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Research Article

Organizational Competitive Advantage Analysis Using SWOT Matrix and Hybrid Approach of Fuzzy-DEMATEL, ANP and DEA

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Abstract

Today, due to the expansion of organizational competition, the growth of technology, and the increasing demand for customers, organizations that gain a competitive advantage over competitors by adopting scientific strategies can survive. There are various approaches to create a competitive advantage in organizations. On the other hand, in the scientific literature of this field, there is no integrated model that can cover the gap between these approaches. The aim of this paper is to present a new hybrid model for determining organizational competition strategies and criteria through decision-making tools. In this research, brands of dairy products listed in Iran were selected as a case study to demonstrate the application of the methodology. First, competitive strategies were determined through the Delphi method and expert judgment based on the SWOT technique. Then, relying on the SWOT technique, appropriate evaluation criteria were extracted through the fuzzy DEMATEL method. In the next step, each brand was considered as a decision-making unit (DMU). In addition, the output of the fuzzy DEMATEL method formed the initial values (inputs-outputs) of data envelopment analysis (DEA). Finally, after determining DEA weights via analytic network process (ANP), the efficiency of DMUs was measured by the Russell DEA model. The results of DEA showed that based on the strategies of the SWOT technique, 38% of the units under investigation are efficient. Also, the lowest efficiency obtained from the units was 82%, which shows that there is no noticeable dispersion in the efficiency values. In other words, it shows that the performance of all brands of dairy products is at a suitable level. The rest of the results and discussion are presented in detail. Analysis shows that the model of this research can be a suitable model for survival in today's tight organizational competition in the world.

Keywords: Organizational Competitive Advantage; SWOT Technique; Fuzzy DEMATEL; Analytic Network Process; Data Envelopment Analysis.

1. Introduction

In recent decades, competitive advantage is one of the important topics that has been emphasized in the literature of strategic marketing and management. Competitive advantage occurs when an organization achieves improvements and capabilities in an indicator or a combination of indicators that gives it an advantage over competitors (Fabrizio et al., 2022). Such as access to natural resources, highly specialized human resources, industrial technologies, information, etc. Also, creating and maintaining the stability of competitive advantage requires competencies that create value for customers by relying on the organization's capabilities (Leppänen et al., 2023). In this regard, different perspectives on the determining and effective factors have been presented. For example, theorists of industrial organizations consider environmental factors to determine competitive advantage. The first person among these theorists is Bean, who expressed his theory in 1968. However, the famous theorist of this group is Michael Porter (Mahirwe & Wei, 2018). According to Porter's model, the profitability of companies depends on the attractiveness of the industry and the relative position of the company in the industry. If the strategy makes the organization perform activities different from competitors, competitive advantage is achieved (Porter, 1985). Among other theories of this group, we can mention the theory of Amit and Shomiker (1993). They believed that the profitability of the company depends on the degree of compatibility of strategic assets and strategic factors of the industry. Therefore, the basis of competitive advantage is based on the interaction of industrial organization and competence theory.

In contrast to this group of theories, a number of theorists emphasize the importance of internal organizational factors in gaining competitive advantage. Based on this, we can refer to the attitude based on resources and the attitude of dynamic capabilities. The resource-based attitude considers organizations as sets of resources and believes that the basis of an organization's competitive advantage is its resources. Provided that the organizations have the characteristics of being rare, valuable, low substitutability

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and inimitable. In other words, the source of competitive advantage is the organization's resources. If the resources have the above four characteristics, the competitive advantage is sustainable (Zhang et al., 2023). The attitude of dynamic capabilities considers the source of competitive advantage to be distinct processes (methods of coordination and combination). In this attitude, the term "dynamic" refers to the ability to rebuild competencies that are compatible with the changing business environment, dependencies and real market situations. In addition, the term "capabilities" emphasizes the key role of strategic management in adapting, integrating and reconfiguring the competencies, resources and skills of the organization to meet the requirements of the changing environment. According to this attitude, it is not possible to acquire dynamic capabilities from the market and its creation requires dynamic management processes within the organization (Shahanipour et al., 2020). In general, it can be said that in all environmental theories, "industry" is the unit of analysis. Also, in theories based on resources, dynamic capabilities, and core competencies, the "organization" is the unit of analysis.

In summary, according to the theoretical foundations of strategic management and marketing, we examined three types of competitive advantage attitudes in the background mentioned above. Each of these theories looks at the issue of competitive advantage from different angles, and their main difference is due to their view of the field of competition (Saeidi et al., 2019). These three types of attitudes are as follows:

- Environmental resources and capabilities
- Organizational resources and capabilities.
- Resources and inter-organizational communication and synergy resulting from it.

So far, we have learned about the necessity of the category of competitive advantage. In addition, we found out how much this issue affects the progress of the organization. The current research aims to improve all attitudes regarding competitive advantage by using an integrated model of decision-making methods. In such a way that the weak points of each attitude are covered by the strong points of other attitudes. The main purpose of this paper is to present a new hybrid model for determining organizational competition strategies and criteria through decision-making tools. This work helps to maintain theories in determining the main criteria and indicators of competitive advantage. This is the problem that this research focuses on. The framework considered for the research problem links the methods of SWOT (short for strengths, weaknesses, opportunities, threats), fuzzy DEMATEL, analytic network process (ANP), and data envelopment analysis (DEA) to each other. The SWOT matrix, which is one of the important support tools for decision-making, forms the core of the proposed model. This tool is used for the systematic analysis of the internal and external environments of the organization. By examining weaknesses, strengths, opportunities and threats, SWOT reflects the correct position of the organization to improve the situation (Shinde et al., 2023). Therefore, it is a suitable starting point for determining competitive advantage indicators with scientific coverage of all attitudes. After determining the criteria by SWOT technique, evaluation of criteria and ranking of alternatives and decision-making units are done by other mentioned tools. Specifically, the combined use of fuzzy DEMATEL, ANP, and DEA to achieve reliable results with the least error is the contribution of the present research in the literature of the research field. To the best of our knowledge, this is a gap that has not been assessed by researchers. The proposed model was examined in order to verify it in the dairy industry and to determine the position of the "Manga" brand, active in the field of soy, milk and dairy products, compared to other brands.

In summary, the main contribution and novelties of the paper is highlighted in follows:

- Development of a comprehensive model for effective application of all theories of competitive advantage.
- Using the SWOT technique to analyze the internal, middle and external environments of the organization.
- Applying Fuzzy-DEMATEL for the step of ranking alternatives in SWOT.
- Comparing the efficiency of organizations through the ANP-DEA method.
- Depicting a case study from the real world to show the effectiveness of the presented model in solving real problems.

The remainder of the paper is organized as follows: a relevant studies review is presented in Section 2; Section 3 presents the proposed methodology; in Section 4, computational results, discussion, and managerial implications are discussed; in Section 5, the conclusion and future research orientation are presented.

2. Literature Review

As mentioned in the prior section, this research in methodology is based on decision-making tools. From a methodological point of view, the science of decision making has been expanded into different branches, the most famous of which are multi-criteria decision-making (MCDM) and DEA. MCDM is classified into two general categories including multi-attribute decision-making (MADM) and multi-objective decision-making (MODM). MADM techniques deal with the ranking of alternatives for decision-making problems, which are used in a wide range of research due to their simplicity and greater application (Alinezhad & Khalili, 2019; Oke et al., 2022; Alinezhad et al., 2023). In contrast, MODM methods have more computational complexity, which is the reason for much less research in this field (Sarrafha et al., 2014). On the other hand, DEA is a non-parametric mathematical method based on operations research, the first model of which was presented with the well-known name CCR by Charnes et al. (1978). This method compares the performance of decision-making units (DMUs) by considering the initial values (input-output) for them. DEA forms the efficient frontier by obtaining the efficiency values and introduces the efficient DMU as a reference model for other units (Taherinezhad & Alinezhad, 2023). Finally, it clarifies the decision-making path for each unit to reach the efficient frontier. In the last decades, the application of DEA in research has grown a lot. For example, we can mention its use in medicine (Taherinezhad & Alinezhad, 2022; Taherinezhad & Alinezhad, 2023), finance and banking (Alinezhad et al., 2007; Kiani Mavi et al., 2010), manufacturing (Adedeji et al., 2023), supply chain (Khalili & Alinezhad, 2018), poultry industry (Alinezhad & Taherinezhad, 2021; Taherinezhad et al., 2023a), media industry (Taherinezhad et al., 2023b), oil industry (Taherinezhad & Alinezhad, 2023), etc.

The approach that was taken to review the literature background is such that it places the concept of competitive advantage next to decision-making methods. This approach helps to review the most relevant past studies. Additionally, we limited the search for studies to the years 2018–2024 to identify the most recent scientific contributions. The details of the literature are as follows: Sanny et al. (2018) conducted a study with the aim of improving the analysis of SWOT dimensions with group decision making. They proposed the combination of ANP (short for analytic network process) and fuzzy TOPSIS methods at the end of the study, which can be used to formulate the best alternative strategy. It should be noted that their method does not rank companies from the point of view of competitive advantage and only SWOT alternatives are ranked. Jain (2018) presented a flexible production system (FMS) aimed at dealing with competitive pressure in manufacturing organizations. In this study, the ranking of FMS performance factors was done using MOORA and preference selection index (PSI) techniques. In addition, attribute weights were defined by AHP (short for analytic hierarchy process). Along with FMS, the SWOT matrix is also a suitable tool that reduces the pressure of market competition for manufacturing organizations. The lack of strategic and management tools along with operational tools can be the gap in this research. The study by Shahin et al. (2018) is also placed next to the previous study. Where MADM techniques have been used to prioritize product development strategies in the Isfahan steel industry. The prior study gap also holds true for this research. In addition, Saluja and Singh (2019) investigated the scientific decision-making criteria to justify the advancement of newer welding technology to create a competitive advantage. For this, they used the methods of AHP and modified AHP to justify the selection of the appropriate welding method for the production of welded tube. This research has also relied on the attitude of capacities and resources within the organization to create a competitive advantage. In another study, Zhao et al. (2019) used MADM techniques (DEMATEL, ANP, and VIKOR) to improve financial service innovation strategies to increase the competitive advantage of the Chinese banking industry. It can be said that the innovation of this research is defined in the MADM hybrid method, and in attitude, it does not cover all the theories of competitive advantage. In the literature review process, studies were also found that focused only on the SWOT tool for competitive advantage evaluations (Devi et al., 2022; Ariyahya et al., 2023; Sagheer & Al-Hilawy, 2023). Note that, these researches are often in the field of strategic management and their only common point with this paper is the concept of competitive advantage and the SWOT matrix. Further, from the last few researches that have benefited from DEA in the concept of competitive advantage, can be mentioned Lin et al. (2021) and Tang and Qin (2022).

In the recent year, i.e., 2024, interesting studies on the combination of DEA and the concept of competitive advantage has been published. This shows that this field has and will have a high research potential to advance the frontiers of knowledge. For example, Çağlar and Nişel (2024) examined FinTechs as an effective factor in the competitive advantage of organizations (especially the financial sector). They used the DEA technique to measure the performance of fintech companies. The results showed that the profitability performance of FinTechs is higher than their marketability performance. Or in another research, Shabani and Akbarpour Shirazi (2024) focused on evaluating the performance of commercial bank branches in dynamic competitive conditions. For this purpose, they developed a network DEA model appropriate to the problem. The results showed that the weighting coefficients of the periods do not significantly affect the overall efficiency of commercial bank branches, unlike desirable and undesirable intermediates.

By briefly reviewing what has been mentioned, it is clear that previous related studies have not focused on a method that can aggregate all indicators of competitive advantage attitudes and theories. This is exactly the gap that this study addresses. Therefore, the novelties, innovations and key contributions of this research in the subject are as follows:

- Providing a comprehensive model to survive all attitudes and theories in determining competitive advantage indicators.
- Using the SWOT matrix as the main core of the model with the aim of systematically analyzing the internal, middle and external environments of the organization. Also, discovering weaknesses-strengths and threats-opportunities.
- Using the fuzzy DEMATEL technique to rank the most effective SWOT alternatives.

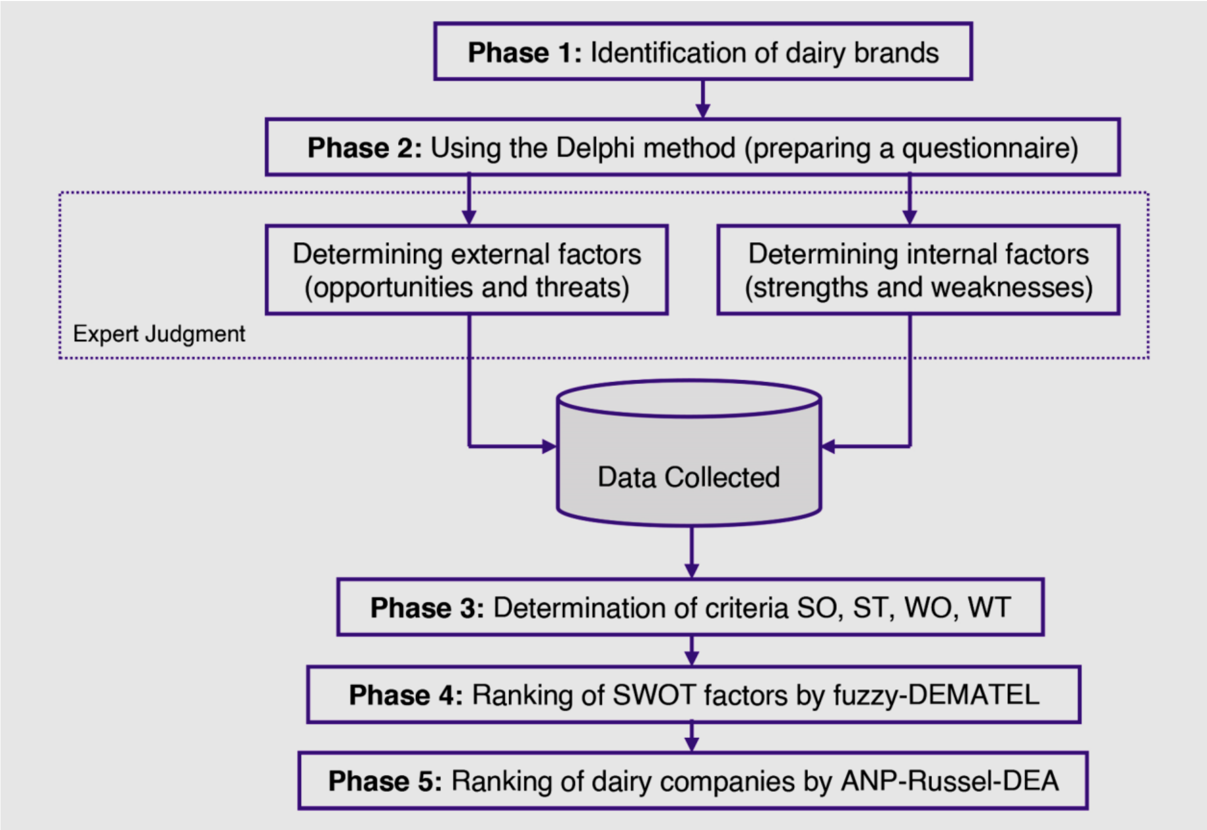

Fig. 1. Research methodology architecture.

- Providing a true view of the position of organizations in a specific industry relative to each other and comparing them from the point of view of competitive advantage via the ANP-DEA method.
- Implementation of the presented model in a real case study in the dairy industry.

3. Materials and Methods

In this section, the framework of the research method is presented first. Then, the methods used are introduced in detail in separate subsections. Figure 1 reflects a conceptual model of research implementation phases. As can be seen, in the first phase, all dairy brands listed in Iran, which was possible data extraction form them, were identified. The commercial titles of these companies are as follows: 1) Manga 2) Choopan 3) Ramak 4) Alis 5) Kalber 6) Mihan 7) Pak 8) Koohpayeh 9) Rouzaneh 10) Pegah 11) Damdaran 12) Kalleh 13) Pakban. In the second phase, internal factors (strengths (S) and weaknesses (W)) and external factors (opportunities (O) and threats (T)) that can affect the sustainable competitiveness of a dairy brand were identified through the Delphi method and preparing a questionnaire. In the third phase, SO, ST, WO, and WT criteria were created based on the SWOT matrix. In the fourth phase, the evaluation of the communication and the effectiveness of the criteria was carried out by the Fuzzy DEMATEL method in order to finally determine the best SWOT factors to determine the initial values of Russell's DEA model. Finally, in the fifth phase, through the implementation of Russell's DEA model, the efficiency of dairy units was obtained, so that the ANP method played a special role in determining the coefficients of the model.

3.1. Delphi technique

The Delphi technique is a systematic approach to extracting opinions from a group of experts on a topic or a question. In better words, reaching a group summary through a series of questionnaires, while maintaining the anonymity of the respondents and feedback to the members. This technique was officially and scientifically presented for the first time in 1950 by the RAND company. This communication method was originally designed and developed for the purpose of organized and interactive prediction based on the mutual thinking of experts. The basis of Delphi is that the opinion of experts in any scientific field is the most authoritative about predicting the future. Therefore, unlike survey research methods, the validity of the Delphi method depends on the scientific validity of the participating experts and is not dependent on the number of participants in the research. The number of participants in the Delphi technique ranges from 5 to 20

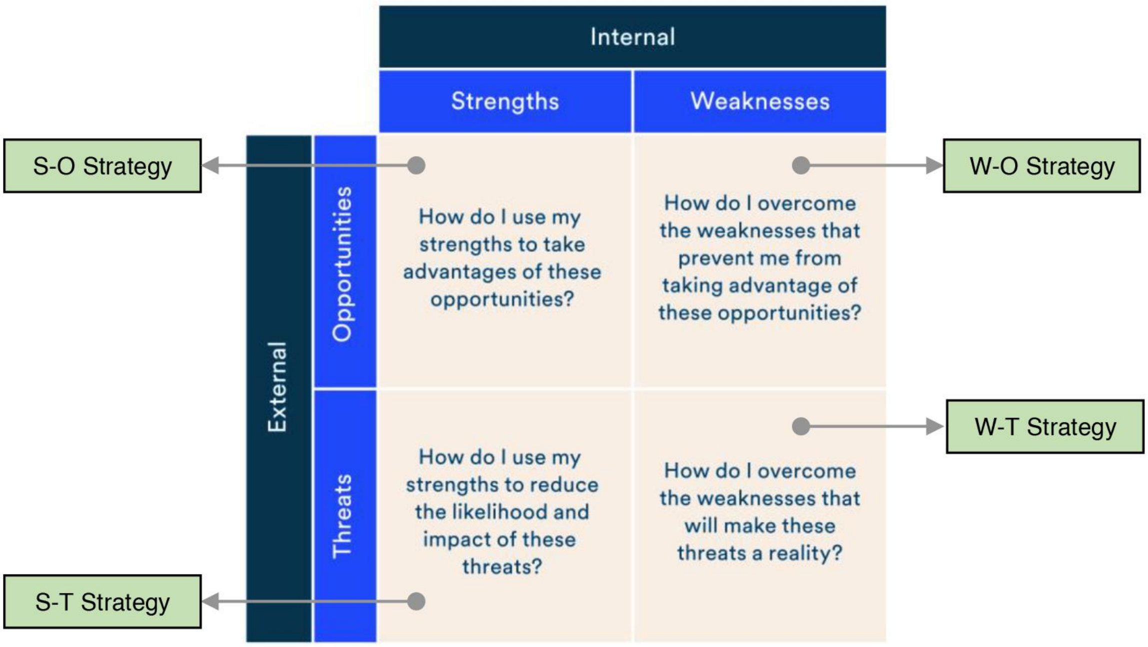

Fig. 2. SWOT analysis matrix (BDC, 2020)

people (Loo, 2002). Woudenberg (1991) divides Delphi types into three groups:

- *Traditional Delphi:* This type of Delphi, which is the same method used by its inventors, has two uses: prediction and estimation of unknown indicators. This method is also used to determine the consensus of experts on future developments in science and technology.
- *Political Delphi:* This type of Delphi does not seek to reach an agreement, but seeks to reach the most important opposing views on a political issue of the day. The main goal of this type of Delphi is to reach the range of positions and views in the community.
- *Decision-making Delphi:* This Delphi is used to reach joint decisions of a group of different people about a specific issue. Usually, in a complex and multi-dimensional decision-making issue, the structural communication process of an expert group is effective in its correct and root solution.

Delphi is a low-cost, widely used, objective, non-threatening and easy method for recognition. Great flexibility, application in different disciplines, use of different communication approaches and the possibility of use on a wide geographical level, no need to train the interviewers, anonymity, providing open discussions, identifying and understanding the background of the subject are other advantages of Delphi. One of the most important limitations of this technique is the need for a lot of effort and work, and its slow and time-consuming process. Also, the Delphi technique is only the initial stage that only tries to gain consensus, and this consensus is not necessarily the most accurate opinion. Because the assumption in Delphi is equality of participants in terms of knowledge and experience, in practice this assumption may not be correct (Loo, 2002).

3.2. SWOT matrix analysis

SWOT analysis was first proposed in 1950 by two Harvard Business School graduates named George Albert Smith and Roland Christensen. With increasing success at that time, this analysis was recognized as a useful management tool, but perhaps the most visible success of this analysis was obtained when Jack Welch of General Electric (GE) used it in 1980 to review GE's strategies and increase the organization's productivity. This technique is actually an efficient tool to identify the environmental conditions and internal capabilities of the organization. The foundation of this tool in strategic management and marketing is knowing the surrounding environment of the organization (Brown Epstein, 2022). The letters SWOT, which is also written in other forms (TOWS), is the beginning of the words “Strength”, “Weakness”, “Opportunity”, and “Threat”, which are defined as follows (Brown Epstein, 2022):

- *Strength:* It is a special competence by which the organization can be superior to its competitors in areas such as the type of financial resources, positive mental image among buyers, positive relations with suppliers, and so on.
- *Weakness:* It is the type of limitation or deficiency in resources, skills, facilities and abilities that

significantly hinders the effective performance of the organization. Management performance is also effective in aggravating weaknesses.

- *Opportunity:* It is a major desirable success in the organization's external environment, such as recognizing a part of the market that was forgotten before. Changes in the state of competition or laws and improvements in relationships with buyers and sellers.
- *Threat:* An unfavorable threat is in the organization's external environment, such as the bargaining power of key buyers or suppliers, major and sudden changes in technology, and other things that can be a major threat to the organization's success.

The analysis of these four factors provides a framework that facilitates the determination and formulation of strategies. The four types of strategies obtained according to the SWOT matrix in Figure 2 are as follows (BDC, 2020):

S-O strategies: Strategies for using the organization's strengths to invest in environmental opportunities.

W-O strategies: Strategies for using environmental opportunities to overcome the organization's weaknesses.

S-T strategies: Strategies for using the organization's strengths to overcome environmental threats.

W-T strategies: Strategies to minimize the weaknesses of the organization by distancing from environmental threats.

3.3. Fuzzy DEMATEL technique

DEMATEL (abbreviated for Decision Making Trial and Evaluation) is one of the famous MADM techniques that is used to identify the pattern of causal relationships between studied variables. DEMATEL was presented in 1971 by Fonetla and Gabus. This technique examines the intensity of communication in the form of scoring, searches for feedback along with their importance, and accepts non-transferable relationships (Wu & Lee, 2007). Before describing the steps of fuzzy DEMTEL in this part, it is necessary to give a brief explanation of fuzzy theory and triangular fuzzy numbers.

In a decision-making process, decision makers usually face doubts, issues and uncertainties. In better words, what we face in the real world is always uncertain and ambiguous. Coping with uncertainty requires a tool that can consider these conditions in different scientific models (Alinezhad & Taherinezhad, 2020). Fuzzy logic theory is precisely focused on this problem. Mathematical methods and models combined with fuzzy logic concepts become powerful tools for solving problems in uncertain conditions (Zadeh, 1983).

One of the basic concepts in this field is the triangular fuzzy number (TFN) that has been used in the fuzzy DEMATEL steps. TFN is a number represented by three real numbers as $F = (L, M, U)$. The upper bound, denoted by U, is the maximum value that the fuzzy number F can take. L as the lower bound, the minimum value of fuzzy number F and M is value with most degree of membership. Figure 3 shows the fuzzy number $F = (L, M, U)$ in the geometric space. The horizontal axis $\mu(x)$ shows the degree of membership of each member x (Zadeh, 1983).

The mathematical relationship of the TFN membership function mentioned above is according to Equation (1):

$$\mu_F(x) = \begin{cases} \dfrac{x-L}{M-L} & L < x < M \\ \dfrac{U-x}{U-M} & M < x < U \\ 0 & Otherwise \end{cases} \quad (1)$$

Note that one of the applications of TFN is when we include linguistic values (qualitative values) in our calculations. Linguistic values used in this research and their fuzzy equivalents are given in Table 1. The information in Table 1 is used in step 2 of the fuzzy DEMATEL technique that can be seen in the rest of the part.

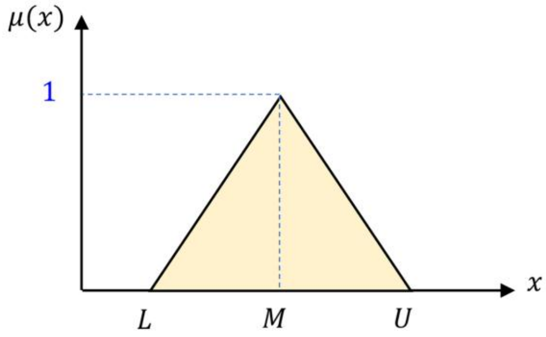

Fig. 3. Triangular fuzzy number with membership function μ(x)

Table 1
The linguistic expressions used in the Delphi questionnaire in the current research and their TFN values

Linguistic Expression	Numerical Value	Fuzzy Equivalent
Effectless	0	(1, 1, 1)
Equally Effect	1	(0.33, 0.5, 1)
Negligible Effect	2	(0.25, 0.33, 0.5)
Very Low Effect	3	(0.20, 0.25, 0.33)
Low Effect	4	(0.17, 0.20, 0.25)
Medium Effect	5	(0.14, 0.17, 0.20)
High Effect	6	(0.13, 0.14, 0.17)
Very High Effect	7	(0.11, 0.13, 0.14)
Impressive effect	8	(0.10, 0.11, 0.13)

Now we return to description of the fuzzy DEMATEL technique. The steps to implement this method are as follows:

Step 1. Determining criteria (main and secondary): Determining the criteria in this research is the responsibility of the output strategies of the SWOT technique.

Step 2. Determination of linguistic expressions and their fuzzy-triangular equivalent: DEMATEL needs a tool that can identify ambiguous linguistic and mental expressions to form the matrix of pairwise comparisons, because the opinions of experts in the Delphi questionnaire are qualitative. Table 1 is used for this purpose.

Step 3. Pairwise comparisons of criteria are made according to expert opinion that in these matrices, $\tilde{\mathbf{x}}_{\mathbf{ij}} = (\mathbf{l}_{\mathbf{ij}}, \mathbf{m}_{\mathbf{ij}}, \mathbf{u}_{\mathbf{ij}})$ are triangular fuzzy numbers and $\tilde{\mathbf{x}}_{\mathbf{ii}}$; $(\mathbf{i} = \mathbf{1}, \mathbf{2}, \mathbf{3}, \dots, \mathbf{n})$ to the form of fuzzy number $(0,0,0)$ is considered.

Step 4. In order to consider the opinions of all experts, their average is calculated according to Equation (2). In Equation (2), p is the number of experts and $\tilde{\mathbf{x}}^{\mathbf{1}}, \tilde{\mathbf{x}}^{\mathbf{2}}, \dots, \tilde{\mathbf{x}}^{\mathbf{p}}$ are the pairwise comparison matrix of expert one, expert two to expert p, respectively, and $\tilde{\mathbf{z}}$ is a triangular fuzzy number in the form of $\tilde{\mathbf{z}}_{\mathbf{ij}} = (\mathbf{l}'_{\mathbf{ij}}, \mathbf{m}'_{\mathbf{ij}}, \mathbf{u}'_{\mathbf{ij}})$.

$$\tilde{\mathbf{z}} = \frac{\tilde{\mathbf{x}}^{\mathbf{1}} \oplus \tilde{\mathbf{x}}^{\mathbf{2}} \oplus \tilde{\mathbf{x}}^{\mathbf{3}} \oplus \dots \oplus \mathbf{x}^{\mathbf{p}}}{\mathbf{p}} \qquad (2)$$

Step 5. The normalization of the matrix obtained from the average opinion of experts is calculated according to Equation (3). where r is determined from Equation (4).

$$\tilde{\mathbf{H}}_{\mathbf{ij}} = \frac{\tilde{\mathbf{z}}_{\mathbf{ij}}}{\mathbf{r}} = \left(\frac{\mathbf{l}'_{\mathbf{ij}}}{\mathbf{r}}, \frac{\mathbf{m}'_{\mathbf{ij}}}{\mathbf{r}}, \frac{\mathbf{u}'_{\mathbf{ij}}}{\mathbf{r}}\right) = \left(\mathbf{l}''_{\mathbf{ij}}, \mathbf{m}''_{\mathbf{ij}}, \mathbf{u}''_{\mathbf{ij}}\right) \qquad (3)$$

$$\mathbf{r} = \mathbf{max}_{\mathbf{1 \le i \le n}}\left(\textstyle\sum_{\mathbf{j=1}}^{\mathbf{n}} \mathbf{u}_{\mathbf{ij}}\right) \qquad (4)$$

Step 6. After calculating the above matrices, the fuzzy total relations matrix is obtained according to Equation (5). Where each element of total matrix is a fuzzy number in the form of $\tilde{\mathbf{t}}_{\mathbf{ij}} = (\mathbf{l}^{\mathbf{t}}_{\mathbf{ij}}, \mathbf{m}^{\mathbf{t}}_{\mathbf{ij}}, \mathbf{u}^{\mathbf{t}}_{\mathbf{ij}})$ and is calculated through Equations (6) to (8). In Equations (6) to (8), $\mathbf{I}$ is the unit matrix, and $(\mathbf{H}_{\mathbf{l}}, \mathbf{H}_{\mathbf{m}}, \mathbf{H}_{\mathbf{u}})$ are $n \times n$ matrices, whose elements are respectively the lower number, the middle number, and the upper number of the $\mathbf{H}$ matrix TFNs.

$$\mathbf{T} = \lim_{\mathbf{k} \to +\infty}\left(\tilde{\mathbf{H}}^{\mathbf{1}} \oplus \tilde{\mathbf{H}}^{\mathbf{2}} \oplus \dots \oplus \tilde{\mathbf{H}}^{\mathbf{k}}\right) \qquad (5)$$

$$\left[\mathbf{l}^{\mathbf{t}}_{\mathbf{ij}}\right] = \mathbf{H}_{\mathbf{l}} \times (\mathbf{I} - \mathbf{H}_{\mathbf{l}})^{-\mathbf{1}} \qquad (6)$$

$$\left[\mathbf{m}^{\mathbf{t}}_{\mathbf{ij}}\right] = \mathbf{H}_{\mathbf{m}} \times (\mathbf{I} - \mathbf{H}_{\mathbf{m}})^{-\mathbf{1}} \qquad (7)$$

$$\left[\mathbf{u}^{\mathbf{t}}_{\mathbf{ij}}\right] = \mathbf{H}_{\mathbf{u}} \times (\mathbf{I} - \mathbf{H}_{\mathbf{u}})^{-\mathbf{1}} \qquad (8)$$

Step 7. In this step, the goal is to obtain the sum of the rows and columns of the $\tilde{\mathbf{T}}$ matrix. This is done through Equations (9) and (10). where $\tilde{\mathbf{D}}$ and $\tilde{\mathbf{R}}$ are $n \times 1$ and $1 \times n$ matrices, respectively. In addition, the importance of indicators $\tilde{\mathbf{D}}_{\mathbf{i}} + \tilde{\mathbf{R}}_{\mathbf{i}}$ and the relationship between criteria $\tilde{\mathbf{D}}_{\mathbf{i}} - \tilde{\mathbf{R}}_{\mathbf{i}}$ are determined. If $\tilde{\mathbf{D}}_{\mathbf{i}} - \tilde{\mathbf{R}}_{\mathbf{i}} > \mathbf{0}$, the relevant criterion is effective, and if $\tilde{\mathbf{D}}_{\mathbf{i}} - \tilde{\mathbf{R}}_{\mathbf{i}} < \mathbf{0}$, the relevant criterion accepts the effect.

$$\tilde{\mathbf{D}} = (\tilde{\mathbf{D}}_{\mathbf{i}})_{\mathbf{n \times 1}} = \left[\sum_{\mathbf{j=1}}^{\mathbf{n}} \tilde{\mathbf{T}}_{\mathbf{ij}}\right]_{\mathbf{n \times 1}} \qquad (9)$$

$$\tilde{\mathbf{R}} = (\tilde{\mathbf{R}}_{\mathbf{i}})_{\mathbf{1 \times n}} = \left[\sum_{\mathbf{i=1}}^{\mathbf{n}} \tilde{\mathbf{T}}_{\mathbf{ij}}\right]_{\mathbf{1 \times n}} \qquad (10)$$

Step 8. In this step, we defuzzify the fuzzy numbers of $\tilde{\mathbf{D}}_{\mathbf{i}} + \tilde{\mathbf{R}}_{\mathbf{i}}$ and $\tilde{\mathbf{D}}_{\mathbf{i}} - \tilde{\mathbf{R}}_{\mathbf{i}}$ that were obtained from the previous step. This is done by Equation (11). B is defuzzed number of triangular fuzzy number of $\tilde{\mathbf{A}} = (\mathbf{a}_{\mathbf{1}}, \mathbf{a}_{\mathbf{2}}, \mathbf{a}_{\mathbf{3}})$. Finally, based on the defuzzed numbers, the importance-impact table of the criteria is compiled.

$$\mathbf{B} = \frac{(\mathbf{a}_{\mathbf{1}} + \mathbf{a}_{\mathbf{3}} + \mathbf{2} \times \mathbf{a}_{\mathbf{2}})}{\mathbf{4}} \qquad (11)$$

3.4. Analytic network process

ANP is one of the MADM methods, which is approximately similar to the AHP method. In the AHP method, dependencies should be linear, from top to bottom and vice versa. If the dependence is two-way, that is, the weight of the criteria is dependent on the weight of the alternatives and the weight of the alternatives is also dependent on the weight of the criteria, the problem is outside of the hierarchical state, and forms a network or nonlinear system with feedback. In such a case, network theory should be used to calculate the weight of elements. The ANP process consists of 4 steps as follows (Görener, 2012):

Step 1. Building a model and transforming the problem into a network structure: In this step, the topic or problem should be clearly transformed into a logical system, like a network. This network structure can be obtained through brainstorming or any other appropriate method, such as the Delphi or nominal group method. In this step, the desired problem becomes a network structure in which the nodes are considered as clusters. The elements in a cluster may be related to one or all the elements of other clusters, be influenced by them, or have an effect on them. These relationships (external dependency) are shown with arrows. It is also possible that the elements within a cluster have mutual relationships among themselves (internal dependency) and such relationships are shown by the bow connected to that cluster (see Figure 4).

Step 2. Forming the matrix of pairwise comparisons and determining the priority vectors: Similar to the pairwise comparisons performed in the AHP method, the decision elements in each of the clusters are divided into two according to their importance in relation to the control criteria. The clusters themselves are also compared two by two based on their role and impact in achieving the goal. Decision makers have to make decisions about binary comparison of elements or the clusters themselves. In addition, interdependencies between the elements of a cluster should also be compared two by two. The effect of each element on the other elements can be presented through a special vector. The relative importance of the elements is measured based on the 9-point scale of Saaty (1996). In this step, the internal importance vector is calculated, which indicates the relative importance (importance coefficient) of elements or clusters, which is obtained through the Equation (12). where A is the pairwise

Step 3. comparison matrix of criteria, W is the eigenvector (importance coefficient) and λ_{Max} is the largest numerical eigenvalue.

$$\mathrm{AW} = \lambda_{max}\mathrm{w} \qquad (12)$$

Step 4. Forming the super-matrix and converting it to the limit super-matrix: To obtain overall preferences in a system with mutual effects, the internal preference vectors (i.e., the calculated w vectors) are entered in the appropriate columns of a matrix. As a result, a super-matrix (actually a partitioned matrix) is obtained, where each part of this matrix shows the relationship between two clusters in a system. The super-matrix of displayed network (see Figure 4) is calculated by Equation (13):

$$\mathrm{W}_n = \begin{bmatrix} 0 & 0 & \mathrm{W}_{13} \\ w_{21} & \mathrm{W}_{22} & \mathrm{W}_{23} \\ 0 & \mathrm{W}_{32} & \mathrm{I} \end{bmatrix} \qquad (13)$$

This type of super-matrix is called the primary super-matrix. By replacing the vector of internal priorities (importance coefficients) of elements and clusters in the initial super-matrix, the non-weighted super-matrix is obtained. Then, the weighted super-matrix is calculated by multiplying the values of the non-weighted super-matrix in the cluster matrix. Finally, through the normalization of the weighted super-matrix, the super-matrix in column-wise is transformed into a random state.

In this step, the limit super-matrix is obtained by exponentiating all elements of the balanced super-matrix until divergence is achieved (through iteration). Or in other words, all the elements of the super-matrix become the same, which can be calculated according to Equation (14):

$$\lim_{n\to\infty} \mathrm{W}^{n+1} \qquad (14)$$

Step 5. If the super-matrix formed in the third step considers the entire network (that is, the alternatives are also included in the full-matrix), the overall priority of the options can be obtained from the column related to the alternatives in the normalized limit super-matrix. If the super-matrix includes only a part of the network (which are interdependent) and the alternatives are not considered in the super-matrix, it is necessary to make further calculations to obtain the overall priority of the alternatives. Finally, the alternative that has the highest overall priority is selected as the best alternative to the problem.

It is important to mention that in this research, ANP was used only to calculate the weights and obtain the known input and output values. Therefore, the ranking of alternatives has been done through the Russell-DEA model, which is explained in the next part.

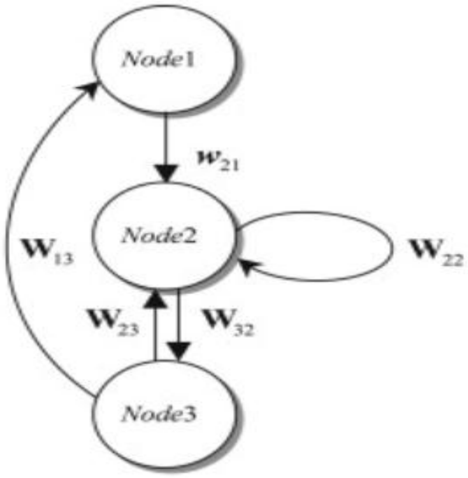

Fig. 4. An example of a network structure

3.5. Russell model in DEA

DEA is a method for calculating the relative efficiency of DMUs, such as banks, hospitals, etc., where each of these units receives several inputs and produces several outputs. The key feature of this method is that DMUs are homogeneous and consume inputs of the same type to produce outputs of the same type. This is the same feature that makes the units comparable. DEA is one of the most powerful non-parametric methods of performance evaluation that uses mathematical programming. DEA models can be classified into radial and non-radial categories. CCR and BCC models are the most well-known radial DEA models, which are shown in type of input-oriented (multiple form) in Equations (15) and (16), respectively (Charnes et al., 1978; Banker et al., 1984).

$$\begin{aligned}
&\text{Min } \theta_0\\
&S.to:\\
&\sum_{j=1}^{n} \lambda_j x_{ij} \le \theta_o x_{io} \qquad i = 1, \dots, m\\
&\sum_{j=1}^{n} \lambda_j y_{rj} \ge y_{ro} \qquad r = 1, \dots, s\\
&\lambda_j \ge 0 \ , \ j = 1, \dots, n \quad \theta \text{ free} \qquad (15)
\end{aligned}$$

$$\begin{aligned}
&Min\ \theta_0\\
&S.to:\\
&\sum_{j=1}^{n} \lambda_j y_{rj} \ge y_{r0} \qquad r = 1, \dots, s\\
&\theta_0 x_{i0} - \sum_{j=1}^{n} \lambda_j x_{ij} \ge 0 \qquad i = 1, \dots, m\\
&\sum_{j=1}^{n} \lambda_j = 1 \qquad j = 1, \dots, n\\
&\lambda_j \ge 0 \ , \ j = 1, \dots, n \quad \theta \text{ free} \qquad (16)
\end{aligned}$$

where x_{ij} denotes the i-th input and y_{rj} the r-th output of the j-th DMU. m represents the total number of inputs, s represents the total number of outputs, and n represents the total number of units. θ is also an expression of efficiency.

Models that measure efficiency radially do not generate absolute efficiency. This means that they cannot distinguish between weak and strong efficiency. Therefore, they need to consider deficit and surplus variables in the objective function. One of the non-radial models that fully obtains the efficiency values and apparently the deficit and surplus variables are not present in its objective function (these variables appear implicitly in the objective function), is Russell's model, which is in the form of Equation (17) is written (Esmaeili, 2012):

$$\begin{aligned}
&Min \quad R = \frac{\sum_{i=1}^{m} \theta_i + \sum_{r=1}^{s} \varphi_r}{m+s}\\
&S.to:\\
&\sum_{j=1}^{n} \lambda_j x_{ij} \le \theta_i x_{i0} \qquad i = 1, \dots, m\\
&\sum_{j=1}^{n} \lambda_j y_{rj} \ge \varphi_r y_{r0} \qquad r = 1, \dots, s\\
&\theta_i \le 1 \qquad i = 1, \dots, m\\
&\varphi_r \ge 1 \qquad r = 1, \dots, s\\
&\lambda_{j \ge 0} \qquad j = 1, \dots, n \qquad (17)
\end{aligned}$$

In this research, for the ranking of dairy companies (DMUs), in order to examine the competitive advantage, Russell's model is used as the proposed research model. It should be noted that DEA-Solver commercial software was used to implement the DEA model.

4. Results and Discussion

4.1. Determination of internal factors, external factors and primary criteria

In the first step, the Delphi method was used to determine internal factors (weaknesses and strengths), external factors (threats and opportunities) and primary criteria (primary strategies). After the final screening of experts' opinions according to the results of the questionnaires, the titles of internal and external factors and primary criteria were compiled according to Table 2.

Table 2
List of all SWOT factors or strategies extracted from the questionnaires

Factors or Strategies	Notation
1. The use of modern technology in most production lines	S1
2. Existence of specialized personnel	S2
3. Financial ability for investment and advertising	S3
4. Variety of production of dairy and soya milk products and their reasonable prices	S4
5. The only producer of vegetable soya milk products in Iran and the absence of strong domestic competitors	S5

6. The length of the design process until the production of the product envelope and the small number of newly designed envelopes	W1
7. Lack of customer-oriented culture and lack of proper feedback from sales representatives	W2
8. Failure to supply the required raw materials according to the production plan	W3
9. Lack of wide distribution and sales network and easy availability of products throughout the country	W4
10. Poor industrial relations	W5
11. High demand for consumption of dairy and vegetable products	O1
12. Government support for plans to increase the consumption of dairy products	O2
13. The possibility of using financial facilities for investment	O3
14. The existence of potential markets in Asian and African countries for export	O4
15. Increasing the willingness of producers to export in order to increase the dollar rate (more profitable than domestic sales)	O5
16. Low purchasing power of people	T1
17. The possibility of low prices of other competitors' products	T2
18. The possibility of higher distribution fees and profit for the shopkeeper of competitors' products	T3
19. The possibility of increasing the market share of competitors	T4
20. Growing costs of supplying raw materials and exchange rate fluctuations	T5
21. Increasing the variety of dairy and non-dairy products and improving product packaging	SO1
22. Innovation and aligning with the market and identifying potential markets for exporting products	SO2
23. Big contracts for the distribution of milk and soya milk with governmental and non-governmental organizations and institutions	SO3
24. Shortening the design life cycle of new products	WO1
25. Applying the inventory control system and supplying the right raw materials	WO2
26. Focusing on products and penetrating the market and gaining more market share	WO3
27. Investment to establish animal husbandry and supply raw milk	ST1
28. Considering the rate of distribution fee and profit of shopkeepers based on their performance	ST2
29. Holding temporary and permanent internal and external exhibitions and introducing new products and advertisements	ST3
30. Cost management in the sales market of all products	WT1
31. Following up on customer complaints and giving importance to customer feedback	WT2
32. Increasing the number of sales agents throughout the country	WT3

4.2. Selection of input criteria for DEA via Fuzzy DEMATEL

In order to determine the input and output variables for the DEA model of the research, the DEMATEL technique was used in the fuzzy space due to the uncertainty in the input data. For this purpose, the fuzzy spectrum of Table 1 and Fuzzy Decision commercial software were used. First, based on the judgment of experts, by preparing a pairwise comparison table according to Table 3, the importance of each of the sub-criteria and criteria in relation to each other was explained. The pairwise comparison table was considered as the initial input of Fuzzy Decision software. Table 4 shows the results of fuzzy DEMATEL in which the importance of the criteria $(\widetilde{D}_i + \widetilde{R}_i)$ and the relationship between the criteria $(\widetilde{D}_i - \widetilde{R}_i)$ are specified. If $\widetilde{D}_i - \widetilde{R}_i > 0$, the relevant criterion is effective, and if $\widetilde{D}_i - \widetilde{R}_i < 0$, the relevant criterion takes effect. In the next step, by defuzzify of the results of Table 4 according to the relation $B = \frac{(a_1 + a_3 + 2 \times a_2)}{4}$, the definitive results of Table 5 are obtained. In the following, the diagram of the importance and degree of impact for the main criteria of the research is drawn according to Figure 5. According to Figure 5, six criteria (SO1, SO2, ST2, ST3, WO1, WT2) have the most relationship with other criteria and are more important. Therefore, the six mentioned criteria are candidates as inputs and outputs for the DEA model. According to the title and essence of these selected criteria, SO2, ST3, and WO1 are determined as inputs and SO1, ST2, and WT2 as outputs of the system. It should be noted, the sub-criteria were not applicable in the current research and were considered in the DEMATEL method to make communication as accurate as possible. In fact, the sub-criteria help us to correctly achieve the main criteria, which are the input and output components of the DEA model. Dairy brands were also considered as alternatives in ANP and DMUs in DEA.

Table 3
Pairwise comparisons of sub-criteria and criteria

	S1			…	W1			…	O1			…	T5			…	SO1			…	WO1			…	ST1			…	WT3		
S1	0	0	0		0	0	0		1	2	3		0	0	0		0.25	0.33	0.50		0	0	0		0.14	0.17	0.20		0	0	0
S2	0.25	0.33	0.50		0	0	0		5	6	7		1	2	3		0.13	0.14	0.17		0	0	0		0	0	0		0	0	0
S3	0.14	0.17	0.20		0	0	0		1	2	3		5	6	7		0.25	0.33	0.50		0	0	0		0.14	0.17	0.20		0	0	0
S4	0	0	0		0	0	0		0	0	0		3	4	5		0	0	0		0	0	0		0	0	0		0	0	0
S5	0.20	0.25	0.33		0	0	0		3	4	5		0	0	0		0.20	0.25	0.33		0	0	0		0	0	0		0	0	0
W1	0	0	0		0	0	0		2	3	4		0	0	0		0	0	0		0.11	0.13	0.14		0	0	0		0	0	0
W2	0	0	0		0.13	0.14	0.17		1	2	3		3	4	5		0	0	0		0.14	0.17	0.20		0	0	0		0	0	0
W3	0	0	0		0.20	0.25	0.33		3	4	5		6	7	8		0	0	0		0.20	0.25	0.33		0	0	0		0	0	0
W4	0	0	0		0	0	0		0	0	0		1	2	3		0	0	0		0	0	0		0	0	0		0.11	0.13	0.14
W5	0	0	0		0.33	0.50	1.00		5	6	7		1	2	3		0	0	0		0.33	0.50	1.00		0	0	0		0.13	0.14	0.17
O1	0.33	0.50	1.00		0.25	0.33	0.50		0	0	0		0	0	0		0.13	0.14	0.17		0.33	0.50	1.00		0	0	0		0	0	0
O2	0.14	0.17	0.20		0	0	0		0.25	0.33	0.50		0	0	0		0.33	0.50	1.00		0	0	0		0	0	0		0	0	0
O3	0.25	0.33	0.50		0	0	0		0.14	0.17	0.20		0	0	0		0.11	0.13	0.14		0.14	0.17	0.20		0	0	0		0	0	0
O4	0.20	0.25	0.33		0.20	0.25	0.33		0.17	0.20	0.25		0	0	0		0.17	0.20	0.25		0.20	0.25	0.33		0	0	0		0	0	0
O5	0.20	0.25	0.33		0.14	0.17	0.20		0.20	0.25	0.33		0	0	0		0.17	0.20	0.25		0.13	0.14	0.17		0	0	0		0	0	0
T1	0	0	0	…	0	0	0	…	0	0	0	…	3	4	5	…	0	0	0	…	0	0	0	…	0	0	0	…	0	0	0
T2	0	0	0		0	0	0		0	0	0		5	6	7		0	0	0		0	0	0		0.11	0.13	0.14		0.20	0.25	0.33
T3	0	0	0		0	0	0		0	0	0		3	4	5		0	0	0		0	0	0		0	0	0		0	0	0
T4	0	0	0		0	0	0		0	0	0		2	3	4		0	0	0		0	0	0		0	0	0		0.13	0.14	0.17
T5	0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0.11	0.13	0.14		0	0	0
SO1	2	3	4		0	0	0		6	7	8		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0
SO2	3	4	5		0	0	0		0	0	0		0	0	0		0.20	0.25	0.33		0	0	0		0	0	0		0	0	0
SO3	5	6	7		0	0	0		0	0	0		0	0	0		0.33	0.50	1.00		0	0	0		0	0	0		0	0	0
WO1	0	0	0		7	8	9		1	2	3		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0
WO2	0	0	0		0	0	0		2	3	4		0	0	0		0	0	0		0.20	0.25	0.33		0	0	0		0	0	0
WO3	0	0	0		0	0	0		6	7	8		0	0	0		0	0	0		0.33	0.50	1.00		0	0	0		0	0	0
ST1	5	6	7		0	0	0		0	0	0		7	8	9		0	0	0		0	0	0		0	0	0		0	0	0
ST2	0	0	0		0	0	0		0	0	0		4	5	6		0	0	0		0	0	0		0.20	0.25	0.33		0	0	0
ST3	0	0	0		0	0	0		0	0	0		6	7	8		0	0	0		0	0	0		0.33	0.50	1.00		0	0	0
WT1	0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		3	4	5
WT2	0	0	0		6	7	8		0	0	0		7	8	9		0	0	0		0	0	0		0	0	0		1	2	3
WT3	0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0		0	0	0

Table 4
Fuzzy DEMATEL results ($\widetilde{D}_i + \widetilde{R}_i$: The importance of the criteria. $\widetilde{D}_i - \widetilde{R}_i$: The relationship between the criteria)

Criteria/Sub-Criteria	$\widetilde{D}_i + \widetilde{R}_i$	$\widetilde{D}_i - \widetilde{R}_i$
S1	(0.939, 0.620, 1.813)	(-0.926, -1.565, -1.380)
S2	(1.358, 1.099, 2.188)	(0.299, 0.518, 1.053)
S3	(0.784, 1.051, 1.738)	(-0.668, -1.234, -1.992)
S4	(0.943, 0.604, 1.689)	(-0.300, -0.545, -0.891)
S5	(0.033, 1.045, 1.845)	(0.016, 0.029, 0.061)
W1	(0.190, 0.953, 0.984)	(0.139, 0.972, 0.701)
W2	(0.366, 0.775, 1.144)	(0.054, 0.096, 0.135)
W3	(0.398, 0.740, 1.277)	(0.026, 0.482, 0.390)
W4	(0.401, 0.742, 1.446)	(-0.162, -0.202, -0.370)
W5	(0.170, 0.826, 0.895)	(-0.134, -0.210, -0.478)
O1	(0.746, 0.852, 1.711)	(0.141, 0.405, 0.888)
O2	(0.980, 1.060, 2.027)	(-0.686, -1.003, -1.349)
O3	(0.715, 0.715, 1.504)	(0.625, 0.738, 0.703)
O4	(0.185, 0.812, 1.216)	(0.152, 0.189, 0.494)
O5	(0.392, 0.692, 1.724)	(0.166, 0.450, 0.434)
T1	(0.608, 0.535, 1.086)	(0.389, 0.363, 0.669)
T2	(0.720, 1.453, 3.106)	(-0.544, -0.867, -1.973)
T3	(0.856, 0.889, 1.226)	(0.044, 0.351, 0.269)
T4	(0.117, 1.196, 1.339)	(-0.033, -0.353, -0.506)
T5	(0.926, 0.888, 1.222)	(0.079, 0.817, 0.991)
SO1	(0.479, 1.403, 1.650)	(1.006, 0.598, 2.090)
SO2	(0.322, 0.645, 0.925)	(0.396, 0.263, 0.761)
SO3	(0.907, 0.928, 1.158)	(-0.384, -0.343, -0.842)
WO1	(0.309, 0.939, 1.641)	(0.551, 0.882, 0.877)
WO2	(0.121, 0.859, 1.449)	(0.195, 0.405, 0.416)
WO3	(0.409, 0.620, 0.835)	(-0.020, -0.033, -0.047)
ST1	(0.905, 1.808, 1.884)	(-0.712, -0.934, -1.260)
ST2	(0.004, 0.969, 1.723)	(0.064, 0.546, 0.981)
ST3	(0.104, 1.468, 1.400)	(0.844, 0.686, 1.384)
WT1	(0.170, 0.503, 1.173)	(0.090, 0.295, 0.415)
WT2	(0.658, 0.872, 0.806)	(0.525, 0.789, 0.774)
WT3	(0.193, 0.995, 1.310)	(-0.050, -0.090, -0.103)

Table 5
DEMATEL definitive results ($\widetilde{D}_i + \widetilde{R}_i$: The importance of the criteria. $\widetilde{D}_i - \widetilde{R}_i$: The relationship between the criteria)

Criteria/Sub-Criteria	$(\widetilde{D}_i + \widetilde{R}_i)^{def}$	$(\widetilde{D}_i - \widetilde{R}_i)^{def}$
S1	0.998	-1.359
S2	1.436	0.597
S3	1.156	-1.282
S4	0.96	-0.57
S5	0.992	0.034
W1	0.77	0.696
W2	0.765	0.095
W3	0.789	0.345
W4	0.833	-0.234
W5	0.679	-0.258
O1	1.04	0.46
O2	1.282	-1.01
O3	0.912	0.701
O4	0.756	0.256
O5	0.875	0.375
T1	0.691	0.446
T2	1.683	-1.063
T3	0.965	0.254
T4	0.962	-0.311
T5	0.981	0.676
SO1	1.234	1.073
SO2	0.634	0.421
SO3	0.98	-0.478
WO1	0.957	0.798
WO2	0.822	0.355
WO3	0.621	-0.033
ST1	1.601	-0.96
ST2	0.916	0.534
ST3	1.11	0.9
WT1	0.587	0.274
WT2	0.802	0.719
WT3	0.873	-0.083

	D+R	D-R
SO1	1.234	1.073
SO2	0.634	0.421
SO3	0.98	-0.478
ST1	1.601	-0.96
ST2	0.916	0.534
ST3	1.11	0.9
WO1	0.957	0.798
WO2	0.822	0.355
WO3	0.621	-0.033
WT1	0.587	0.274
WT2	0.802	0.719
WT3	0.873	-0.083

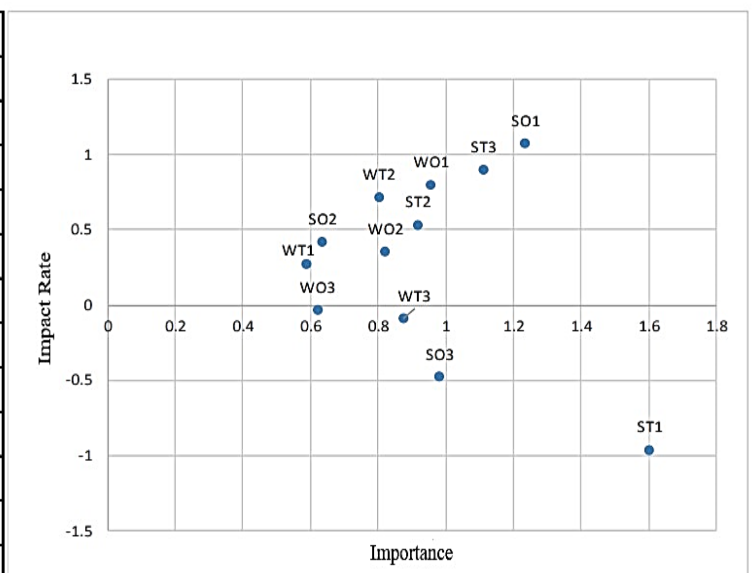

Fig. 5. Chart of importance-impact of criteria

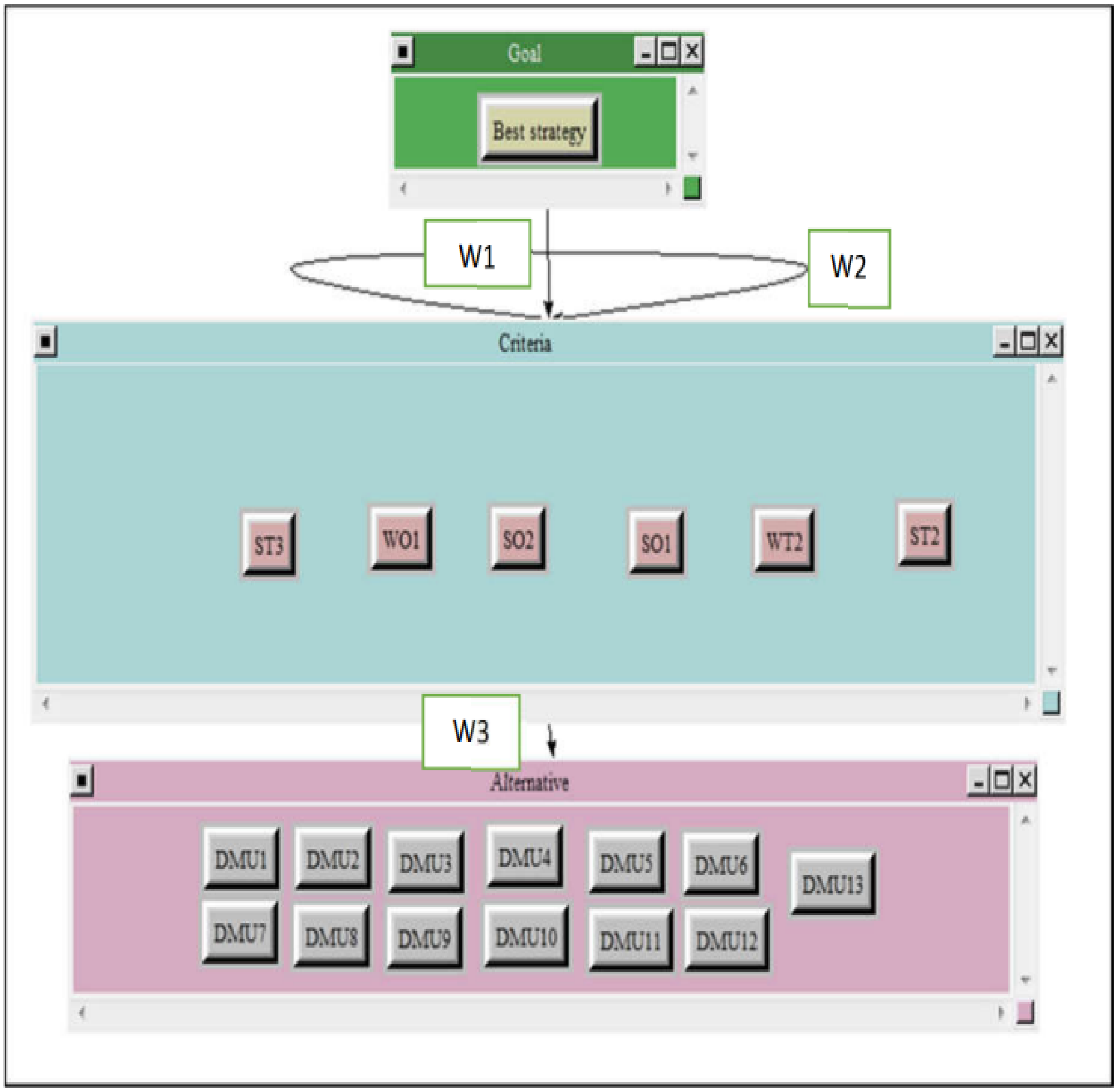

Fig. 6. Hierarchical network diagram of research

4.3. Determination of initial values by ANP and Wasserman relation

At this point, each of the input and output variables at the level of criteria, as well as each of the dairy industry brands, was considered as a DMU (a decision-making unit) at the level of ANP alternatives (Figure 6). Then, using the opinions of 5 experts and with the help of Super Decision commercial software, pairwise comparisons of levels and 5 balanced super-matrices were obtained for each expert. For example, the weighted super matrix related to expert 1 can be seen in Table 6. In the following, Wasserman's relation (Equation (18)) is used to aggregate the effect of all weights of super-matrices and reach the matrix of final values. Where, R_{ik} represents elements related to W_2 and y_{kj} are also the elements related to W_2. Then, the combination of weights of each super-matrix was converted into 5 normalized matrices. Further, by averaging each of the corresponding elements of each normalized matrix, the final (normalized) matrix was obtained according to Table 7.

$$R_{ij}^{norm} = \frac{\sum_{k=1}^{N} R_{ik} Y_{kj}}{\sum_{j=1}^{N}\sum_{k=1}^{N} R_{ik} Y_{kj}} \quad i = 1,2, \dots k \quad j = 1,2, \dots, N \quad (18)$$

Table 6
The weighted super matrix related to expert 1

		Goal		Criteria							Alternative												
Goal	**BEST STG**			**SO1**	**SO2**	**ST2**	**ST3**	**WO1**	**WT2**		**Manga**	**Choopan**	**Ramak**	**Alis**	**Kalber**	**Mihan**	**Pak**	**Koohpayeh**	**Rouzaneh**	**Pegah**	**Damdaran**	**Kalleh**	**Pakban**
Criteria	**SO1**	0.246		0.000	0.541	0.077	0.131	0.198	0.054		0.246	0.058	0.016	0.020	0.026	0.137	0.063	0.072	0.174	0.031	0.042	0.101	0.013
	SO2	0.168		0.510	0.000	0.055	0.099	0.196	0.140		0.150	0.040	0.017	0.021	0.025	0.212	0.071	0.073	0.120	0.033	0.047	0.176	0.013
	ST2	0.056		0.229	0.174	0.000	0.064	0.433	0.101		0.202	0.017	0.021	0.045	0.028	0.247	0.083	0.012	0.134	0.101	0.014	0.060	0.037
	ST3	0.137		0.429	0.277	0.051	0.000	0.179	0.064		0.173	0.051	0.031	0.086	0.015	0.242	0.069	0.012	0.128	0.409	0.024	0.108	0.018
	WO1	0.301		0.286	0.410	0.078	0.170	0.000	0.056		0.246	0.082	0.014	0.023	0.036	0.178	0.051	0.019	0.136	0.031	0.065	0.106	0.012
	WT2	0.091		0.314	0.287	0.096	0.180	0.122	0.000		0.185	0.039	0.015	0.012	0.085	0.235	0.064	0.018	0.139	0.048	0.029	0.108	0.022
Alternative	**Damdaran**	0.000		0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Ramak	0.000		0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Rouzaneh	0.000		0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Alis	0.000		0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Manga	0.000		0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Mihan	0.000		0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Pak	0.000		0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Pakban	0.000		0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Pegah	0.000		0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Choopan	0.000		0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Kalber	0.000		0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Kalleh	0.000		0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Koohpayeh	0.000		0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 7
The final normalized matrix

	Manga	Choopan	Ramak	Alis	Kalber	Mihan	Pak	Koohpayeh	Rouzaneh	Pegah	Damdaran	Kalleh	Pakban
SO2	0.607	0.159	0.051	0.079	0.100	0.473	0.174	0.123	0.416	0.129	0.116	0.278	0.046
ST3	0.444	0.117	0.037	0.049	0.070	0.369	0.139	0.121	0.311	0.080	0.099	0.256	0.033
WO1	0.935	0.233	0.102	0.171	0.145	0.999	0.354	0.278	0.696	0.268	0.198	0.660	0.086
SO1	0.720	0.202	0.079	0.131	0.126	0.861	0.277	0.190	0.513	0.203	0.186	0.574	0.068
ST2	0.232	0.069	0.019	0.028	0.040	0.198	0.066	0.045	0.152	0.042	0.055	0.128	0.016
WT2	0.284	0.075	0.030	0.052	0.039	0.269	0.098	0.073	0.203	0.079	0.060	0.173	0.025

4.4. Measuring the efficiency of dairy brands through Russell's model

At this stage, Russell's model with 13 decision makers (DMUs) was used to determine the efficiency and ranking of dairy brands. In this model, SWOT strategies were considered as inputs and outputs of the model. Finally, 13 Russell models (by the number of DMUs) where each model included three inputs and three outputs were solved using GAMS software and efficiency values were obtained. For example, Russell's model for DMU_1 is written as Equation (19). The evaluation and ranking of dairy brands according to the results of the Russell model can be seen in Table 8. The results of Table 8 show that 46% of dairy brands (i.e., Choopan, Alis, Mihan, Damdaran, and Kalleh) are efficient from the point of view of competitive advantage. Manga company, which was the dairy brand studied by the research, ranked sixth. Therefore, this issue shows that this brand needs more effort in order to improve the level of the company among the existing brands. According to the inputs and outputs of Russell's model (SWOT strategies), the Manga brand can pay special attention to the following in order to maintain its survival and stability in the current market competition:

- Creating innovation and identifying potential markets for exporting products.
- Increasing the variety of products.
- Improving product packaging compared to other competitors.
- Considering higher profit and commission rates than competitors for product distributors.
- Listening to the voices of customers and following up to improve products.

$$\min R_o=\frac{\theta_1+\theta_2+\theta_3+\varphi_1+\varphi_2+\varphi_3}{6}$$

$$s.t.$$

$$\lambda_1\, x_{11} + \lambda_2\, x_{12} + \lambda_3\, x_{13} + \ldots + \lambda_{13}\, x_{1\,13} \le \theta_1 x_{11}$$
$$\lambda_1\, x_{21} + \lambda_2\, x_{22} + \lambda_3\, x_{23} + \ldots + \lambda_{13}\, x_{2\,13} \le \theta_2 x_{21}$$
$$i = 1, \ldots, 3$$
$$\lambda_1\, x_{31} + \lambda_2\, x_{32} + \lambda_3\, x_{33} + \ldots + \lambda_{13}\, x_{3\,13} \le \theta_3 x_{31}$$
$$\lambda_1\, y_{11} + \lambda_2\, y_{12} + \lambda_3\, y_{13} + \ldots + \lambda_{13}\, y_{1\,13} \ge \varphi_1 y_{11}$$
$$\lambda_1\, y_{21} + \lambda_2\, y_{22} + \lambda_3\, y_{23} + \ldots + \lambda_{13}\, y_{2\,13} \ge \varphi_2 y_{21}$$
$$r = 1, \ldots, 3$$
$$\lambda_1\, y_{31} + \lambda_2\, y_{32} + \lambda_3\, y_{33} + \ldots + \lambda_{13}\, y_{3\,13} \ge \varphi_3 y_{31}$$
$$0 \le \theta_i \le 1, \quad i = 1, \ldots, 3$$
$$\varphi_r \ge 1, \quad r = 1, \ldots, 3$$
$$\lambda_j \ge 0, \quad j = 1, \ldots, 13 \qquad (19)$$

Table 8
The results of evaluation and ranking of dairy brands by Russell model

DMU	Dairy Brand	Efficiency Score	Rank
1	Manga	0.88	6
2	Choopan	1.00	1
3	Ramak	0.94	3
4	Alis	1.00	1
5	Kalber	0.91	4
6	Mihan	1.00	1
7	Pak	0.91	4
8	Koohpayeh	0.82	8
9	Rouzaneh	0.86	7
10	Pegah	0.95	2
11	Damdaran	1.00	1
12	Kalleh	1.00	1
13	Pakban	0.90	5

5. Conclusion

Today, many organizations are taking steps to maintain and survive in the global trade arena by using new methods and systems to improve organizational processes and grow and upgrade themselves. In this research, the SWOT technique, which is one of the famous strategic marketing techniques, was used in order to compare the case study (i.e., Manga brand) with the active brands of Iran in the dairy industry from the point of view of competitive advantage. For this purpose, after identifying the gap between the previous research, using a combined method including SWOT, Fuzzy-DEMATEL, ANP, and DEA, the evaluation and ranking of different dairy brands (DMUs) was done by determining efficiency. The results showed that the combined approach proposed in the research can cover all the various factors in the theories of competitive advantage. The reason for this was the use of the SWOT technique as a basis for producing the criteria for the future stages of the research. SWOT analysis is considered a very important component in the strategic formation process. The analysis of external opportunities and threats is basically used to evaluate whether the organization can use the opportunities and minimize the threats. SWOT analysis can help organizations and even countries to measure and evaluate their overall situation compared to other competitors. Although the focus of the research was on the Manga dairy brand, the results could be useful for other brands as well. For example, inefficient dairy brands can plan to increase their performance by considering the references or the efficient units determined by the DEA model. This planning can be consistent with the basic approach of DEA, which is to reduce costs or increase profits. In fact, the result of increased efficiency leads to the growth of dairy units and their competitive advantages over other brands. In addition, the results of this research can be extended to other industries and serve as a comprehensive approach to facilitate policymakers and executives.

Among the limitations of the research, the following can be mentioned:

- Unavailability of all organizational experts to form a complete statistical community.
- Unavailability or confidentiality of some information and data. The DEA method is based on the use of correct data and numerical values to determine the inputs and outputs of the model. The higher the accuracy and precision of the statistics and information collected and the shorter the time interval between data collection and conducting research experiments, the more reliable the results obtained from the model.
- Differences in opinions and judgments of experts regarding common issues.
- Inconsistency of some data in the use of ANP technique.

Researchers are encouraged to use the following ideas for future studies:

- Ranking of efficient DMUs obtained using AHP or ANP techniques.
- Using the Cross-Efficiency ranking model.
- Using other DEA models such as multi-component, network, two-stage and fuzzy models to determine the efficiency of dairy brands.
- Using other MADM techniques as a suitable alternative to ANP, such as VIKOR, PROMETHEE ORESTE, etc.

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