

The Selection of Packaging in the Function of Product Brand Development

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ARTICLE INFO

Article history:

Received 3 April 2026

Received in revised form 9 May 2026

Accepted 14 May 2026

Available online 15 May 2026

Keywords:

Packaging; product brand; small farm; multi-criteria decision-making methods; IMF SWARA; fuzzy ARAS

ABSTRACT

This paper analyzes different types of packaging in the context of product brand development and small business improvement. A decision-making model with ten criteria and four types of packaging was developed. Fuzzy methods were applied to support expert evaluation of these criteria and alternatives. The IMF SWARA (Improved Fuzzy Stepwise Weight Assessment Ratio Analysis) method was used to determine the weight of the criteria, and the results showed that the most important criteria were brand recognition and product protection. The fuzzy ARAS (Additive Ratio Assessment) method was then applied to rank the packaging alternatives. The results indicate that glass packaging was ranked as the best alternative due to its durability, recyclability, and adaptability to branding requirements, thereby gaining an advantage over other types of packaging. A sensitivity analysis confirmed the robustness of these results, showing that glass packaging remained the most favorable option under most scenarios, except when cost was emphasized. The contribution of this research lies in demonstrating the role of packaging functions in product brand promotion and providing insights into the application of multi-criteria methods for strategic decision-making in the packaging sector.

1. Introduction

In order to cope with the increasing changes in the market and improve their business, an increasing number of small farms are moving to independently sell their products. In this way, they try to bypass distributors in order to keep the commission they receive from the sale of their products for themselves [1]. Small farms therefore increasingly prefer to sell through local markets and use social platforms to promote and sell products [2]. This trend allows farms to establish control over their business and the presentation of their products on the market. However, this creates new challenges for the farms because they face direct competition and have to build their brand in order to be recognizable in the market. One of the key elements to achieve this is packaging [3]. Packaging is primarily a means of protecting products during distribution and storage [4], and it is also a means of establishing first contact with customers. For this reason, packaging has several functions. Packaging should be attractive and of high quality in order to attract

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<https://doi.org/10.65069/smart2120264>

customers to take possession of the product. Their perception is influenced by packaging [5]. For small farms that face limited resources and have to think about how to invest those funds, it is very important to choose packaging that will help build the brand of the product.

After attracting a customer to buy a product, an additional task of packaging is to retain those customers [6]. The packaging must be practical and easily accessible, while at the same time protecting the product. Packaging should reduce the risks of affecting product quality during distribution [7]. Care should be taken to ensure that the packaging is environmentally acceptable [8] and compliant with legal regulations, as food products are mostly handled by small farms. Legal regulations dictate what the packaging should look like, and in addition, there is increasing pressure from customers for the packaging to be easily recycled or biodegradable so as not to harm the environment. This is because customers are increasingly environmentally conscious [9]. It is necessary to emphasize that packaging must preserve the quality of the product, which is key to retaining customers, but also to building a certain image of the economy.

To form a brand, it is necessary to have a complete product, with the packaging being an integral part of that product. Packaging provides the customer with all the information about the product and its origin. Packaging can emphasize the approach that the economy promotes, whether it emphasizes traditional values and refers to recipes in the production of that product, or is modern and aware and emphasizes this with its packaging.

Increasing awareness of product branding for small businesses is a challenge because it is necessary to take into account the choice of packaging that will contribute to strengthening the brand. Packaging needs to distinguish products from other competing products and build a consumer world around these products. As the importance of a product for the customer grows, so does its brand. The motivation for conducting this research lies in the need to develop a decision-making model that will help small farms choose packaging that will best present their products and contribute to long-term product brand management. Based on the stated motivation of this research, the main goal of this research is to examine which packaging can best contribute to the development of the farm brand by applying multi-criteria decision-making methods (MCDM). Based on this goal, the specific goals of this research were defined, as follows:

- Identify key criteria for packaging selection for small-scale agricultural products with an emphasis on branding and customer perception.
- Compare selected packaging according to defined criteria to determine which of these packaging types can contribute most to the development of the product brand.
- Apply MCDM methods to identify the best packaging for products.
- Contribute to the development of tools for making strategic decisions for packaging selection in order to improve the product brand.

Based on everything, the contribution of this paper is multiple. First, the practical contribution of this research is reflected in the practical application of how small farms can improve decision-making regarding the choice of packaging, which will contribute to strengthening the image and recognition of the product. Second, a theoretical contribution is reflected in the strengthening of the development of the packaging choice model based on MCDM methods that will enrich the literature regarding decision-making in small farms. Third, the ecological contribution reflected in the fact that the type of packaging that will be chosen must contribute to the sustainability of small farm operations through environmental protection and strengthening awareness of the importance of ecological operations in farms. Fourth, the methodological contribution is reflected in the development of a decision-making model that can be adapted to other sectors and enable easier decision-making in order to improve business.

2. Methodology and case study

To achieve the research objectives, the study first outlines the applied methodology and research methods, followed by a case study that demonstrates their practical implementation.

2.1 Methodology and research methods

When conducting research for the needs of the Fruit Farm, the methodology for the needs of this research is presented in Figure 1.

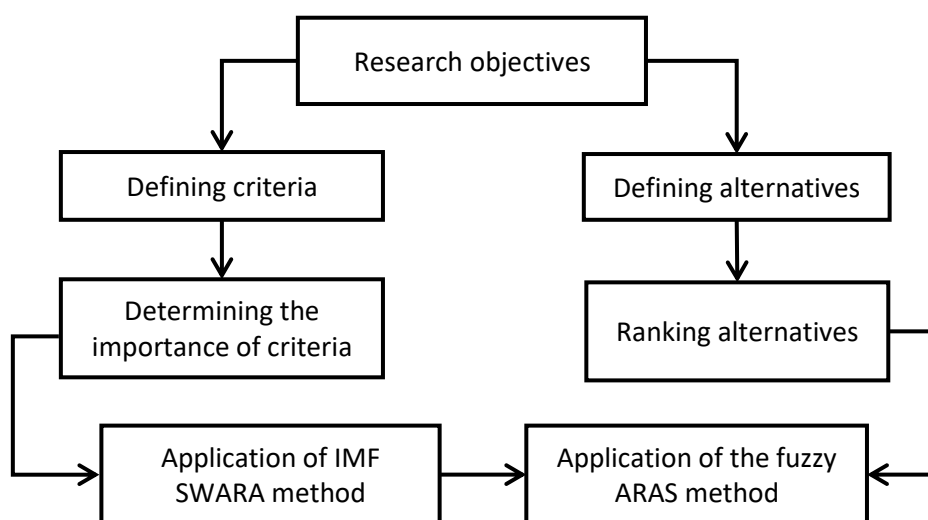


Fig. 1. Research methodology

When conducting research, it is necessary to define the objectives of the research. The introductory part of this paper defines the main objective and specific objectives of the research. In order to achieve this objective, it is first necessary to define the criteria and alternatives for this research. The selection of a case study defines the alternatives and criteria for this research. In order to determine which packaging best meets the set conditions, it is first necessary to determine the importance of the criteria, after which the process of ranking alternatives and selecting the packaging is carried out. This is because the methods that rank alternatives use the importance of criteria [10], so it is first necessary to determine this importance. Determining the importance of criteria and ranking alternatives will be carried out using fuzzy methods [11]. The reason for this should be sought in the fact that qualitative criteria that are difficult to evaluate with numerical scores have been selected, so linguistic terms are used for evaluation [12].

The integrated method of improved fuzzy stepwise weighting ratio analysis (IMF SWARA) will be used to determine the importance of the criteria. This method is a modification of the classic fuzzy SWARA method. This method was first used in the work of Vrtačić et al. [13]. They developed this method to facilitate the use of the fuzzy SWARA method in evaluating the importance of criteria. Modifications mainly relate to determining the importance of criteria using a value scale [14]. In addition, in this scale of values, fuzzy numbers (TFN) are defined and their scales are determined (Table 1).

Table 1

Linguistic terms and TFN scale, Source: [13]

Linguistic scale	Abbreviation	TFN Scale
absolutely less significant	ALS	(1, 1, 1)
dominantly less significant	DLS	(1/2, 2/3, 1)
much less significant	MLS	(2/5, 1/2, 2/3)
really less significant	RLS	(1/3, 2/5, 1/2)
less significant	LS	(2/7, 1/3, 2/5)
moderately less significant	MDLS	(1/4, 2/7, 1/3)
weakly less significant	WLS	(2/9, 1/4, 2/7)
equal significant	ES	(0, 0, 0)

The steps of this method are:

Step 1. Selection of criteria

Step 2. Ranking criteria.

Step 3. Determination of relative importance (table 2).

Step 4. Calculation of the coefficient value k_j ,

$$k_j = \begin{cases} 1, & \text{if } j = 1 \\ s_j + 1, & \text{if } j > 1 \end{cases} \quad (1)$$

Step 5. Calculation of significance value q_j

$$q_j = \begin{cases} 1, & \text{if } j = 1 \\ \frac{q_j - 1}{k_j}, & \text{if } j > 1 \end{cases} \quad (2)$$

Step 6. Calculation of criteria weight w_j

$$w_j = \frac{q_j}{\sum_{j=1}^n q_k} \quad (3)$$

Once the weights of the criteria have been determined, it is necessary to evaluate and rank the packaging. This will be done using the fuzzy additive ratio estimation (ARAS) method. This method was developed by Zavadskas and Turskis [15]. This method starts by calculating the utility function of the optimal alternatives. The steps in implementing the ARAS method are:

Step 1. Evaluation of alternatives with linguistic terms

Step 2. Transformation into fuzzy numbers (Table 2).

Table 2

Linguistic terms and membership functions

Linguistic scale	Abbreviation	TFN Scale
Not good	NOG	(0, 0, 1)
Slightly good	SIG	(0, 1, 3)
Somewhat good	SOG	(1, 3, 5)
Moderately good	MOG	(3, 5, 7)
Good	GOOD	(5, 7, 9)
Very Good	VEG	(7, 9, 10)
Extremely good	EXG	(9, 10, 10)

Step 3. Determine the optimal performance rating.

$$x_{0j} = \begin{cases} \max_i x_{ij}; & j \in \Omega_{\max} \\ \min_i x_{ij}; & j \in \Omega_{\min} \end{cases} \quad (4)$$

Step 4. Normalization

$$\tilde{r}_{ij} = \frac{x_{ij}^l}{\sum_{i=1}^m x_{ij}^u}, \frac{x_{ij}^m}{\sum_{i=1}^m x_{ij}^u}, \frac{x_{ij}^u}{\sum_{i=1}^m x_{ij}^u} \text{ for benefit criteria} \quad (5)$$

$$\tilde{r}_{ij} = \frac{\frac{1}{x_{ij}^l}}{\frac{1}{\sum_{i=1}^m x_{ij}^u}}, \frac{\frac{1}{x_{ij}^m}}{\frac{1}{\sum_{i=1}^m x_{ij}^u}}, \frac{\frac{1}{x_{ij}^u}}{\frac{1}{\sum_{i=1}^m x_{ij}^u}} \text{ for cost criteria} \quad (6)$$

Step 5. Multiplication with weights.

$$\tilde{v}_{ij} = \tilde{w}_j \cdot \tilde{r}_{ij} \quad (7)$$

Step 6. Calculate the overall performance rating.

$$\tilde{S}_{ij} = \sum_{j=1}^n \tilde{v}_{ij} \quad (8)$$

Step 7. Defuzzification

$$df_{S_{ij}} = \frac{l+4m+u}{6} \quad (9)$$

Step 8. Calculate the degree of utility.

$$Q_i = \frac{S_i}{S_0} \quad (10)$$

Step 9. Rank alternatives.

After the alternatives have been ranked, the packagings that should be primarily used and that would best improve the business and build the brand is selected.

2.2 Case Study

In order to protect the data on the farm taken as an example, the name Fruit Farm will be used. This farm seeks to differentiate itself from other farms by offering its own distinctive products on the market. To achieve this, it carries out certain promotional activities to differentiate its product from competing products. This research considers the possibility of achieving this by using innovative packaging. However, there are many options on the market for which packaging to primarily use for its products. Due to the wide range of products, this farm will use different packaging, but it is necessary to determine which packaging will help the most in building the brand.

To do this, this research will consider four types of packaging:

- Glass packaging (P1) which is durable, recyclable packaging that can be used for liquid products such as juices, marmalades, jams, etc. The specificity of this packaging is that it can be used as returnable packaging and can be used in accordance with the principles of the circular economy.
- Cardboard packaging (P2) is made of natural and renewable materials and is environmentally friendly and easy to recycle. It is suitable for personalization and various prints. However, there are limitations to the use of this packaging because it is not resistant to moisture and mechanical shocks and is less durable than other types of packaging.
- Plastic packaging (P3) offers good flexibility and durability and can be used for various products. It is very light and economical for mass production. However, it has a high impact on the environment because most of this packaging is poorly biodegradable and its use contributes to environmental pollution.
- Composite packaging (P4) is made of a combination of different materials in order to take advantage of the specific properties of the materials used. It allows for an extension of the product's shelf life and reduces the need for additional preservatives. Recycling this packaging is very expensive and technically complex due to its complexity.

Each of these types of packaging has its own specificities and limitations, and this packaging needs to be evaluated. To do this, it is first necessary to determine the criteria by which this packaging will be observed and to define how the evaluation will be carried out. In this decision-making problem, there are several alternatives in the form of packaging and several criteria by which these types of packaging are observed, and it will be solved using multi-criteria decision-making methods (MCDM). The task of these methods is to determine the weight of the criteria and then rank the packaging in order to determine which of these types of packaging is the most suitable for building a product brand. When determining the criteria, care was taken to focus the research on important elements that influence brand development, then on the ecological segment, as well as on the functional elements that this packaging should have. Based on this, ten criteria were selected (Table 3). Based on these alternatives and criteria, a decision-making model is formed.

Table 3
Criteria for packaging evaluation

Id	Criterion	Description
C1	Aesthetics	Visual appeal of the packaging in terms of design and shape to make the product recognizable.
C2	Brand recognition	The possibility of distinguishing the product from the competition through packaging.
C3	Environmental friendliness	The level to which the packaging can be recycled or decomposed in nature.
C4	Functionality	Accessibility in terms of handling the packaging to make it easier to get to the product while preserving its quality.
C5	Product protection	The ability of packaging to preserve the quality of the product and to facilitate the transportation and storage of the product.
C6	Cost	The monetary value of purchasing and using packaging
C7	Innovation	The level at which the packaging brings new or innovative elements
C8	Legal compliance	Compliance of the packaging with the set standards regarding product safety and labeling
C9	Adaptability	Flexibility of packaging that can be used for different products
C10	Purchasing perception	The possibility of the packaging influencing the customer regarding the purchase of that product

3. Results and discussion

In order to determine which packaging is most suitable for improving business and building a brand, Fruit Farm first appointed experts who would determine the importance of the criteria and evaluate possible packaging according to the criteria used. Five experts were selected who would deal with the production and sale of products within this economy. These experts have many years of experience in production and marketing, which is why they were selected as experts in this study. A meeting was organized with these experts, at which the criteria were first discussed, and then the packaging. First, they individually assessed the importance of the criteria, and then the packaging. Then, each of them read their ratings and explained why they received those ratings, and they corrected their ratings based on the reasons given by the other experts. After two interactions between the experts, the importance of these criteria was determined, and then the packaging was evaluated.

First, the importance of the criteria will be determined. The experts divided these criteria into four groups and gave equal importance to all criteria within these groups. Each of these groups is

slightly less important than the previous group and gave slightly less significant (WLS) ratings between groups, while equally significant (ES) ratings were given for criteria within a group. After determining the importance of the criteria, the steps of the IMF SWARA method were used and in this way the results of the importance of the criteria were obtained (Table 4). According to these ratings, the most important criteria are C2 - brand recognition and C5 - product protection (Table 4). This is because it is observed how packaging can affect the brand of the product, so it was logical that the brand recognition criterion would be the most important criterion, and the primary function of any packaging is to preserve the product from production to consumption, so this second criterion was considered the most important. The least important criteria, according to the experts, are criteria C7 - Innovation and C9 – Adaptability of the criteria. With these ratings, the experts, however, believed that there is no need to experiment too much with packaging, but that the product packaging should be partially different from the competitor's products and not completely different, in order to take advantage of the opportunity to adapt the packaging. For example, that fruit. For example, if it is plum jam, the packaging should be in the shape of a plum or resemble a plum in some way.

Table 4
Calculation of criteria weights using the IMF SWARA method

	s_j	k_j	q_j	w_j
C2	(1.00, 1.00, 1.00)	(1.00, 1.00, 1.00)	(1.00, 1.00, 1.00)	(0.13, 0.13, 0.14)
C5	(0.00, 0.00, 0.00)	(1.00, 1.00, 1.00)	(1.00, 1.00, 1.00)	(0.13, 0.13, 0.14)
C1	(0.22, 0.25, 0.29)	(1.22, 1.25, 1.29)	(0.78, 0.80, 0.82)	(0.10, 0.11, 0.11)
C3	(0.00, 0.00, 0.00)	(1.00, 1.00, 1.00)	(0.78, 0.80, 0.82)	(0.10, 0.11, 0.11)
C8	(0.00, 0.00, 0.00)	(1.00, 1.00, 1.00)	(0.78, 0.80, 0.82)	(0.10, 0.11, 0.11)
C10	(0.00, 0.00, 0.00)	(1.00, 1.00, 1.00)	(0.78, 0.80, 0.82)	(0.10, 0.11, 0.11)
C4	(0.22, 0.25, 0.29)	(1.22, 1.25, 1.29)	(0.60, 0.64, 0.67)	(0.08, 0.09, 0.09)
C6	(0.00, 0.00, 0.00)	(1.00, 1.00, 1.00)	(0.60, 0.64, 0.67)	(0.08, 0.09, 0.09)
C7	(0.22, 0.25, 0.29)	(1.22, 1.25, 1.29)	(0.47, 0.51, 0.55)	(0.06, 0.07, 0.08)
C9	(0.00, 0.00, 0.00)	(1.00, 1.00, 1.00)	(0.47, 0.51, 0.55)	(0.06, 0.07, 0.08)
	sum		(7.26, 7.50, 7.71)	

After determining the importance of the criteria, the alternatives were evaluated using defined linguistic terms (Table 5).

Table 5
Packaging Evaluation Using Linguistic Terms

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
P1	EXG	VEG	VEG	GOOD	EXG	MOG	GOOD	EXG	GOOD	VEG
P2	VEG	GOOD	EXG	VEG	GOOD	VEG	MOG	VEG	VEG	GOOD
P3	MOG	MOG	SOG	EXG	VEG	EXG	MOG	GOOD	EXG	MOG
P4	GOOD	VEG	MOG	VEG	EXG	GOOD	VEG	EXG	VEG	VEG

After that, the steps of the fuzzy ARAS method are used. The first step is to convert these linguistic terms into the corresponding fuzzy numbers. So, the EXG result is converted into a fuzzy number (9, 10, 10), then the VEG result is converted into a fuzzy number (7, 9, 10), and the remaining results are converted into fuzzy numbers according to the defined membership functions (Table 3). The next step of this method is to determine the optimal performance. This is actually determining the optimal alternative, which is determining the maximum value of the alternatives for each criterion. Then the normalization step is performed. In this step, the values of the

alternatives are divided by the sum of the values of all alternatives for individual criteria. In the example of criterion C1 and packaging P1, this looks like this:

$$\tilde{r}_{11} = \left(\frac{9}{46} = 0.20, \frac{10}{41} = 0.24, \frac{10}{33} = 0.33 \right)$$

The other normalization values are calculated in the same way, with the fact that it is necessary to perform benefit normalization for each criterion due to the specificity of the ratings defined by this research. The next step is to multiply by weights. In this step, the normalization values are multiplied by the criterion weight. On the same criterion and alternative, it is done in the following way:

$$\tilde{v}_{11} = (0.20 \cdot 0.10 = 0.02, 0.24 \cdot 0.11 = 0.03, 0.30 \cdot 0.11 = 0.03)$$

Then comes the step in which the overall performance score is calculated. This step is carried out by summing the weight values, then defuzzification is carried out and finally the utility function is calculated where the individual alternative values are divided by the optimal alternative (Table 6).

Table 6
Results of applying the fuzzy ARAS method

	$\tilde{S}_{ij}$	$df_{s_{ij}}$	Q_i	Rank
P1	(0.14, 0.21, 0.31)	0.220	0.901	1
P2	(0.13, 0.20, 0.31)	0.209	0.857	3
P3	(0.10, 0.16, 0.26)	0.172	0.707	4
P4	(0.13, 0.20, 0.31)	0.215	0.883	2
P0	(0.17, 0.23, 0.33)	0.244		

The results of this showed that the best packaging for brand development is glass packaging. The reason for this is that it is very suitable and glass can be shaped according to the wishes of the farm. It is possible to take specific sizes and shapes of gallons, bottles and all other glass packaging. Research conducted by Gonçalves et al [16] showed that glass is recycled to a very large extent. What is specific to glass packaging is that this packaging can be returnable packaging [17]. When the customer uses up the product, he can return the packaging to the farm and get a discount for the purchase of new products. In this way, this packaging is used in the function of a circular economy and the environment is preserved.

The second-ranked packaging for brand building purposes is composite packaging. The reason why it was ranked second is that it allows the product properties to be maintained longer than some other types of packaging. However, since it is made as a layered packaging, the tendency in the world is for it to be biodegradable [18]. Therefore, when using this type of packaging, it is necessary to take into account the time it takes for it to decompose in nature. The shorter the biodegradation time, the more the environment is preserved [19].

The third ranked packaging is cardboard packaging. The problem with using this packaging in brand building is that it can only be used for dry products. It begins to decompose in contact with water or moisture [20]. However, this packaging can be used as collective packaging in which individual products are packed. Care must then be taken to present the brand on this collective packaging and care must be taken to differentiate it from similar packaging.

The worst ranked is plastic packaging for brand building. The reason for this is that plastic packaging has a great impact on environmental pollution [21]. More and more activities are being invested to reduce the decomposition time of this packaging [22], but there is still a danger to the environment in the form of micro plastics [23]. These are just some of the reasons why plastic packaging is chosen as the worst packaging for building a product brand and improving business.

In order to determine how the ranking of these types of packaging behaves, a sensitivity analysis will be conducted. The aim of this sensitivity analysis is to determine how the change in the weight of the criteria affects the final ranking of packaging types [24, 25]. In this research, the importance of one criterion will be increased by 2, 3, 4 and 5 times, while other criteria will be proportionally reduced so that the sum of all weights remains relatively the same. In this way, for the reason that there are ten criteria, 40 scenarios were formed. These scenarios showed that none of the researched packaging meets the same set of criteria in order to strengthen the brand. Thus, although in the largest number of scenarios, glass packaging gave the best results, however, when the Cost criterion was changed, this type of packaging was ranked the worst. This is due to the fact that the production of this type of packaging costs the most, so with the increasing importance of the Cost criterion, it took the worst place. However, these results also showed that Plastic packaging ranked the worst in most scenarios and was ranked third in three scenarios (Figure 2). Based on this, it was shown that this type of packaging cannot be used to strengthen the product brand, but that other types of packaging should be used. Therefore, when the decision maker needs to decide which packaging to use, he must keep in mind what, in his opinion, this packaging must satisfy, which goals. Sensitivity analysis (Figure 2) shows how a particular type of packaging satisfies individual criteria, while satisfying all other criteria to a lesser extent.

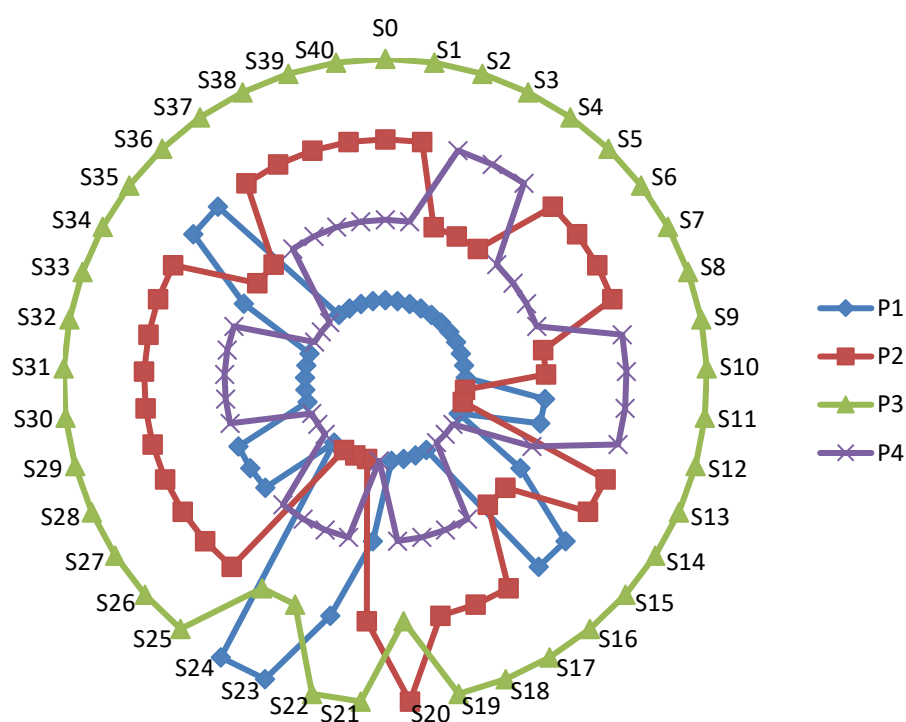


Fig. 2. Results of the sensitivity analysis

4. Conclusions

The conducted research examined how certain types of packaging can be used to build a product brand and improve the business of the Fruit Farm. Four types of packaging were considered and evaluated according to ten criteria. These criteria are specific in that they cover different packaging dimensions. Thus, the types of packaging are viewed more broadly in the context of brand building. For this purpose, a research model was created that answered the question of which type of packaging should primarily be used for products using fuzzy methods.

These methods were chosen because the selected criteria are mostly qualitative, and the evaluation of these criteria is easier using linguistic terms than numerical evaluation.

In order to determine which criteria are more important than others, the IMF SWARA method was used. This method was chosen because it is easier and more consistent than the classic SWARA method. The results of the application of this method show that two criteria have a slight advantage over the other criteria, namely brand recognition and product protection. The advantage of these two criteria is logical because it was about promoting the brand, and the packaging must have a protective function in order to deliver a quality product to customers. In order to examine which type of packaging has the best potential for brand promotion, the fuzzy ARAS method was used. This method has been used since 2010 and as such has become common for MCDM decision problems. The results of applying this method show that glass packaging is the best for promoting the Fruit Farm brand. Composite packaging follows, while plastic packaging is rated the lowest. The conducted sensitivity analysis confirmed that glass packaging consistently achieved the highest ranking under most scenarios, demonstrating its robustness as the preferred option for brand development. However, when the cost criterion was emphasized, glass packaging ranked lowest, highlighting the importance of balancing economic considerations with branding and sustainability goals.

The limitations of this research are in terms of the number of considered types of packaging. In practice, there are a much larger number of types of packaging and these types should be examined in future research. Then it is possible to apply other criteria, so it is necessary to carry out research to examine which criteria are the most important for evaluating the function of the packaging in terms of improving the product brand. Future studies should address conducting comparative analysis with other models and case studies, thus allowing for broader validation and strengthening the generalizability of the proposed decision-making framework which also represents another limitation of this research. It should be noted that this research was conducted on an example from practice and that the selection of criteria and alternatives is in accordance with the business of the observed entity.

Acknowledgement

This research was not funded by any grant.

Conflicts of Interest

The author declare no conflicts of interest.

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