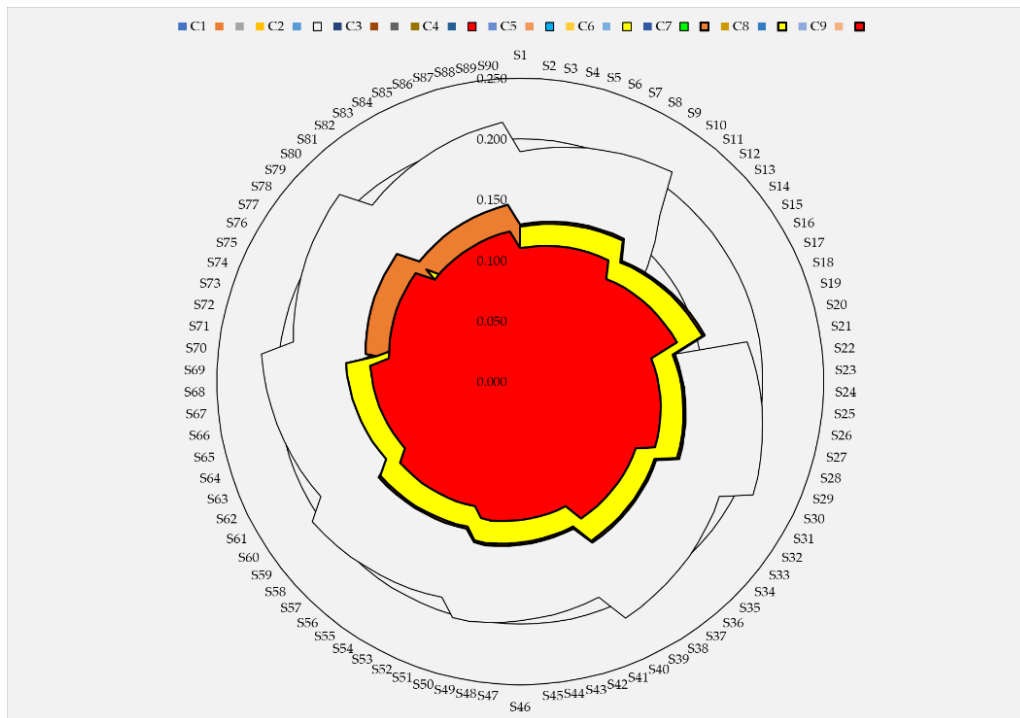
## 5. Sensitivity Tests and Comparative Analysis

The results calculated in the previous section need to be verified through specific sensitivity tests [57], comparative analysis [58], and statistical correlation parameters. Therefore, several additional tests were conducted for both types of perfumes to test the stability of the obtained rankings and the loyalty of the user age groups.

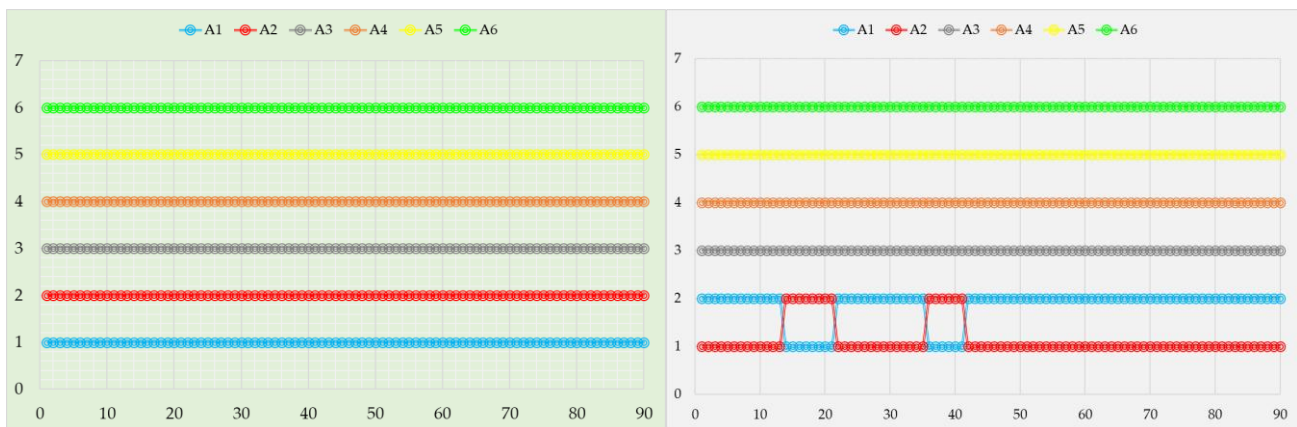
### 5.1. Sensitivity analysis

In the modern era, characterized by rapid changes in all areas, the conditions in which users operate evolve very quickly. When this is combined with market competition, where maintaining competitiveness is a real challenge, it is necessary to carry out a proactive management method that can predict future developments and maintain market position, which is certainly reflected in direct relationships with users and their degree of loyalty. Therefore, in the following section of the paper, the criterion weight coefficients were simulated under new operating conditions (Figure 3), implying changes in their values within a range of 5-95% of their original value. An example of changes in criterion values used to evaluate the loyalty of user age groups is as follows: in the first 10 scenarios, the value of C1 was decreased within the above-mentioned interval. In the first scenario, the value was reduced by 5%; in the second, by an additional 10% (cumulative 15%), and in each subsequent scenario by another 10%, up to scenario S10, resulting in a cumulative 95% reduction of the original value. The same procedure was applied to the remaining eight criteria, but it is important to note that when the value of one criterion is decreased, the values of the others are increased accordingly.

Observing the simulated criterion values under new conditions, it can be noted that the lowest value of any criterion occurs in scenario 60, when the value of the sixth criterion is reduced by 95%, resulting in a value of (0.003,0.004,0.005). In contrast, the highest value of any criterion in the sensitivity analysis is (0.174,0.192,0.215), which corresponds to the second criterion. After defining the new simulated values of the criteria through 90 scenarios, it is necessary to reproduce 90 new models for oriental and 90 models for designer perfumes to determine the impact of the newly emerged conditions on the criterion weights and user loyalty. The results of this type of analysis are presented in Figure 4 for both types of perfumes.



**Fig. 3.** Values of influential parameters in the simulated environment

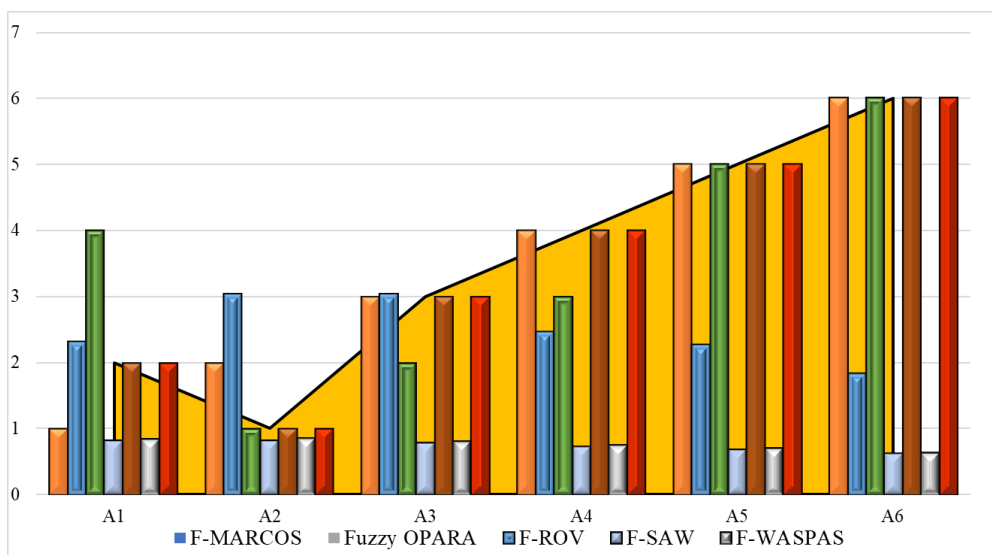


**Fig. 4.** Results of sensitivity analysis for oriental (left) and designer perfumes (right)

The results reveal a very interesting fact for oriental perfumes, namely that there are no changes in the loyalty of user age groups, regardless of the criterion values. In contrast, the situation is slightly different for designer perfumes. With new values of the second criterion in scenarios S13-S20, or the fourth criterion in scenarios S35-S40, the two top-ranked user groups change positions. Specifically, when the importance of the criteria “brand loyalty” and “repeat purchase due to habit and satisfaction” is reduced, the 26-35 age group loses the first position, which indicates loyalty to the purchase of designer perfumes. In all other cases, the rankings of user groups remain unchanged.

### 5.2. Comparative analysis

An integral part of considering stability tests is the comparative analysis, which in this study was conducted using four additional fuzzy MCDM methods: Fuzzy OPARA – Objective Pairwise Adjusted Ratio Analysis [59], Fuzzy ROV – Range of Value [60], Fuzzy SAW – Simple Weighting Method [61], and Fuzzy WASPAS – [62]. Figure 5 presents the comparative analysis with the results obtained for designer perfumes.

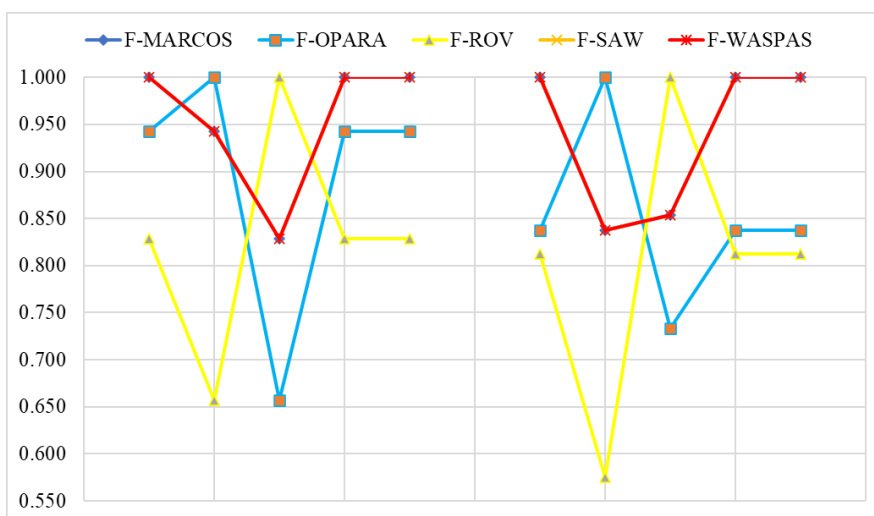


**Fig. 5.** Comparative analysis results using other MCDM approaches for designer perfumes

The comparative analysis shows different results depending on the type of perfume for which customer loyalty is defined. In the case of oriental perfumes, no chart is presented because there are no changes compared to the originally obtained results. When it comes to this type of analysis for designer perfumes, however, there are certain changes among the top four user age groups. Regarding the results from Fuzzy OPARA, there is only one change, the first two age groups are swapped, i.e., A1 is in the first position now, and A2 in the second. Due to the different nature of its methodological framework, the Fuzzy ROV method shows the following loyalty ranking: A2>A3>A4>A1>A5>A6, representing the largest changes compared to the originally obtained results. Fuzzy SAW and Fuzzy WASPAS confirm the results obtained with the IMF SWARA - Fuzzy MARCOS method.

### 5.3. Correlation tests

To more clearly demonstrate the stability of the obtained results and verification tests, the SCC [63,64] and WS [65] correlation coefficients were calculated, as shown in Figure 6 for designer perfumes. In the case of oriental perfumes, the correlation is complete, as there were no changes in the rankings of the alternative solutions.



**Fig. 6.** SCC and WS coefficients for designer perfumes

Figure 6 shows the values of statistical correlation for the SCC and WS coefficients, ranging from 0.575 (between Fuzzy OPARA to Fuzzy ROV) to complete correlation, i.e., a value of 1.000. The lowest correlation of the original IMF SWARA – Fuzzy MARCOS is with the Fuzzy ROV method: SCC = 0.829 and WS = 0.813, indicating a high correlation and stability of the model. Regarding the correlation across 90 scenarios in the sensitivity analysis, WS = 0.838 and SCC = 0.943, demonstrating a very high correlation of rankings in this analysis.

## **6. Conclusion**

Adapting to market changes and the constant demands and needs of users, particularly the youngest population, is fundamental to modern business and maintaining a competitive position. The path from gaining users' trust to achieving their loyalty is not simple and, naturally, requires significant effort, quality and time. In this paper, an integrated Fuzzy MCDM model consisting of the IMF SWARA method and the Fuzzy Bonferroni operator was applied to calculate and average the significance of nine criteria for evaluating loyalty. A group of 15 experts with extensive experience and expertise was formed to reliably determine loyalty and guide further development in the sale of oriental and designer perfumes. Within the methodological framework, more than 150 fuzzy models were created to adequately demonstrate customer loyalty across six age groups. The Fuzzy MARCOS method was applied to determine customer loyalty, and the results show that the 15-25 age group is loyal to oriental perfumes, while the 26-35 age group is loyal to designer perfumes. The contribution of this research lies in both scientific and professional domains. The professional contribution relates to the assessment of performance in the sale of oriental and designer perfumes, as well as defining directions for further operations based on the results obtained. The scientific contribution lies in the integration of multiple approaches into a single fuzzy MCDM model, the application of which in this field in this manner is a rare case. Through mentioned contributions, scientific and social justification of performed research can be manifested, which can be a benchmark for further similar studies. Based on the obtained results, it is recommended that managers in the perfume industry place greater emphasis on the younger age group (15–25), whose preferences are oriented toward popular (trendy) and oriental perfumes. This implies the implementation of more intensive and targeted promotional campaigns through digital channels and social media. In contrast, for the older population, the focus should be placed on the loyalty and quality associated with designer perfumes with a long tradition, which are often linked to nostalgia and by the perception of a sense of belonging. These recommendations highlight the importance of market segmentation and the optimization of marketing strategies in accordance with the preferences of consumers across different age groups.

Future research is aimed at developing short-term and medium-term strategies for managing sales capacities, maintaining existing relationships with the young population, and creating appropriate communication foundations and proactive approaches to managing relationships and sales involving mature and older users. Also, one direction for future research can be application of MCDM models to assess other activities in the company in order to ensure complete business efficiency or application of these methods in integration with other approaches to evaluate satisfaction of customers periodically.

## **Acknowledgement**

This research was not funded by any grant.

## **Conflicts of Interest**

The authors declare no conflicts of interest.

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