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Organizational strategy development in distribution channel management using fuzzy AHP and hierarchical fuzzy TOPSIS

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ABSTRACT

Distribution channel management not only consists of choosing distribution channels. In fact, probably the most difficult phase of the distribution management starts after this choice. Determining an appropriate organization strategy for distribution channel management is like a problem of concern to marketing practitioners and academics as well in this phase. In this study, the organization strategy of distribution channel management is developed using fuzzy analytic hierarchy process (FAHP) and hierarchical fuzzy TOPSIS (HFTOPSIS) for an edible-vegetable oils manufacturer firm operating in Turkey. The company distributes its products all over the country. Due to the complex structure of the distribution network, the company wants to decide the organization strategy to manage the distribution channels. In this paper, the methods of FAHP and HFTOPSIS for evaluating and selecting among the five organization strategy models for distribution channel management of vegetable oil manufacturer have been presented. The proposed models include determinants of distribution channel management for edible-vegetable oil industry; (i) customer profile, (ii) distributor reliability, (iii) the position of competitors in market, and (iv) managerial and financial perspective. Using FAHP and HFTOPSIS, hybrid based strategy (KBS), which has the greatest desirability index value after the evaluation among the five alternatives is found as the best choice. Thus, the case of the vegetable oil manufacturer company provides the researchers and practitioners to understand in a better way the importance of developing organization strategy in channel management from a practical point of view.

1. Introduction

The implementation phase of distribution channel management takes place after the design process (Tek, 1997). In other words, the primary firm or manufacturer first chooses her effective distribution channel design and then determines distributors specifically motives and evaluates them in proper situation. To manage the channel there must be a special structure in the primary firm. Here, while firms establish these structures, they must choose suitable organizational structure for aim of distribution channel to compete with other competitor firms and keep their position in the market.

In the literature, one of the popular problems in the distribution channels management field is *choosing distribution channels* (Coughlan, 1985; Coughlan & Wernerfelt, 1989; Crosno, Nygaard, & Dahlstrom, 2007; Eriksson, Hohenthal, & Lindbergh, 2006; Gupta, Su, & Walter, 2004; Kiang, Raghu, & Shang, 2000; McGuire & Staelin, 1983; McNaughton, 1996; Min, 1991; Moorthy, 1986). On the other hand, in the last few years the attention of academicians and practitioners has changed into how to establish the distribution channel management structures and how to manage and control distribution channels. Webb (2002) investigates the effect of introducing the Internet channel into a complex, multichannel distribution system from the perspective of the supplier firm. Van Bruggen, Kacker, and Nieuwlaat (2005) investigate on how distributors' channel function performances affect their relationships with organizational customers and how the impact of these actions on relationship quality is influenced by the interdependence structure of the relationship. Frey and Holden (2005) investigate the channel management in e-government applications. They propose a point of view on how federal agencies may be able to manage their various channels for e-government. Gensler, Dekimpe, and Skiera (2007) apply a model to asses channel performance of a large home-shopping company. They analyze the performance of its main channels over time, and test for differences in channel performance among different product categories, as well as between different customer segments. Finally, they derive implications for managers to operate a company's multiple sales channels more effectively.

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Kahraman, Ruan, and Doğan (2003) used the FAHP approach in the selection of the best facility location alternative by taking into account quantitative and qualitative criteria. Bozdağ, Kahraman, and Ruan (2003) have used the FAHP approach in the evaluation of computer integrated manufacturing alternatives by taking into account both intangible and tangible factors. Büyüközkan, Kahraman, and Ruan (2004) employed the FAHP mehod in selecting the most appropriate software development strategy. Kahraman, Cebeci, and Ruan (2004) used the FAHP process to evaluate and to compare the catering firms in Turkey. Tolga, Demircan, and Kahraman (2005) used the methods of FAHP and fuzzy replacement analysis in the operating system selection problem. Başlıgil (2005) provided an analytical toolto select the best software providing the most customer satisfaction. Kong and Liu (2005) aimed to find out the key factors that affect success in E-commerce using Fuzzy AHP. Kahraman, Ertay, and Büyüközkan (2006) proposed an integrated framework based on fuzzy QFD and a fuzzy optimization model to determine the product technical requirements to be considered in designing a product. The coefficients of the objective function are obtained from the approaches of Fuzzy analytic network and Fuzzy analytic hierarchy process. Bozbura, Beskese, and Kahraman (2007) have applied FAHP to improve the quality of prioritization of human capital measurement indicators under the fuzziness. Büyüközkan (2009) proposed an analytic framework to provide practitioners a more effective and efficient model for prioritizing m-commerce requirements.

Büyüközkan, Feyzioğlu, and Nebol (2008) proposed a multi criteria decision making approach to effectively evaluate e-logistics-based strategic alliance partners. Önüt and Soner (2008) applied a fuzzy TOPSIS based methodology to solve the solid waste transshipment site selection problem in İstanbul, the criteria weights are calculated by using the AHP. Kahraman, Ateş, Çevik, Gülbay, and Erdoğan (2007) developed a hierarchical fuzzy TOPSIS method for evaluating and selecting among logistic information technologies. Ateş, Çevik, Kahraman, Gülbay, and Erdoğan (2006) constructed a comprehensive hierarchical evaluation model with many main and sub attributes and proposed a new algorithm for fuzzy TOPSIS that enables taking into account the hierarchy in the evaluation model. Dağdeviren, Yavuz, and Kılınç (2009) developed an evaluation model based on the AHP and TOPSIS for the selection of optimal weapon in a fuzzy environment. The AHP is used to analyze the structure of the weapon selection problem and fuzzy TOPSIS method is used to obtain final ranking. Öztürk, Ertuğrul, and Karakaşoğlu (2008) proposed FAHP and Fuzzy TOPSIS for the transportation selection problem, in order to take vague nature of the linguistic assessment into consideration. Ballı and Korukoğlu (2009) proposed a fuzzy decision approach based on FAHP and TOPSIS to select appropriate operating system for computer systems of the firms by taking subjective judgements of decision makers into consideration. Seçme, Bayrakdaoğlu, and Kahraman (2009) proposed a fuzzy multi criteria decision model to evaluate the performances of banks. The largest five commercial banks are examined and evaluated in terms of financial and nonfinancial indicators by integrating the methods of FAHP and TOPSIS.

In this study fuzzy analytic hierarchy process (FAHP) and hierarchical fuzzy TOPSIS (HFTOPSIS) methods are used to develop an organizational strategy to manage distribution channels of a vegetable oil producer operating in Turkey.

In Section 2, there is a conceptual outline for developing distribution channels management strategy. The third part includes brief information about the firm and sector of subject. In Section 4, decision structure of the firm and the models of FAHP and HFTOPSIS are presented and finally, the comparisons and results of the considered methods are given in the last section.

2. Developing organizational strategies for management of distribution channels

The success of management and distribution strategy directly depends on the success of organizational management structure of distribution channels. Organization has a big importance for management process and can be defined as effective usage of financial and human resources and factors of the firm. While establishing distribution management organization, the activities that are essential to achieve firm's goals, have to be defined well. The approaches of structuring distribution organization can be classified with an analogy of marketing organization (Armstrong & Kotler, 2005; Kotler, 2003; Mucuk, 1997; Roger, Hartley, Berkowitz, & Rudelius, 2005; Ülgen, 1993):

1. *Product based strategy*: Firms that have multiple types of products mostly use this strategy. In this approach distribution network management is structured through the product lines and for every specific product or product line a manager is assigned who is responsible for all management activities for that specific product or product line.
2. *Geographic based strategy*: The big firms that act in broad markets (all national or international markets) can establish their distribution management departments through geographic based strategy. This strategy will be effective if the consumer demands change with respect to region.
3. *Customer based strategy:* Distribution management department is structured with respect to different customer types. Organizational structure looks like as it is in product based structure but here "market managers" work instead of "product managers" For example wholesaler and retailer can differ with respect to their customers. Depending on the specialist about the subject, using detailed information, making coordination easy activities related with customers and effective customer relations are advantages of this strategy. However it also has some disadvantages there may be discriminations among customers because of the competition between departments.
4. *Function based strategy*: Grouping the similar and same type of activities, which creates organization, is called separate with respect to functions. The functional organization distribution management department is established depend on subjects as developing mediators (mechanism that finding mediators to distribution channel as defined before) analyzing the sales (measure the performance of the distribution channel members as vendors) and institutional sales.
5. *Hybrid based strategy*: Sometimes some firms can establish a strategy which is a combination of geographic, product, customer or functional organization strategies. Large number of product type may require product base strategy; while different customer types and demands may require customer-based strategy. The combination of these strategies help to satisfy the different customer demands needs and help the firms to achieve their goals.

The best distribution management organization structure depends on the types of product of the firm, characteristics and demands of the people in target market, and many other factors like these. In this study strategic determinative factors are defined from the perspective of customer profile, reliability of distributors, positions of the competitors in the market, managerial and financial structure.

3. Determinants of distribution channel management

Determinants of distribution channel management for edible-vegetable oil industry are proposed as; *customer profile*, *distributor*

reliability, *the position of competitors in market*, *managerial and financial perspective* according to the review of the related literature and the discussions with both industry practitioners and academicians. These are briefly described below.

3.1. Customer profile (MP)

The main determinant that affects the process of choosing distributing and marketing strategy is customer profile. This factor can be concluded as follow. In this market there is not a homogenous structure and customers are differentiated geography and demand structure depends on social-economical situation rather than synchronized behaviors. In vegetal oil sector this difference is protected depends on the following criterions.

(i) *Sensitivity to type of product* (ÜD): The preference on the type of vegetal oil depends on region of consumption. For example in Middle, South and West Anatolia regions mostly "sun flower oil" is consumed, where in East especially in Aegean Region "olive oil" is most popular. In black sea region "corn oil" is preferred. In Marmora region especially sunflower oil is consumed (Tosun, 2003).

(ii) *Sensitivity to type of package* (AD): Especially for corn and sunflower oil packages, generally a 5 l packages predominates others. The type of package again depends on the climate and other physical characteristics of the region. For example in Black Sea region plastic packages are preferred, while in middle Anatolia and south of it the can packages are preferred mostly. On the other hand, people who live in big cities and metropolis prefer to use small plastic packages (1 or 2 l packages). Besides the availability and ease of shopping in small amounts, another reason of these figures is the number of people per house (BYSD, 2002).

(iii) *Sensitivity to price* (FD): In cities that the socioeconomic index values are high, the brand, quality, and fame of the products is much more important than price. However, in populations which consist of crowded and poor families the price gain high importance (Dölekoğlu, 2001).

(iv) *Sensitivity to product's quality and attribute* (KD): Some have oil production plants where some of them have only bottling plants. The bottling plants purchase and fill into branded packages. Oil production plants purchased raw oil to process oil and fill them into branded packages. Bottler firms cannot control the quality of raw oil; however the firm that have oil production plant can control the oil quality and its attribute by their process and technology that they used (BYSD, 2002).

(v) *Total consuming points* (*institutional sale*) (*TN*): For institutional sale the targets are hotels, tourist organizations, dormitories, campuses, governmental organizations, catering firms, army, and municipalities.

3.2. Distributor reliability (DG)

In Turkish oil firms distributing strategy generally the leading role beyond distributors generally. Development of trust between primary firm and distributor firms has the highest priority.

(i) *The financial structure of distributors (DF)*: The primary firms prefer distributors, which have strong financial structure to have a good place in their market. In nature of commercial mentality this is related with payback of goods sold. The firms aim to have a strong place in the market with a strong financially structured partner namely their distributors. Therefore the firms want warranty document like a bank deposit (Tek, 1997).

(ii) *The commercial history of distributor (TG)*: The primary firms evaluate the distributors' qualifications on the number of years of sectoral and general experience past recorded problems in those years, or payment problems to understand the reliability of distributor before working with it. Chosen distributors will be an important to criteria for the life time and advantages for firm as earnings and discount (Kotler, 2003).

(iii) *The product portfolio of distributor (DP)*: The different products that distributors distribute and distributor's product portfolio is searched. An alternative way to estimate and understand the reliability of distributors is other firms known that trust the distributor. In other words the distributing national brands and have stableness on this way is another criterion to guess reliability of the distributors (Mucuk, 1997).

(iv) *Number of current reachable points (NS)*: Efficiency of the distributors can be defined by the number of points (retailers, etc.) that the distributor can reach. Here the important issues are distributors' sales and revenues also the ability to force retailers to sell these goods (Tek, 1997).

(v) *Number of sales man and vehicles (EA)*: Number of sales man and vehicles that a distributor own is an important criterion. Firms must find an effective distributing strategy to reach their aims with making their retailer effective in target area (Tek, 1997).

(vi) *Loyalty to due dates and payments (VU)*: While the primary firm makes its choice and contract, first step is defining the purchasing–payments activities with agreement of both sides. One of the important requirements here is to introduce independent date–price relationship and make this couple suitable for current condition of market. Second step is source of reference that can be defined as the value of risk of distributor in primary firm's portfolio. Value of risk contains the performance of payback depend on condition. This means distributor's loyalty to his paybacks and contracts is an important criterion (Kotler, 2003).

3.3. The positions of competitors in market (RP)

The concept of competitors does not only contain the national or local brand. In the market there are a lot of bottling firms which gives a clear explanation on the shape and size of the market. Meaning that there is a great risk for firms that try to enter the market or exist firms in the market. Especially underground firms have a great risk in the price focusing competition strategy (BYSD, 2002).

(i) *Price applications of competitors (FU)*: This is an important criterion to establish distributing strategy. As it is known price is an important factor between for comparison of similar alike goods and this likelihood may depends on cost or may not. In oil market, while brand is considered as independently with price, price becomes the most important competition tool. In oil market profitability is low and firms choose their prices depended on properties of their environment and their total ton and revenue. Except very special situations firms have a standard average price levels (Tek, 1997).

(ii) *Brand positioning (MK)*: Another criterion is brand positioning of competitors and level of fame of the product. Cost of being a brand defined as cost of advertising and other sales strategies. While searching this for oil firms in Turkey the easiest way is relating it with position of shelves and evaluate it with the level of fame (Tosun, 2003).

(iii) *Distributing strategies of competitors (RS)*: If a firm wants to take a place in market, it has to have ability to explain competitors' strategies and brand positions. If we look at the brands that use strategies which focus on product–distribution, we can see that they generally keep their place in market with distributors generally. Choice of distribution channels are directly related with the firms' operating area definition. For every distributor some values like its geographic position, population, and demand may be related with the effect of this distributor. In this sense establishing brand value and an effective distribution strategy related with competitor market power depends on choosing distributors (Kotler, 2003).

(iv) *Institutionalization status of competitors (RK)*: One of the most important facts to point positioning is competitors' tools and ways to use them for their strategies in the market. If competitor can determine and shape their own marketing, sale, finance departments they will have power and effect in the market. In other words it would not be easy to enter to or hold in the market if competitor can define departments, assign right people to all position, analyzes market and correctly use all of these information in synchronized way to define market strategies (Tek, 1997).

(v) *Advertising strategies (RE)*: Like low price, quality, and profitability, advertising also used to be known by customers and to find effective distribution channels. This will help distributor to keep money and effort. In this sense the important issue is how the competitors use national or local advertising tools. Because customer demand depends on level of knowledge about the characteristics, image and availability of that brand can be reached easily (Roger et al., 2005).

(vi) *Local origin (YO)*: Local nationalism has a big role on consumer. Also some expressions like "my oil" or "my brand" are very good for local oil firms as Zade, Lice, Olin, Orkide. It is not important that if they are national or not. However some brands are meaningful only in their own region and they produce an important barrier to other firms that try to enter local market in that area (BYSD, 2002).

(vii) *Aggregated portfolio (BP)*: It is known that firms which have different products that oil, have more advantages than other firms that produce only oil. Producing different products brings some advantages in means of effectiveness of distributors and sales point. Because different products help firms to balance their profit margin and to be known by consumers (Tosun, 2003).

3.4. Managerial and financial perspective (FP)

Concept of distribution has an effect on establishing reliability between distributor and consumer directly. On reliability point firms' managerial and financial activities can be understood by firms' interlocutors. If a firm can react parallel with consumer and distributors need by its effective management and financial position, it will gain a perfect image.

(i) *Managerial support (YD)*: To establish a strong organization structure, all organizations need managerial support and wish stable decision making strategies from managers. Some activities like good human resource management or fair wage distribution cannot be made without managerial support. The main requirements of practitioners in the area are auditing of channels and distribution, and adoption to innovations by managements. The targets defined by managers and vehicles that are provided by managers are very important for distribution and have an important value. This information and sharing of decisions lead firms to reach to the position that they want to be (Tek, 1997).

(ii) *Technological infrastructure (TD)*: In today's market the primary requirement is to answer all the improvements and changes in very short time. Information flow from producer to customer and from customer to producer must be very fast and correct. To obtain this fast flow firms have to choose right technology. In this sense to understand competitors' position in the market and to understand changes in consumers demands the high technological information management systems are very important. More information management system is related with effectiveness and financial power of managers (Armstrong & Kotler, 2005).

(iii) *Marketing budget (PB)*: In market all firms have to plan their budget very well to have effective advertising, distributing, and marketing activities. The planned budget is directly related with income level and profit of the firm. Marketing plan, which is prepared for any time interval is a very important database for total income and quantity (Kotler, 2003).

(iv) *Effective feedback/return from sales' incomes (EG)*: In any distribution channels at any point firms have to collect payments at the same time with time that defined in contract when send products to that point. This requirement becomes an important principle that it is related with low profit margin. The main tool to prevent delays is planning an interest cost tolerated with situations of the markets and buyers. There is a lot of risk for firms if they cannot satisfy feedback payments in the market (Tek, 1997).

(v) *Effective fund management (EF)*: In order to be competitive, budgeting and fund management should be effective. In this sense, effective organizational structure gain importance for vegetable oil sector, because of some imported inputs such as raw oil. These inputs are effected from exchange rates because of geographical position of the country and changes in purchasing strategy (OAIB, 2005; Tosun, 2003). Establishing a correct budget, following a flexible money policy, controlling balanced source usage provides effective usage of values chain in the market. In other words, fund management can be used to define the effect of imported materials on product price (Kotler, 2003).

4. Fuzzy multicriteria decision making for organizational strategy development

Multiple criteria decision-making (MCDM) is a powerful tool widely used for evaluating problems containing multiple, usually conflicting criteria. In addition, because subjective considerations are relevant to partner evaluation and selection decision, a fuzzy logic approach is adopted (Büyüközkan et al., 2008).

Many efficient methods have been presented for the fuzzy multi-critera decision making problems with the decision maker (DM)'s preference information completely known and completely unknown such as TOPSIS method, AHP method. For multi attribute decision making problem, there exist many fuzzy AHP and fuzzy TOPSIS methods. There are two main differences between AHP and TOPSIS. Pairwise comparisons for attributes and alternatives are made in AHP, while TOPSIS does not (Kahraman et al., 2007).

4.1. Fuzzy analytical hierarchy process (FAHP) method

The Analytic Hierarchy Process (AHP) method was developed in the 1980s by Thomas L. Saaty. AHP assumes that evaluation criteria can be completely expressed in a hierarchical structure. The data acquired from the decision-makers are pairwise comparisons concerning the relative importance of each of the criteria, or the

degree of preference of one factor to another with respect to each criterion. In the conventional AHP, the pairwise comparison is made by using a ratio scale. Even though the discrete scale has the advantages of simplicity and ease of use, it does not take into account the uncertainty associated with the mapping of one's perception (or judgment) to a number (Büyüközkan et al., 2008).

In order to deal with the uncertainty and vagueness from the subjective perception and the experience of humans in the decision-making process, many FAHP methods are proposed by various authors. Decision-makers usually find that it is more confident to give interval judgments than fixed-value judgments. This is because usually he/she is unable to explicit about his/her preferences due to the fuzzy nature of the comparison process (Büyüközkan et al., 2008).

In the FAHP approach, triangular fuzzy numbers are used for the preferences of one criterion over another and then by using the Chang's extent analysis method, the synthetic extent value of the pairwise comparison is calculated. The triangular fuzzy scale of preferences is given in Table 1. The extent analysis method is used to consider the extent of an object to be satisfied for the goal, that is, satisfied extent. In the method, the "extent" is quantified by using a fuzzy number. On the basis of the fuzzy values for the extent analysis of each object, a fuzzy synthetic degree value can be obtained, which is defined as follows (Büyüközkan et al., 2008; Kahraman et al., 2006).

Let $X = \{x_1, x_2, \ldots, x_n\}$ be an object set and $U = \{u_1, u_2, \ldots, u_m\}$ be a goal set. According to the method of Chang's extent analysis model, each object is taken and extent analysis for each goal g_i is performed. Therefore, m extent analysis values for each object can be obtained as $M_{g_i}^1, M_{g_i}^2, \ldots, M_{g_i}^m$, $i = 1, 2, \ldots, n$. All the $M_{g_i}^j$, $j = 1, 2, \ldots, m$ are triangular fuzzy numbers. The algorithm of the Chang's extent analysis model is as follows;

Step 1: The value of fuzzy synthetic extent with respect to the ith object is defined as

$$S_i = \sum_{j=1}^{m} M_{g_i}^j \left[\sum_{i=1}^{n} \sum_{j=1}^{m} M_{g_i}^j \right]^{-1} \tag{1}$$

To obtain $\sum_{j=1}^{m} M_{g_i}^j$ perform the fuzzy addition operation of m extent analysis for a particular matrix such that

$$\sum_{j=1}^{m} M_{g_i}^j = \left(\sum_{j=1}^{m} l_j, \sum_{j=1}^{m} m_j, \sum_{j=1}^{m} u_j \right) \tag{2}$$

and to obtain $\left[\sum_{i=1}^{n} \sum_{j=1}^{m} M_{g_i}^j \right]^{-1}$, perform the fuzzy addition operation of $M_{g_i}^j$, $j = 1, 2, \ldots, m$ values such that

$$\sum_{i=1}^{n} \sum_{j=1}^{m} M_{g_i}^j = \left(\sum_{i=1}^{n} l_i, \sum_{i=1}^{n} m_i, \sum_{i=1}^{n} u_i \right) \tag{3}$$

and then compute the inverse of the vector in Eq. (3) such that

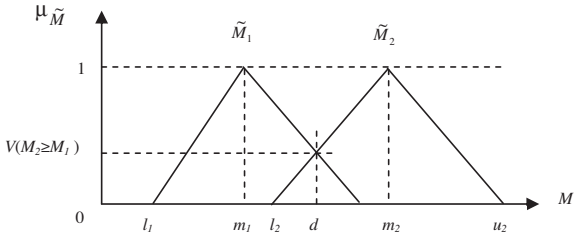

Fig. 1. The intersection between $\tilde{M}_1$ and $\tilde{M}_2$.

$$\left[\sum_{i=1}^{n} \sum_{j=1}^{m} M_{g_i}^j \right]^{-1} = \left(\frac{1}{\sum_{i=1}^{n} u_i}, \frac{1}{\sum_{i=1}^{n} m_i}, \frac{1}{\sum_{i=1}^{n} l_i} \right) \tag{4}$$

The principles for the comparison of fuzzy numbers were introduced to derive the weight vectors of all elements for each level of hierarchy with the use of fuzzy synthetic values.

To compare of the fuzzy numbers, following principles are used.

Step 2: The degree of possibility of $M_2 \geqslant M_1$ is defined as

$$V(M_2 \geqslant M_1) = \sup_{y \geqslant x} [\min(\mu_{M_1(x)}, \mu_{M_2(y)})] = hgt(M_1 \cap M_2) = \mu_{M_2(d)} = \begin{cases} 1, & if m_2 \geqslant m_1 \\ 0, & l_1 \geqslant u_2 \\ \frac{(l_1 - u_2)}{(m_2 - u_2) - (m_1 - l_1)}, & otherwise \end{cases} \tag{5}$$

where $M_1 = (l_1, m_1, u_1)$ and $M_2 = (l_2, m_2, u_2)$ and d is the ordinate of the highest intersection point D between μ_{M_1} and μ_{M_2} (see Fig. 1). To compare M_1 and M_2, both $V(M_2 \geqslant M_1)$ and $V(M_1 \geqslant M_2)$ are needed.

Step 3: The degree of possibility for a fuzzy number to be greater than k fuzzy numbers M_i, $(i = 1, 2, \ldots, k)$ can be defined by

$$V(M \geqslant M_1, M_2, \ldots, M_k) = \min V(M \geqslant M_i), \quad i = 1, 2, \ldots, k \tag{6}$$

Assume that,

$$d'(A_i) = \min V(S_i \geqslant S_k), \quad k = 1, 2, \ldots, n; \; k \neq i \tag{7}$$

Then the weight vector is given by

$$W' = \left(d'(A_1), d'(A_2), \ldots, d'(A_n) \right)^T \tag{8}$$

where A_i, $(i = 1, 2, \ldots, n)$ are n elements.

Step 4: Via normalization, the normalized weight vectors are

$$W = (d(A_1), d(A_2), \ldots, d(A_n))^T \tag{9}$$

where W is not a fuzzy number (Büyüközkan et al., 2008; Kahraman et al., 2006).

4.2. Hierarchical fuzzy TOPSIS (HFTOPSIS)

TOPSIS is developed by Hwang and Yoon in 1981 and viewed as a multi attribute decision making (MADM) problem. The method is based on the concept that chosen alternative should have the shortest distance from the positive ideal solution (PIS) and the longest distance from the negative ideal solution (NIS). TOPSIS defines an index called similarity (or relative closeness) to the PIS and the remoteness from the NIS. Then, the method chooses an alternative with the maximum similarity to the PIS (Kahraman et al., 2007)

The main steps of the hierarchical fuzzy TOPSIS method are as follows;

Step 1: Choose the appropriate linguistic variables for the alternatives with respect to criteria. The linguistic variables are described by triangular fuzzy numbers, such as $\tilde{x}_{ij} = (a_{ij}, b_{ij}, c_{ij})$. The fuzzy weights can be described as $w_j = (\alpha_j, \beta_j, \delta_j)$.

Step 2: Construct the fuzzy decision matrix ($D = [\tilde{x}_{ij}]$) and the normalized fuzzy decision matrix $D' = [r_{ij}]$.

$$r_{ij} = \begin{cases} x_{ij}(+)x_j^* = \left(\frac{a_{ij}}{c_j^*}, \frac{b_{ij}}{b_j^*}, \frac{c_{ij}}{a_j^*} \right) \\ x_j^-(+)x_{ij} = \left(\frac{a_j^-}{c_{ij}}, \frac{b_j^-}{b_{ij}}, \frac{c_j^-}{a_{ij}} \right) \end{cases} \tag{10}$$

Step 3: Obtain the fuzzy weighted normalized decision matrix $v = [v_{ij}]$.

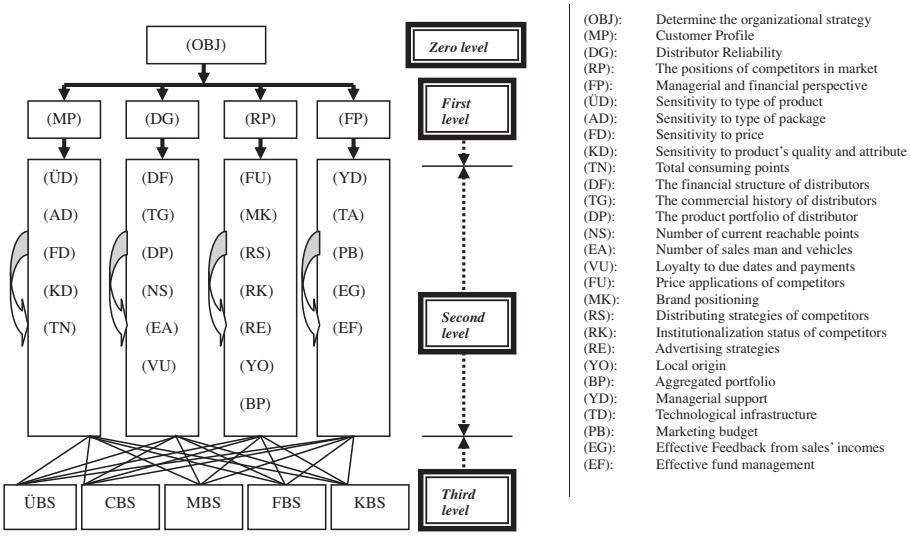

Fig. 2. The best organization strategy model for vegetable oil manufacturer.

Table 1
Triangular fuzzy scale of preferences.

Saaty's scale relative importance	Definition	Fuzzy AHP scale	
		Triangular fuzzy scale	Triangular fuzzy reciprocal scale
1	Equally importance	(1,1,1)	(1,1,1)
3	Moderate importance of one over another	(2,3,4)	(1/4,1/3,1/2)
5	Essential or strong importance	(4,5,6)	(1/6,1/5,1/4)
7	Demonstrated importance	(6,7,8)	(1/8,1/7,1/6)
9	Extreme importance	(9,9,9)	(1/9,1/9,1/9)
2	Intermediate values	(1,2,3)	(1/3,1/2,1)
4	between two adjacent	(3,4,5)	(1/5,1/4,1/3)
6	judgements	(5,6,7)	(1/7,1/6,1/5)
8		(7,8,9)	(1/9,1/8,1/7)

$$v_{ij} = \begin{cases} r_{ij}(.)w_j^* = \left(\frac{a_{ij}}{c_j^*}\alpha_j, \frac{b_{ij}}{b_j^*}\beta_j, \frac{c_{ij}}{a_j^*}\delta_j\right) \\ r_{ij}(.)w_j^* = \left(\frac{a_j^-}{c_{ij}}\alpha_j, \frac{b_j^-}{b_{ij}}\beta_j, \frac{c_j^-}{a_{ij}}\delta_j\right) \end{cases} \quad (11)$$

Step 4: Obtain the Positive Ideal Solution (PIS), A^*, and the Negative Ideal Solution (NIS), A^-, are defined as

$$A^* = \left[v_1^*, v_2^*, \ldots, v_n^*\right] \quad (12)$$

$$A^- = \left[v_1^-, v_2^-, \ldots, v_n^-\right] \quad (13)$$

where $v_j^* = \max_i v_{ij}$ and $v_j^- = \min_i v_{ij}$

Step 5: The generalized mean for fuzzy number v_{ij}, $\forall i,j$ is defined as

$$M(v_{ij}) = \frac{-a_{ij}^2 + d_{ij}^2 - a_{ij}b_{ij} + b_{ij}c_{ij}}{[3(-a_{ij} + d_{ij})]} \quad (14)$$

For each column j, we find a v_{ij} whose greatest mean is v_j^* and the lowest mean is v_j^-.

Step 6: Obtain the separation measures S_i^* and S_i^- as follows,

$$S_i^* = \sum_{j=1}^{n} D_{ij}^*, \quad i = 1,2,\ldots,m \quad (15)$$

$$S_i^- = \sum_{j=1}^{n} D_{ij}^-, \quad i = 1,2,\ldots,m \quad (16)$$

D_{ij}^* and D_{ij}^- are calculated by

$$D_{ij}^* = \begin{cases} 1 - \frac{c_{ij}-a^*}{b^*+c_{ij}-a^*-b_{ij}}, & \text{for } b_{ij} < b^* \\ 1 - \frac{c^*-a_{ij}}{b_{ij}+c^*-a_{ij}-b^*}, & \text{for } b_{ij} > b^* \end{cases}, \quad \forall i,j \quad (17)$$

$$D_{ij}^- = \begin{cases} 1 - \frac{c^- - a_{ij}}{b_{ij}+c^- - a_{ij}-b^-}, & \text{for } b^- < b_{ij} \\ 1 - \frac{c_{ij}-a^-}{b^- + c_{ij} - a^- - b_{ij}}, & \text{for } b^- > b_{ij} \end{cases}, \quad \forall i,j \quad (18)$$

where both D_{ij}^* and D_{ij}^- are crisp numbers.

Step 7: Compute the relative closeness the ideals by following;

$$C_i = \frac{S_i^-}{S_i^- + S_i^*} \quad (19)$$

The alternatives are ranked in descending order of the C_i index (Kahraman et al., 2007).

5. A case study in vegetable oil manufacturing sector

By the growth of world population, consuming of comestible is increasing day by day. In all over the world since oiled seed farming came in favour, some vegetables like soya bean, peanut, rape (or canola) corn, sesame seed, palm seed, oiled linen, coconut and castor oil have got importance. Oil seeds that are growed in Turkey are sunflower, sesame, rape, soya, peanut and poppy. The vegetable oils that are consumed in Turkey with their percentages are as follows: 48.4% sunflower oil, 33.6% cottonseed oil, 18% olive oil and others (BYSD, 2002).

Processing vegetable oil industry is a primary sub industry of the comestible industry. There are 8 margarine producers and about 150 liquid vegetable oil producers in Turkey. They are mostly located in Thrace and also there are new producers in all over the Anatolia. However the capacity usage level is low and even decrease with increasing number of plants. Also located in the same area there is a lot of bottling firms which bring oil in tankers and fill them by old and primitive methods. In other words because of uncontrolled production, unfair competition become a big problem for sector. The big number of small scaled firms in the sector shows that sector suffers from disintegration. A lot of firms and brands are competing in the market that creates varieties in the quality of the product. And also shows the high level of competition. Oil production sector has a low profit margin level. As a result the firms have to operate with high provident capacity (OAIB, 2005; Tosun, 2003).

Table 2
Fuzzy comparison matrix of four decision criteria with respect to the goal and its priority vectors.

Criteria	MP	DG	RP	FP	Priority vector (W_G)
MP	(1,1,1)	(4,5,6)	(1,1,1)	(1/4,1/3,1/2)	0.3211
DG	(1/6,1/5,1/4)	(1,1,1)	(1/3,1/2,1)	(1/6,1/5,1/4)	0
RP	(1,1,1)	(1,2,3)	(1,1,1)	(1/3,1/2,1)	0.580521
FP	(2,3,4)	(4,5,6)	(1,2,3)	(1,1,1)	0.098379

Table 3
Fuzzy comparison matrix of five sub-criteria with respect to MP and its priority vectors.

Sub-Criteria	ÜD	AD	FD	KD	TN	Priority vector (W_{MP})
ÜD	(1,1,1)	(2,3,4)	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1/3,1/2,1)	0.133945
AD	(1/4,1/3,1/2)	(1,1,1)	(1/6,1/5,1/4)	(1/4,1/3,1/2)	(1,2,3)	0.053431
FD	(2,3,4)	(4,5,6)	(1,1,1)	(1/3,1/2,1)	(1,2,3)	0.346391
KD	(2,3,4)	(2,3,4)	(1,2,3)	(1,1,1)	(2,3,4)	0.357531
TN	(1,2,3)	(1/3,1/2,1)	(1/3,1/2,1)	(1/4,1/3,1/2)	(1,1,1)	0.108703

Table 4
Fuzzy comparison matrix of six sub-criteria with respect to DG and its priority vectors.

Sub-Criteria	DF	TG	DP	NS	EA	VU	Priority vector (W_{DG})
DF	(1,1,1)	(1,1,1)	(4,5,6)	(2,3,4)	(2,3,4)	(1,2,3)	0.523076
TG	(1,1,1)	(1,1,1)	(2,3,4)	(2,3,4)	(2,3,4)	(1,2,3)	0.448155
DP	(1/6,1/5,1/4)	(1/4,1/3,1/2)	(1,1,1)	(1,1,1)	(1,2,3)	(1,2,3)	0.028769
NS	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1,1,1)	(1,1,1)	(1,1,1)	(1,2,3)	0
EA	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1/3,1/2,1)	(1,1,1)	(1,2,3)	0
VU	(1/3,1/2,1)	(1/3,1/2,1)	(1/3,1/2,1)	(1/3,1/2,1)	(1/3,1/2,1)	(1,1,1)	0

Table 5
Fuzzy comparison matrix of seven sub-criteria with respect to RP and its priority vectors.

Sub-Criteria	FU	MK	RS	RK	RE	YO	BP	Priority vector (W_{RP})
FU	(1,1,1)	(1/6,1/5,1/4)	(1/3,1/2,1)	(2,3,4)	(1,2,3)	(1,2,3)	(1,1,1)	0.182963
MK	(4,5,6)	(1,1,1)	(1/3,1/2,1)	(2,3,4)	(1,2,3)	(1,1,1)	(1,2,3)	0.319245
RS	(1,2,3)	(1,2,3)	(1,1,1)	(2,3,4)	(1,1,1)	(2,3,4)	(2,3,4)	0.256557
RK	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1,1,1)	(1/3,1/2,1)	(1,2,3)	(1/4,1/3,1/2)	0
RE	(1/3,1/2,1)	(1/3,1/2,1)	(1,1,1)	(1,2,3)	(1,1,1)	(1,1,1)	(1,1,1)	0.108477
YO	(1/3,1/2,1)	(1,1,1)	(1/4,1/3,1/2)	(1/3,1/2,1)	(1,1,1)	(1,1,1)	(1/4,1/3,1/2)	0
BP	(1,1,1)	(1/3,1/2,1)	(1/4,1/3,1/2)	(2,3,4)	(1,1,1)	(2,3,4)	(1,1,1)	0.132758

Table 6
Fuzzy comparison matrix of five sub-criteria with respect to FP and its priority vectors.

Sub-Criteria	YD	TA	PB	EG	EF	Priority vector (W_{FP})
YD	(1,1,1)	(2,3,4)	(1,1,1)	(1,1,1)	(1/4,1/3,1/2)	0.221284
TA	(1/4,1/3,1/2)	(1,1,1)	(1,1,1)	(1/4,1/3,1/2)	(1/4,1/3,1/2)	0
PB	(1,1,1)	(1,1,1)	(1,1,1)	(1,1,1)	(1/3,1/2,1)	0.0489
EG	(1,1,1)	(2,3,4)	(1,1,1)	(1,1,1)	(1/3,1/2,1)	0.243957
EF	(2,3,4)	(2,3,4)	(1,2,3)	(1,2,3)	(1,1,1)	0.485859

Table 7
Fuzzy comparison matrix of five alternatives with respect to ÜD of MP and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{UD})
ÜBS	(1,1,1)	(1,1,1)	(2,3,4)	(2,3,4)	(1,1,1)	0.318208
CBS	(1,1,1)	(1,1,1)	(4,5,6)	(1,2,3)	(1,1,1)	0.363583
MBS	(1/4,1/3,1/2)	(1/6,1/5,1/4)	(1,1,1)	(1,1,1)	(1/4,1/3,1/2)	0
FBS	(1/4,1/3,1/2)	(1/3,1/2,1)	(1,1,1)	(1,1,1)	(1/4,1/3,1/2)	0
KBS	(1,1,1)	(1,1,1)	(2,3,4)	(2,3,4)	(1,1,1)	0.318208

In the world the consumption of vegetable oil per capita is about 26 kg and in Turkey this is about 16 kg. The consumption of liquid vegetable oil is about 9.5 kg. On the average 350–370,000 ton margarine and 650–750,000 ton liquid vegetable oil is used per year. In Turkey, there are lots of sunflower oil producers and this makes prices low and because of this the consumers prefer sunflower mostly. In the world the order of vegetable oil consumption is as follows: soya, palm, sunflower. As mentioned before sunflower oil is in third order (Dölekoğlu, 2001).

Table 8
Fuzzy comparison matrix of five alternatives with respect to AD of MP and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{AD})
ÜBS	(1,1,1)	(1/4,1/3,1/2)	(1,2,3)	(1,1,1)	(1/4,1/3,1/2)	0.1231
CBS	(2,3,4)	(1,1,1)	(2,3,4)	(1,2,3)	(1/3,1/2,1)	0.332287
MBS	(1/3,1/2,1)	(1/4,1/3,1/2)	(1,1,1)	(2,3,4)	(1/4,1/3,1/2)	0.145083
FBS	(1,1,1)	(1/3,1/2,1)	(1/4,1/3,1/2)	(1,1,1)	(1/5,1/4,1/3)	0
KBS	(1,2,3)	(1,2,3)	(2,3,4)	(3,4,5)	(1,1,1)	0.399529

Table 9
Fuzzy comparison matrix of five alternatives with respect to FD of MP and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{FD})
ÜBS	(1,1,1)	(1,1,1)	(2,3,4)	(2,3,4)	(1/4,1/3,1/2)	0.235905
CBS	(1,1,1)	(1,1,1)	(4,5,6)	(2,3,4)	(1/3,1/2,1)	0.315352
MBS	(1/4,1/3,1/2)	(1/6,1/5,1/4)	(1,1,1)	(2,3,4)	(1/4,1/3,1/2)	0.058014
FBS	(1/3,1/2,1)	(1/3,1/2,1)	(1/3,1/2,1)	(1,1,1)	(1/6,1/5,1/4)	0
KBS	(2,3,4)	(1,2,3)	(2,3,4)	(3,4,5)	(1,1,1)	0.39073

Table 10
Fuzzy comparison matrix of five alternatives with respect to KD of MP and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{KD})
ÜBS	(1,1,1)	(1,1,1)	(1/4,1/3,1/2)	(2,3,4)	(1/3,1/2,1)	0.15101
CBS	(1,1,1)	(1,1,1)	(1,1,1)	(2,3,4)	(1/3,1/2,1)	0.177235
MBS	(2,3,4)	(1,1,1)	(1,1,1)	(2,3,4)	(1/3,1/2,1)	0.27872
FBS	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1,1,1)	(1/6,1/5,1/4)	0
KBS	(1,2,3)	(1,1,1)	(1,2,3)	(4,5,6)	(1,1,1)	0.393035

Table 11
Fuzzy comparison matrix of five alternatives with respect to TN of MP and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{TN})
ÜBS	(1,1,1)	(2,3,4)	(3,4,5)	(1,2,3)	(1,1,1)	0.420681
CBS	(1/4,1/3,1/2)	(1,1,1)	(1,1,1)	(1,2,3)	(1,1,1)	0.182674
MBS	(1/5,1/4,1/3)	(1,1,1)	(1,1,1)	(1,2,3)	(1/3,1/2,1)	0.103916
FBS	(1/3,1/2,1)	(1/4,1/3,1/2)	(1/3,1/2,1)	(1,1,1)	(1/4,1/3,1/2)	0
KBS	(1,2,3)	(1,1,1)	(1,2,3)	(2,3,4)	(1,1,1)	0.292728

Table 12
Fuzzy comparison matrix of five alternatives with respect to DF of DG and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{DF})
ÜBS	(1,1,1)	(1,1,1)	(2,3,4)	(1,2,3)	(1/3,1/2,1)	0.28908
CBS	(1,1,1)	(1,1,1)	(1,1,1)	(1,2,3)	(1,1,1)	0.190313
MBS	(1/4,1/3,1/2)	(1,1,1)	(1,1,1)	(1,2,3)	(1/4,1/3,1/2)	0.000764
FBS	(1/3,1/2,1)	(1/3,1/2,1)	(1,2,3)	(1,1,1)	(1/4,1/3,1/2)	0.141227
KBS	(1,2,3)	(1,1,1)	(2,3,4)	(1,2,3)	(1,1,1)	0.378616

Table 13
Fuzzy comparison matrix of five alternatives with respect to TG of DG and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{TG})
ÜBS	(1,1,1)	(1/3,1/2,1)	(1/4,1/3,1/2)	(1,2,3)	(1,1,1)	0.165814
CBS	(1,2,3)	(1,1,1)	(1,1,1)	(1,2,3)	(1,1,1)	0.239867
MBS	(2,3,4)	(1,1,1)	(1,1,1)	(1,2,3)	(1/3,1/2,1)	0.254038
FBS	(1/3,1/2,1)	(1/3,1/2,1)	(1/3,1/2,1)	(1,1,1)	(1/3,1/2,1)	0.100414
KBS	(1,1,1)	(1,1,1)	(1,2,3)	(1,2,3)	(1,1,1)	0.239867

The considered firm started food trading activities in 1950s and initiated the foundation of vegetable oil production facilities in 1989. Being landed on 100.000 m^2 open and 30.000 m^2 closed area, the refinery is capable of processing all kinds of vegetable oils like "Sunflower oil, Olive oil, Corn oil, Soybean oil, Canola oil, Cotton oil, Hazelnut oil, Vegetable Oil Blend etc." The firm has started sunflower oil production and selling facilities at this qualified production plant at 1991. And now, the firm is one of the biggest vegetable oil production firms of Turkey.

An edible-vegetable oil firm wishes to select the best organization strategy for the distribution channel management. A graphical representation of the model under fuzzy environment is shown in

Table 14
Fuzzy comparison matrix of five alternatives with respect to DP of DG and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{DP})
ÜBS	(1,1,1)	(1/4,1/3,1/2)	(1,2,3)	(1,2,3)	(1/4,1/3,1/2)	0.150214
CBS	(2,3,4)	(1,1,1)	(4,5,6)	(2,3,4)	(1/4,1/3,1/2)	0.37341
MBS	(1/3,1/2,1)	(1/6,1/5,1/4)	(1,1,1)	(1/3,1/2,1)	(1/5,1/4,1/3)	0
FBS	(1/3,1/2,1)	(1/4,1/3,1/2)	(1,2,3)	(1,1,1)	(1/3,1/2,1)	0.086601
KBS	(2,3,4)	(2,3,4)	(3,4,5)	(1,2,3)	(1,1,1)	0.389775

Table 15
Fuzzy comparison matrix of five alternatives with respect to NS of DG and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{NS})
ÜBS	(1,1,1)	(1/6,1/5,1/4)	(1,1,1)	(1,1,1)	(1/6,1/5,1/4)	0
CBS	(4,5,6)	(1,1,1)	(1,2,3)	(1,2,3)	(1,1,1)	0.445135
MBS	(1,1,1)	(1/4,1/3,1/2)	(1,1,1)	(1,2,3)	(1/4,1/3,1/2)	0.01978
FBS	(1,1,1)	(1/3,1/2,1)	(1/3,1/2,1)	(1,1,1)	(1/4,1/3,1/2)	0
KBS	(4,5,6)	(1,1,1)	(2,3,4)	(2,3,4)	(1,1,1)	0.535085

Table 16
Fuzzy comparison matrix of five alternatives with respect to EA of DG and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{EA})
ÜBS	(1,1,1)	(1/4,1/3,1/2)	(1,1,1)	(1,1,1)	(1/6,1/5,1/4)	0
CBS	(2,3,4)	(1,1,1)	(3,4,5)	(4,5,6)	(1,1,1)	0.54591
MBS	(1,1,1)	(1/5,1/4,1/3)	(1,1,1)	(1,2,3)	(1/3,1/2,1)	0
FBS	(1,1,1)	(1/6,1/5,1/4)	(1/3,1/2,1)	(1,1,1)	(1/4,1/3,1/2)	0
KBS	(4,5,6)	(1,1,1)	(1,2,3)	(2,3,4)	(1,1,1)	0.45409

Table 17
Fuzzy comparison matrix of five alternatives with respect to VU of DG and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{VU})
ÜBS	(1,1,1)	(1/4,1/3,1/2)	(1,1,1)	(1/3,1/2,1)	(1/6,1/5,1/4)	0
CBS	(1,2,3)	(1,1,1)	(1,2,3)	(1,1,1)	(1/4,1/3,1/2)	0.209694
MBS	(1,1,1)	(1/3,1/2,1)	(1,1,1)	(1,2,3)	(1,1,1)	0.111742
FBS	(1,2,3)	(1,1,1)	(1/4,1/3,1/2)	(1,1,1)	(1/4,1/3,1/2)	0.078187
KBS	(4,5,6)	(1,1,1)	(1,2,3)	(2,3,4)	(1,1,1)	0.600377

Table 18
Fuzzy comparison matrix of five alternatives with respect to FU of RP and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{FU})
ÜBS	(1,1,1)	(1,1,1)	(2,3,4)	(2,3,4)	(1,1,1)	0.296201
CBS	(1,1,1)	(1,1,1)	(2,3,4)	(2,3,4)	(1,1,1)	0.296201
MBS	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1,1,1)	(2,3,4)	(1,1,1)	0.14768
FBS	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1,1,1)	(1/4,1/3,1/2)	0
KBS	(1,1,1)	(1,1,1)	(1,1,1)	(2,3,4)	(1,1,1)	0.259918

Table 19
Fuzzy comparison matrix of five alternatives with respect to MK of RP and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{MK})
ÜBS	(1,1,1)	(1,1,1)	(2,3,4)	(2,3,4)	(1,1,1)	0.341578
CBS	(1,1,1)	(1,1,1)	(1,2,3)	(1,2,3)	(1/4,1/3,1/2)	0.227574
MBS	(1/4,1/3,1/2)	(1/3,1/2,1)	(1,1,1)	(2,3,4)	(1,1,1)	0.191506
FBS	(1/4,1/3,1/2)	(1/3,1/2,1)	(1/4,1/3,1/2)	(1,1,1)	(1/4,1/3,1/2)	0
KBS	(1,1,1)	(1,1,1)	(1,1,1)	(2,3,4)	(1,1,1)	0.239341

Fig. 2 below. It can be seen that the overall objective is to choose the best organization strategy for distribution channel management. The decision structure has three levels:

First level (*level of determinants*). The determinants of distribution channel management are determined as customer profile (MP), distributor reliability (DG), the position of competitors in market (RG), managerial and financial perspective (FP).

Second level (*level of enablers*). The determinants consist of enablers, which involve 23 sub-criteria, i.e. *Sensitivity to type of product* (*ÜD*), *Sensitivity to type of package* (*AD*), *Sensitivity to price* (*FD*), *Sensitivity to Product's Quality and Attribute* (*KD*), *Total consuming points* (*institutional sale*) (*TN*); *The Financial Structure*

Table 20
Fuzzy comparison matrix of five alternatives with respect to RS of RP and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{RS})
ÜBS	(1,1,1)	(1,1,1)	(2,3,4)	(1,1,1)	(1,1,1)	0.263691
CBS	(1,1,1)	(1,1,1)	(2,3,4)	(2,3,4)	(1,1,1)	0.394505
MBS	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1,1,1)	(1,1,1)	(1/3,1/2,1)	0
FBS	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1,1,1)	(1,1,1)	(1/4,1/3,1/2)	0
KBS	(1,1,1)	(1,1,1)	(1,2,3)	(2,3,4)	(1,1,1)	0.341804

Table 21
Fuzzy comparison matrix of five alternatives with respect to RK of RP and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{RK})
ÜBS	(1,1,1)	(1,1,1)	(1,2,3)	(1/3,1/2,1)	(1/4,1/3,1/2)	0.055528
CBS	(1,1,1)	(1,1,1)	(1,2,3)	(1/3,1/2,1)	(1/4,1/3,1/2)	0.055528
MBS	(1/3,1/2,1)	(1/3,1/2,1)	(1,1,1)	(1/3,1/2,1)	(1/4,1/3,1/2)	0
FBS	(1,2,3)	(1,2,3)	(1,2,3)	(1,1,1)	(1/6,1/5,1/4)	0.274584
KBS	(2,3,4)	(2,3,4)	(2,3,4)	(4,5,6)	(1,1,1)	0.61436

Table 22
Fuzzy comparison matrix of five alternatives with respect to RE of RP and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{RE})
ÜBS	(1,1,1)	(2,3,4)	(1,1,1)	(1,2,3)	(1,1,1)	0.297042
CBS	(1/4,1/3,1/2)	(1,1,1)	(1/4,1/3,1/2)	(1,2,3)	(1,1,1)	0.124565
MBS	(1,1,1)	(2,3,4)	(1,1,1)	(2,3,4)	(1,2,3)	0.370643
FBS	(1/3,1/2,1)	(1/3,1/2,1)	(1/4,1/3,1/2)	(1,1,1)	(1/3,1/2,1)	0.032349
KBS	(1,1,1)	(1,1,1)	(1/3,1/2,1)	(1,2,3)	(1,1,1)	0.175401

Table 23
Fuzzy comparison matrix of five alternatives with respect to YO of RP and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{YO})
ÜBS	(1,1,1)	(1,1,1)	(1,1,1)	(2,3,4)	(1,1,1)	0.320334
CBS	(1,1,1)	(1,1,1)	(1,1,1)	(2,3,4)	(1,1,1)	0.320334
MBS	(1,1,1)	(1,1,1)	(1,1,1)	(2,3,4)	(1,1,1)	0.320334
FBS	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1,1,1)	(1,1,1)	0
KBS	(1,1,1)	(1,1,1)	(1,1,1)	(1,1,1)	(1,1,1)	0.038997

Table 24
Fuzzy comparison matrix of five alternatives with respect to BP of RP and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{BP})
ÜBS	(1,1,1)	(1/3,1/2,1)	(1/4,1/3,1/2)	(1/5,1/4,1/3)	(1,2,3)	0
CBS	(1,2,3)	(1,1,1)	(1/3,1/2,1)	(1/6,1/5,1/4)	(2,3,4)	0.084414
MBS	(2,3,4)	(1,2,3)	(1,1,1)	(1/4,1/3,1/2)	(2,3,4)	0.267717
FBS	(3,4,5)	(4,5,6)	(2,3,4)	(1,1,1)	(4,5,6)	0.647869
KBS	(1,1,1)	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1/6,1/5,1/4)	(1,1,1)	0

Table 25
Fuzzy comparison matrix of five alternatives with respect to YD of FP and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{YD})
ÜBS	(1,1,1)	(2,3,4)	(1,1,1)	(1,2,3)	(2,3,4)	0.342355
CBS		(1,1,1)	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(2,3,4)	0.152824
MBS	(1,1,1)	(2,3,4)	(1,1,1)	(1,1,1)	(2,3,4)	0.306992
FBS	(1/3,1/2,1)	(1,1,1)	(1,1,1)	(1,1,1)	(2,3,4)	0.197829
KBS	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1,1,1)	0

Table 26
Fuzzy comparison matrix of five alternatives with respect to TA of FP and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{TA})
ÜBS	(1,1,1)	(1,1,1)	(1,1,1)	(2,3,4)	(1/4,1/3,1/2)	0.044724
CBS	(1,1,1)	(1,1,1)	(1,1,1)	(2,3,4)	(1/4,1/3,1/2)	0.044724
MBS	(1,1,1)	(1,1,1)	(1,1,1)	(2,3,4)	(1/4,1/3,1/2)	0.044724
FBS	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1/4,1/3,1/2)	(1,1,1)	(1/6,1/5,1/4)	0
KBS	(2,3,4)	(2,3,4)	(2,3,4)	(4,5,6)	(1,1,1)	0.865827

Table 27
Fuzzy comparison matrix of five alternatives with respect to PB of FP and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{PB})
ÜBS	(1,1,1)	(1,1,1)	(1,1,1)	(1,2,3)	(1/4,1/3,1/2)	0.061269
CBS	(1,1,1)	(1,1,1)	(1,1,1)	(1,2,3)	(1/4,1/3,1/2)	0.061269
MBS	(1,1,1)	(1,1,1)	(1,1,1)	(1,2,3)	(1/4,1/3,1/2)	0.061269
FBS	(1/3,1/2,1)	(1/3,1/2,1)	(1/3,1/2,1)	(1,1,1)	(1/4,1/3,1/2)	0
KBS	(2,3,4)	(2,3,4)	(2,3,4)	(3,4,5)	(1,1,1)	0.816193

Table 28
Fuzzy comparison matrix of five alternatives with respect to EG of FP and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{EG})
ÜBS	(1,1,1)	(1/3,1/2,1)	(1,1,1)	(1/3,1/2,1)	(1/4,1/3,1/2)	0
CBS	(1,2,3)	(1,1,1)	(2,3,4)	(1/3,1/2,1)	(1/4,1/3,1/2)	0.248741
MBS	(1,1,1)	(1/4,1/3,1/2)	(1,1,1)	(1/3,1/2,1)	(1/4,1/3,1/2)	0
FBS	(1,2,3)	(1,1,1)	(1,2,3)	(1,1,1)	(1/4,1/3,1/2)	0.280292
KBS	(2,3,4)	(2,3,4)	(2,3,4)	(2,3,4)	(1,1,1)	0.470966

Table 29
Fuzzy comparison matrix of five alternatives with respect to EF of FP and its priority vectors.

	ÜBS	CBS	MBS	FBS	KBS	Priority vector (W_{EF})
ÜBS	(1,1,1)	(1/3,1/2,1)	(1/4,1/3,1/2)	(1,2,3)	(1/6,1/5,1/4)	0
CBS	(1,2,3)	(1,1,1)	(1/5,1/4,1/3)	(2,3,4)	(1/5,1/4,1/3)	0
MBS	(2,3,4)	(3,4,5)	(1,1,1)	(3,4,5)	(1/4,1/3,1/2)	0.361394
FBS	(1/3,1/2,1)	(1/4,1/3,1/2)	(1/5,1/4,1/3)	(1,1,1)	(1/7,1/6,1/5)	0
KBS	(4,5,6)	(3,4,5)	(2,3,4)	(5,6,7)	(1,1,1)	0.638606

Table 30
Local weights of the alternatives with respect to customer profile (MP).

	ÜD	AD	FD	KD	TN	Alternative priority weights
Alternatives						
Weight	0.133945	0.053431	0.346391	0.357531	0.108703	
ÜBS	0.318208	0.1231	0.235905	0.15101	0.420681	0.230635
CBS	0.363583	0.332287	0.315352	0.177235	0.182674	0.258914
MBS	0	0.145083	0.058014	0.27872	0.103916	0.138794
FBS	0	0	0	0	0	0
KBS	0.318208	0.399529	0.39073	0.393035	0.292728	0.371658

Table 31
Local weights of the alternatives with respect to distributor reliability (DG).

	DF	TG	DP	NS	EA	VU	Alternative priority weights
Alternatives							
Weight	0.523076	0.448155	0.028769	0	0	0	
ÜBS	0.28908	0.165814	0.150214	0	0	0	0.229843
CBS	0.190313	0.239867	0.37341	0.445135	0.54591	0.209694	0.217788
MBS	0.000764	0.254038	0	0.01978	0	0.111742	0.114248
FBS	0.141227	0.100414	0.086601	0	0	0.078187	0.121365
KBS	0.378616	0.239867	0.389775	0.535085	0.45409	0.600377	0.316756

Table 32
Local weights of the alternatives with respect to position of competitors in market (RP).

	FU	MK	RS	RK	RE	YO	BP	Alternative priority weights
Alternatives								
Weight	0.182963	0.319245	0.256557	0	0.108477	0	0.132758	0.263115
ÜBS	0.296201	0.341578	0.263691	0.055528	0.297042	0.320334	0	0.252778
CBS	0.296201	0.227574	0.394505	0.055528	0.124565	0.320334	0.084414	0.163905
MBS	0.14768	0.191506	0	0	0.370643	0.320334	0.267717	0.089519
FBS	0	0	0	0.274584	0.032349	0	0.647869	0.230683
KBS	0.259918	0.239341	0.341804	0.61436	0.175401	0.038997	0	0.263115

Table 33
Local weights of the alternatives with respect to Managerial and financial perspective (FP).

	YD	TA	PB	EG	EF	Alternative priority weights
Weight	0.221284	0	0.0489	0.243957	0.485859	
Alternatives						
ÜBS	0.342355	0.044724	0.061269	0	0	0.078754
CBS	0.152824	0.044724	0.061269	0.248741	0	0.097496
MBS	0.306992	0.044724	0.061269	0	0.361394	0.246515
FBS	0.197829	0	0	0.280292	0	0.112156
KBS	0	0.865827	0.816193	0.470966	0.638606	0.46508

Table 34
Global weights of the alternatives with respect to the goal.

	MP	DG	RP	FP	Alternative priority weights
Alternatives					
Weight	0.3211	0	0.580521	0.098379	
ÜBS	0.230635	0.229843	0.263115	0.078754	0.234548
CBS	0.258914	0.217788	0.252778	0.097496	0.239472
MBS	0.138794	0.114248	0.163905	0.246515	0.163969
FBS	0	0.121365	0.089519	0.112156	0.063001
KBS	0.371658	0.316756	0.230683	0.46508	0.29901

Table 35
$\widetilde{I}_{MA}$.

Goal	
MP	(0.3, 0.5, 0.7)
DG	(0, 0, 0.2)
RP	(0.3, 0.5, 0.7)
FP	(0.8, 1, 1)

of Distributors (*DF*), *The Commercial History of Distributor* (*TG*), *The Product Portfolio of Distributor* (*DP*), *Number of Current Reachable Points* (*NS*), *Number of Sales Man and Vehicles* (*EA*), *Loyalty to Due Dates and Payments* (*VU*); *Price Applications of Competitors* (*FU*), *Brand Positioning* (*MK*), *Distributing Strategies of Competitors* (*RS*), *Institutionalization Status of Competitors* (*RK*), *Advertising Strategies* (*RE*), *Local Origin* (*YO*), *Aggregated Portfolio* (*BP*); *Managerial Support* (*YD*), *Technological Infrastructure* (*TD*), *Marketing Budget* (*PB*), *Effective Feedback/Return from Sales' Incomes* (*EG*), *Effective Fund Management* (*EF*).
Third level (*level of alternatives*). The organization strategy alternatives for distribution channel management in the model are; *Product Based Strategy* (*ÜBS*), *Geographic Based Strategy* (*CBS*), *Customer Based Strategy* (*MBS*), *Function Based Strategy* (*FBS*), *Hybrid Based Strategy* (*KBS*).

In the following, the methods of fuzzy analytic hierarchy process and hierarchical fuzzy TOPSIS have been applied for evaluating and selecting among the five organization strategy model for distribution channel management of vegetable oil manufacturer.

Table 36
$\widetilde{I}_{SA}$.

	MP	DG	RP	FP
ÜD	(0.3, 0.5, 0.7)	0	0	0
AD	(0.3, 0.5, 0.7)	0	0	0
KD	(0.8, 1, 1)	0	0	0
FD	(0.3, 0.5, 0.7)	0	0	0
TN	(0.6, 0.8, 1)	0	0	0
DF	0	(0.8, 1, 1)	0	0
TG	0	(0.8, 1, 1)	0	0
DP	0	(0.3, 0.5, 0.7)	0	0
NS	0	(0.3, 0.5, 0.7)	0	0
EA	0	(0, 0.2, 0.4)	0	0
VU	0	(0.3, 0.5, 0.7)	0	0
FU	0	0	(0.3, 0.5, 0.7)	0
MK	0	0	(0.8, 1, 1)	0
RS	0	0	(0.8, 1, 1)	0
RK	0	0	(0.3, 0.5, 0.7)	0
RE	0	0	(0.3, 0.5, 0.7)	0
YO	0	0	(0, 0.2, 0.4)	0
BP	0	0	(0.3, 0.5, 0.7)	0
YD	0	0	0	(0.6, 0.8, 1)
TD	0	0	0	(0.3, 0.5, 0.7)
PB	0	0	0	(0.6, 0.8, 1)
EG	0	0	0	(0.6, 0.8, 1)
EF	0	0	0	(0.8, 1, 1)

5.1. Solution of FAHP method

In this study, we use Chang's extent analysis method on FAHP due to its computational simplicity and effectiveness. The fuzzy comparison matrices of FAHP are taken from the fuzzifying comparison matrices in the Paksoy, Bayraktar, and

Table 37
$\widetilde{I}_A$.

	ÜD	AD	FD	KD	TN	DF	TG	DP
ÜBS	(80,80,100)	(30,50,70)	(30,50,70)	(30,50,70)	(80,80,100)	(60,80,100)	(30,50,70)	(60,80,100)
CBS	(80,80,100)	(60,80,100)	(30,50,70)	(30,50,70)	(30,50,70)	(60,80,100)	(80,80,100)	(0,20,40)
MBS	(0,20,40)	(0,20,40)	(0,20,40)	(60,80,100)	(0,20,40)	(0,20,40)	(80,80,100)	(0,0,20)
FBS	(0,20,40)	(0,20,40)	(0,20,40)	(0,0,20)	(0,20,40)	(30,50,70)	(30,50,70)	(0,20,40)
KBS	(80,80,100)	(80,80,100)	(80,80,100)	(80,80,100)	(60,80,100)	(80,80,100)	(80,80,100)	(80,80,100)
	NS	EA	VU	FU	MK	RS	RK	RE
ÜBS	(0,20,40)	(0,20,40)	(0,20,40)	(80,80,100)	(80,80,100)	(60,80,100)	(0,20,40)	(60,80,100)
CBS	(80,80,100)	(80,80,100)	(30,50,70)	(80,80,100)	(60,80,100)	(80,80,100)	(0,20,40)	(30,50,70)
MBS	(30,50,70)	(0,20,40)	(30,50,70)	(30,50,70)	(30,50,70)	(30,50,70)	(0,20,40)	(80,80,100)
FBS	(0,20,40)	(0,20,40)	(30,50,70)	(0,20,40)	(0,20,40)	(30,50,70)	(30,50,70)	(0,20,40)
KBS	(80,80,100)	(80,80,100)	(80,80,100)		(80,80,100)	(80,80,100)	(80,80,100)	(30,50,70)
	YO	BP	YD	TD	PB	EG	EF	
ÜBS	(80,80,100)	(0,20,40)	(80,80,100)	(30,50,70)	(30,50,70)	(0,20,40)	(0,0,20)	
CBS	(80,80,100)	(0,20,40)	(30,50,70)	(30,50,70)	(30,50,70)	(30,50,70)	(0,20,40)	
MBS	(80,80,100)	(30,50,70)	(80,80,100)	(30,50,70)	(30,50,70)	(0,20,40)	(30,50,70)	
FBS	(30,50,70)	(80,80,100)	(30,50,70)	(0,0,20)	(0,20,40)	(30,50,70)	(0,0,20)	
KBS	(60,80,100)	(0,0,20)	(0,20,40)	(80,80,100)	(80,80,100)	(80,80,100)	(80,80,100)	

Table 38
r_{ij} values.

	ÜD	AD	FD	KD	TN	DF	TG	DP
ÜBS	(0.8,1,1.25)	(0.3,0.625,0.875)	(0.3,0.625,0.875)	(0.3,0.625,0.875)	(0.8,1,1.25)	(0.6,1,1.25)	(0.3,0.625,0.875)	(0,0.25,0.5)
CBS	(0.8,1,1.25)	(0.6,1,1.25)	(0.3,0.625,0.875)	(0.3,0.625,0.875)	(0.3,0.625,0.875)	(0.6,1,1.25)	(0.8,1,1.25)	(0.6,1,1.25)
MBS	(0,0.25,0.5)	(0,0.25,0.5)	(0,0.25,0.5)	(0.6,1,1.25)	(0,0.25,0.5)	(0,0.25,0.5)	(0.8,1,1.25)	(0,0,0.25)
FBS	(0,0.25,0.5)	(0,0.25,0.5)	(0,0.25,0.5)	(0,0.25,0.5)	(0,0.25,0.5)	(0.3,0.625,0.875)	(0.3,0.625,0.875)	(0,0.25,0.5)
KBS	(0.8,1,1.25)	(0.8,1,1.25)	(0.8,1,1.25)	(0.8,1,1.25)	(0.6,1,1.25)	(0.8,1,1.25)	(0.8,1,1.25)	(0.8,1,1.25)
	NS	EA	VU	FU	MK	RS	RK	RE
ÜBS	(0,0.25,0.5)	(0,0.25,0.5)	(0,0.25,0.5)	(0.8,1,1.25)	(0.8,1,1.25)	(0.6,1,1.25)	(0,0.25,0.5)	(0.6,1,1.25)
CBS	(0.8,1,1.25)	(0.8,1,1.25)	(0.3,0.625,0.875)	(0.8,1,1.25)	(0.6,1,1.25)	(0.8,1,1.25)	(0,0.25,0.5)	(0.3,0.625,0.875)
MBS	(0.3,0.625,0.875)	(0,0.25,0.5)	(0.3,0.625,0.875)	(0.3,0.625,0.875)	(0.3,0.625,0.875)	(0.3,0.625,0.875)	(0,0.25,0.5)	(0.8,1,1.25)
FBS	(0,0.25,0.5)	(0,0.25,0.5)	(0.3,0.625,0.875)	(0,0.25,0.5)	(0,0.25,0.5)	(0.3,0.625,0.875)	(0.3,0.625,0.875)	(0,0.25,0.5)
KBS	(0.8,1,1.25)	(0.8,1,1.25)	(0.8,1,1.25)	(0.6,1,1.25)	(0.8,1,1.25)	(0.8,1,1.25)	(0.8,1,1.25)	(0.3,0.625,0.875)
	YO	BP	YD	TD	PB	EG	EF	
ÜBS	(0.8,1,1.25)	(0,0.25,0.5)	(0.8,1,1.25)	(0.3,0.625,0.875)	(0.3,0.625,0.875)	(0,0.25,0.5)	(0,0,0.25)	
CBS	(0.8,1,1.25)	(0,0.25,0.5)	(0.3,0.625,0.875)	(0.3,0.625,0.875)	(0.3,0.625,0.875)	(0.3,0.625,0.875)	(0,0.25,0.5)	
MBS	(0.8,1,1.25)	(0.3,0.625,0.875)	(0.8,1,1.25)	(0.3,0.625,0.875)	(0.3,0.625,0.875)	(0,0.25,0.5)	(0.3,0.625,0.875)	
FBS	(0.3,0.625,0.875)	(0.8,1,1.25)	(0.3,0.625,0.875)	(0,0.25,0.5)	(0,0.25,0.5)	(0.3,0.625,0.875)	(0,0,0.25)	
KBS	(0.6,1,1.25)	(0,0,0.25)	(0,0.25,0.5)	(0.8,1,1.25)	(0.8,1,1.25)	(0.8,1,1.25)	(0.8,1,1.25)	

Kocabaş (2007). In this approach, triangular fuzzy scale is used for the solving FAHP.

The results of the FAHP method are shown in Tables 2–34.

From Table 2,

$$S_{MP} = (6.25, 7.33, 8.5) \otimes (19.25, 24.73, 31)^{-1}$$
$$= (6.25, 7.33, 8.5) \otimes (1/31, 1/24.73, 1/19.25)$$
$$= (0.2, 0.2964, 0.4415)$$

$$S_{DG} = (0.05, 0.07, 0.12)$$
$$S_{RP} = (0.10, 0.18, 0.31)$$
$$S_{FP} = (0.25, 0.44, 0.72)$$

are obtained. Using these vectors,

$$V(S_{MP} \geqslant S_{DG}) = 1, \quad V(S_{MP} \geqslant S_{RP}) = 1$$
$$V(S_{MP} \geqslant S_{FP}) = 0.5588$$
$$V(S_{DG} \geqslant S_{MP}) = 0, \quad V(S_{DG} \geqslant S_{RP}) = 0.153$$
$$V(S_{DG} \geqslant S_{FP}) = 0$$
$$V(S_{RP} \geqslant S_{MP}) = 0.545, \quad V(S_{RP} \geqslant S_{DG}) = 1$$
$$V(S_{RP} \geqslant S_{FP}) = 0.1875$$
$$V(S_{FP} \geqslant S_{MP}) = 1, \quad V(S_{FP} \geqslant S_{DG}) = 1$$
$$V(S_{FP} \geqslant S_{RP}) = 1$$

are obtained. Thus the weight vector from Table 1 is calculated as,

$$W_G = (0.3211, 0, 0.580521, 0.098379)^T.$$

Similarly, the other priority vectors are calculated in the following.

Table 34 shows overall or global importance levels for the sub criteria in order to select the best distribution channels. According to these results, KBS is the most preferred alternative with 29.9% in terms of all criteria. ÜBS and CBS have the same importance level 23%. MBS has 16% importance level, but FBS is the least preferred alternatives in terms of all criteria.

5.2. Solution of the HFTOPSIS

By applying the steps of HFTOPSIS algorithm to our application, we have 4 main attributes, 23 sub-attributes and 5 alternatives. Taking the hierarchy given in Fig. 2 into consideration a questionnaire for fuzzy TOPSIS given in appendix was prepared. Evaluations from the all respondents are taken and $\widetilde{I}_{MA}, \widetilde{I}_{SA}$ and $\widetilde{I}_A$ are obtained and given in Tables 35–37. Tables 38–42 obtain $r_{ij}, M(v_{ij}), D^*_{ij}$, and D^-_{ij} values.

Table 43 shows the distances from the ideal solution and the normalized values for each strategy.

As it can be seen from Table 43, the best organization strategy for distribution channel management of vegetable oil manufacturer among the considered strategies is the hybrid based strategy

Table 39
v_{ij} values.

	ÜD	AD	FD	KD	TN	DF	TG	DP
ÜBS	(0.072, 0.25, 0.8125)	(0.027, 0.1562,0.4287)	(0.072, 0.25, 0.8125)	(0.027, 0.1562,0.4287)	(0.144, 0.4, 0.875)	(0, 0, 0.25)	(0, 0, 0.175)	(0, 0, 0.07)
CBS	(0.072, 0.25, 0.8125)	(0.054,0.25, 0.6125)	(0.072, 0.25, 0.8125)	(0.027, 0.1562,0.4287)	(0.054,0.25, 0.6125)	(0, 0, 0.25)	(0, 0, 0.25)	(0, 0, 0.175)
MBS	(0,0.0625,0.245)	(0, 0.0625, 0.245)	(0, 0.125, 0.35)	(0.054,0.25, 0.6125)	(0, 0.1, 0.35)	(0, 0, 0.1)	(0, 0, 0.25)	(0, 0, 0.035)
FBS	(0,0.0625,0.245)	(0, 0.0625, 0.245)	(0, 0.125, 0.35)	(0, 0, 0.1225)	(0, 0.1, 0.35)	(0, 0, 0.175)	(0, 0, 0.175)	(0, 0, 0.07)
KBS	(0.072, 0.25, 0.8125)	(0.072, 0.25, 0.8125)	(0.192, 0.5, 0.875)	(0.072, 0.25, 0.8125)	(0.108, 0.4, 0.875)	(0, 0, 0.25)	(0, 0, 0.25)	(0, 0, 0.175)
	NS	EA	VU	FU	MK	RS	RK	RE
ÜBS	(0, 0, 0.07)	(0, 0, 0.04)	(0, 0, 0.07)	(0.072, 0.25, 0.8125)	(0.192, 0.5, 0.875)	(0.144, 0.4, 0.875)	(0, 0.0625, 0.245)	(0.054,)0.25, 0.6125
CBS	(0, 0, 0.175)	(0, 0, 0.1)	(0, 0, 0.1225)	(0.072, 0.25, 0.8125)	(0.144, 0.4, 0.875)	(0.192, 0.5, 0.875)	(0, 0.0625, 0.245)	(0.027, 0.1562,0.4287)
MBS	(0, 0, 0.1225)	(0, 0, 0.04)	(0, 0, 0.1225)	(0.027, 0.1562,0.4287)	(0.072, 0.25, 0.8125)	(0.072, 0.25, 0.8125)	(0, 0.0625, 0.245)	(0.072, 0.25, 0.8125)
FBS	(0, 0, 0.07)	(0, 0, 0.04)	(0, 0, 0.1225)	(0, 0.0625, 0.245)	(0, 0.125, 0.35)	(0.072, 0.25, 0.8125)	(0.027, 0.1562,0.4287)	(0, 0.0625, 0.245)
KBS	(0, 0, 0.175)	(0, 0, 0.1)	(0, 0, 0.175)	(0.054,)0.25, 0.6125		(0.192, 0.5, 0.875)	(0.072, 0.25, 0.8125)	(0.027, 0.1562,0.4287)
	YO	BP	YD	TD	PB	EG	EF	
ÜBS	(0, 0.1, 0.35)	(0, 0.0625, 0.245)	(0.384, 0.8, 1.25)	(0.072, 0.25, 0.8125)	(0.144, 0.4, 0.875)	(0, 0.2, 0.5)	(0, 0, 0.25)	
CBS	(0, 0.1, 0.35)	(0, 0.0625, 0.245)	(0.144, 0.5, 0.875)	(0.072, 0.25, 0.8125)	(0.144, 0.4, 0.875)	(0.144, 0.4, 0.875)	(0, 0.25, 0.5)	
MBS	(0, 0.1, 0.35)	(0.027, 0.1562,0.4287)	(0.384, 0.8, 1.25)	(0.072, 0.25, 0.8125)	(0.144, 0.4, 0.875)	(0, 0.2, 0.5)	(0.192, 0.5, 0.875)	
FBS	(0, 0.0625, 0.245)	(0.072, 0.25, 0.8125)	(0.144, 0.5, 0.875)	(0, 0, 0.175)	(0, 0.2, 0.5)	(0.144, 0.4, 0.875)	(0, 0, 0.25)	
KBS	(0, 0.1, 0.35)	(0, 0, 0.1225)		(0.192, 0.5, 0.875)	(0.384, 0.8, 1.25)	(0.384, 0.8, 1.25)	(0.512, 1, 1.25)	

Table 40
$M(v_{ij})$ values.

	ÜD	AD	FD	KD	TN	DF	TG	DP
ÜBS	0.3178	0.2052	0.3387	0.2052	0.4919	0.0833	0.0583	0.0233
CBS	0.3178	0.3089	0.3387	0.2052	0.3089	0.0833	0.0833	0.0583
MBS	0.1025	0.1025	0.1583	0.3089	0.15	0.0333	0.0833	0.0116
FBS	0.1025	0.1025	0.1583	0.0408	0.15	0.0583	0.0583	0.0233
KBS	0.3178	0.1025	0.5583	0.3178	0.4711	0.0833	0.0833	0.0583
	NS	EA	VU	FU	MK	RS	RK	RE
ÜBS	0.0233	0.0133	0.0233	0.3178	0.5583	0.5252	0.1025	0.3089
CBS	0.0583	0.0333	0.0408	0.3178	0.5252	0.5583	0.1025	0.2052
MBS	0.0408	0.0133	0.0408	0.2052	0.3387	0.3387	0.1025	0.3178
FBS	0.0233	0.0133	0.0408	0.1025	0.1583	0.3387	0.2052	0.1025
KBS	0.0583	0.0333	0.0583	0.3089	0.5583	0.5583	0.3178	0.2052
	YO	BP	YD	TD	PB	EG	EF	
ÜBS	0.15	0.1025	0.9248	0.3387	0.5252	0.2333	0.0833	
CBS	0.15	0.1025	0.5252	0.3387	0.5252	0.5252	0.25	
MBS	0.15	0.2052	0.9248	0.3387	0.5252	0.2333	0.5999	
FBS	0.1025	0.3178	0.5252	0.0583	0.2333	0.5252	0.0833	
KBS	0.15	0.0408	0.2333	0.5583	0.9248	0.9248	1.1574	

(KBS). On the other hand, Function Based Strategy (FBS) has the lowest importance among the strategies.

6. Conclusions

In this study, FAHP and HFTOPSIS models are presented for evaluating the distribution channel management strategy in a vegetable oil manufacturer company, which distribute its products all over the country. Due to the structure of the distribution hierarchy, the company wanted to decide the organization strategy to manage the distribution channels. The company has five organization strategies for distribution channel management: Product based strategy (ÜBS), Geographic based strategy (CBS), Customer based strategy (MBS), function based strategy (FBS) and hybrid based strategy (KBS). We proposed a hierarcical decison model including determinants of distribution channel management for the company and its sector as; (i) customer profile, (ii) distributor reliability, (iii) the position of competitors in market, and (iv) managerial and financial perspective.

FAHP method is utilized to determine the weights of the main and subcriteria of the performance evaluation hieararchy. FAHP is an easy and efficient method in utilizing both qualitative and quantitive data and it was succesfully applied to the evaluating

Table 41
D_{ij}^{*} values.

	ÜD	AD	FD	KD	TN	DF	TG	DP
ÜBS	0	0.2081	0.3083	0.2081	0	0	0	0
CBS	0	0	0.3083	0.2081	0.2425	0	0	0
MBS	0.5201	0.5201	0.7035	0	0.5928	0	0	0
FBS	0.5201	0.5201	0.7035	0.8319	0.5928	0	0	0
KBS	0	0	0	0	−2.22e−16	0	0	0
	NS	EA	VU	FU	MK	RS	RK	RE
ÜBS	0	0	0	0	0	1.11e−16	0.5201	0
CBS	0	0	0	0	1.11e−16	0	0.5201	0.2081
MBS	0	0	0	0.2081	0.3083	0.3083	0.5201	0
FBS	0	0	0	0.5201	0.7035	0.3083	0.2081	0.5201
KBS	0	0	0		0	0	0	0.2081
	YO	BP	YD	TD	PB	EG	EF	
ÜBS	1.11e−16	0.5201	−2.22e−16	0.3083	0.3792	0.8379	1.3550	
CBS	1.11e−16	0.5201	0.3792	0.3083	0.3792	0.3792	1.0162	
MBS	1.11e−16	0.2081	−2.22e−16	0.3083	0.3792	0.8379	0.5081	
FBS	0.1327	0	0.3792	1.0351	0.8379	0.3792	1.3550	
KBS	1.11e−16	0.8319	0.8379	1.11e−16	−2.22e−16	−2.22e−16	1.11e−16	

Table 42
D_{ij}^{-} values.

	ÜD	AD	FD	KD	TN	DF	TG	DP
ÜBS	0.5201	0.3007	0.4027	0.6206	0.5928	0	0	0
CBS	0.5201	0.4953	0.4027	0.6206	0.3383	0	0	0
MBS	1.11e−16	1.11e−16	0	0.7849	0	0	0	0
FBS	1.11e−16	1.11e−16	0	0	0	0	0	0
KBS	0.5201	0.5201	0.7035	0.8319	0.5535	0	0	0
	NS	EA	VU	FU	MK	RS	RK	RE
ÜBS	0	0	0	0.5201	0.7035	0.2858	1.11e−16	0.4953
CBS	0	0	0	0.5201	0.6454	0.3083	1.11e−16	0.3007
MBS	0	0	0	0.3007	0.4027	0	1.11e−16	0.5201
FBS	0	0	0	1.11e−16	0	0	0.3007	1.11e−16
KBS	0	0	0	0.4953	0.7035	0.3083	0.5201	0.5201
	YO	BP	YD	TD	PB	EG	EF	
ÜBS	0.1327	0.3378	0.8379	0.7521	0.4573	0	0	
CBS	0.1327	0.3378	0.4573	0.7521	0.4573	0.4573	0.5	
MBS	0.1327	0.6206	0.8379	0.7521	0.4573	0	0.9150	
FBS	0	0.8319	0.4573	0	0	0.4573	0	
KBS	0.1327	0	0	1.0351	0.8379	0.8379	1.3550	

Table 43
S_i^{*}, S_i^{-}, C_i.

	S_i^{*}	S_i^{-}	C_i	NormalizedC_i
ÜBS	4.6454	6.9600	0.5997	0.2202
CBS	4.4697	7.2445	0.6184	0.2270
MBS	5.9235	5.7244	0.4914	0.1804
FBS	9.5483	2.0473	0.1765	0.0648
KBS	1.8780	9.6563	0.8371	0.3074

and selecting the distribution channned management strategy. On the other hand, HFTOPSIS method is used for ranking of organization strategies in terms of distribution channel management determinants. In this study, we compared these two methods in order to compare the obtained results for the distribution strategy selection problem. After the evaluation among the five alternatives using both FAHP and HFTOPSIS, hybrid based strategy (KBS) which has the greatest desirability index value is determined as the best choice. Both of the method yields the same results. Ranking of the distribution strategies according to the scores are the same for both of the methods and as follows: Hybrid Based Strategy (KBS), Geographic based strategy (CBS), Product based strategy (ÜBS), Customer based strategy (MBS), and Function based strategy (FBS).

Thus, the decison maker can apply one of the methods in order to choose an organization strategy in the distribution channel management. The case of the vegetable oil manufacturer company provides the researchers and practitioners to understand in a better way the importance of developing organization strategy in channel management from a practical point of view.

We assumed independencies amoung criteria. For further study, we suggest that if some inner and outer dependencies occur among the criteria, the application of analytic network process (ANP) should be examined and the results may be compared with ours.

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Appendix A. Questionnare for fuzzy topsis

Questionnaire form used to facilitate importances of main attributes wrt. goal

With respect to the goal "Selection of the best organization strategy for distribution management".

Q1. What degree of importance do you assign to the main attribute *Customer Profile* (*MP*)?
Q2. What degree of importance do you assign to the main attribute *Distributor reliability* (*DG*)?
Q3. What degree of importance do you assign to the main attribute *The position of competitors in market* (*RP*)?
Q4. What degree of importance do you assign to the main attribute *Managerial and financial perspective* (*FP*)?

With respect to overall goal		Importance of one attribute with respect to overall goal				
Question	Attribute	(0,0,0.2) very low	(0,0.2,0.4) low	(0.3,0.5,0.7) medium	(0.8,0.8,1) high	(0.8,1,1) very high
Q1	MP			√		
Q2	DG	√				
Q3	RP			√		
Q4	FP					√

Questionnaire forms used to facilitate importances of sub-attributes wrt. Main attributesWith respect to the main attribute "***Customer Profile*** (***MP***)"

Q5. What degree of importance do you assign to sub-attribute *Sensitivty to type of product* (*ÜD*)?
Q6. What degree of importance do you assign to sub-attribute *Sensitivty to type of package* (*AD*)?
Q7. What degree of importance do you assign to sub-attribute *Sensitivty to price* (*FD*)?
Q8. What degree of importance do you assign to sub-attribute *Sensitivty to product's quality and attribute* (*KD*)?
Q9. What degree of importance do you assign to sub-attribute *Total consuming points (instutional sale)* (*TN*)?

With respect to MP		Importance of sub-attribute with respect to main attribute MP				
Question	Sub-attribute	(0,0,0.2) very low	(0,0.2,0.4) low	(0.3,0.5,0.7) medium	(0.8,0.8,1) high	(0.8,1,1) very high
Q5	ÜD		√			
Q6	AD			√		
Q7	FD					√
Q8	KD			√		
Q9	TN					√

With respect to the main attribute "***Distributor Reliability*** (***DG)".***

Q10. What degree of importance do you assign to sub-attribute *The financial structure of distributor (DF)*?
Q11. What degree of importance do you assign to sub-attribute *The commercial history of distributor* (*TG*)?
Q12. What degree of importance do you assign to sub-attribute *The product portfolio of distributor* (*DP*)?
Q13 What degree of importance do you assign to sub-attribute *The number of current reachable points* (*NS*)?
Q14. What degree of importance do you assign to sub-attribute *Number of sales man and vehicles* (*EA*)?
Q15. What degree of importance do you assign to sub-attribute *Loyalty to due dates and payments* (*VU*)?

With respect to DG		Importance of sub-attribute with respect to main attribute DG				
Question	Sub-attribute	(0,0,0.2) very low	(0,0.2,0.4) low	(0.3,0.5,0.7) medium	(0.8,0.8,1) high	(0.8,1,1) very high
Q10	DF					√
Q11	TG					√
Q12	DP			√		
Q13	NS			√		
Q14	EA		√			
Q15	VU			√		

With respect to the main attribute "***The position of competitiors of market*** (***RP)".***

Q16. What degree of importance do you assign to sub-attribute *Price applications of competitors (FU)*?
Q17. What degree of importance do you assign to sub-attribute *Brand posititioning* (*MK*)?
Q18. What degree of importance do you assign to sub-attribute *Distributing strategies of competitors* (*RS*)?
Q19 What degree of importance do you assign to sub-attribute *Instutionalization status of competitors* (*RK*)?
Q20. What degree of importance do you assign to sub-attribute *Advertising strategies* (*RE*)?
Q21. What degree of importance do you assign to sub-attribute *Local orgin* (*YO*)?
Q22. What degree of importance do you assign to sub-attribute *Aggregated portfolio* (*BP*)?

With respect to RP		Importance of sub-attribute with respect to main attribute RP				
Question	Sub-attribute	(0,0,0.2) very low	(0,0.2,0.4) low	(0.3,0.5,0.7) medium	(0.8,0.8,1) high	(0.8,1,1) very high
Q16	FU			√		
Q17	MK					√
Q18	RS					√
Q19	RK			√		
Q20	RE			√		
Q21	YO		√			
Q22	BP			√		

With respect to the main attribute "***Manaegrial and Financial Perspective*** (***FP)".***

Q23. What degree of importance do you assign to sub-attribute*Manageral Support* (*YD*)?
Q24. What degree of importance do you assign to sub-attribute *Technological Infrtructure* (*TD*)?
Q25. What degree of importance do you assign to sub-attribute *MarketingBudget* (*PB*)?
Q26. What degree of importance do you assign to sub-attribute *Effective feedback/return from sales' incomes* (*EG*)?
Q27. What degree of importance do you assign to sub-attribute *effective fund management* (*EF*)?

With respect to FP		Importance of sub-attribute with respect to main attribute FP				
Question	Sub-attribute	(0,0,0.2) very low	(0,0.2,0.4) low	(0.3,0.5,0.7) medium	(0.8,0.8,1) high	(0.8,1,1) very high
Q23	YD				√	
Q24	TD			√		
Q25	PB				√	
Q26	EG				√	
Q27	EF					√

Questionnaire form used to facilitate scores of alternatives wrt.sub-attributes

Scoring of Alternatives with respect to sub-attributes

Q28. What scores do you assign to each Alternatives with respect to the sub-attribute ÜD?
Q29. What scores do you assign to each Alternatives with respect to the sub-attribute AD?
Q30. What scores do you assign to each Alternatives with respect to the sub-attribute FD?
Q31. What scores do you assign to each Alternatives with respect to the sub-attribute KD?
Q32. What scores do you assign to each Alternatives with respect to the sub-attribute TN?
Q33. What scores do you assign to each Alternatives with respect to the sub-attribute DF?
Q34. What scores do you assign to each Alternatives with respect to the sub-attribute TG?
Q35. What scores do you assign to each Alternatives with respect to the sub-attribute DP?
Q36. What scores do you assign to each Alternatives with respect to the sub-attribute NS?
Q37. What scores do you assign to each Alternatives with respect to the sub-attribute EA?
Q38. What scores do you assign to each Alternatives with respect to the sub-attribute VU?
Q39. What scores do you assign to each Alternatives with respect to the sub-attribute FU?
Q40. What scores do you assign to each Alternatives with respect to the sub-attribute MK?
Q41. What scores do you assign to each Alternatives with respect to the sub-attribute RS?
Q42. What scores do you assign to each Alternatives with respect to the sub-attribute RK?
Q43. What scores do you assign to each Alternatives with respect to the sub-attribute RE?
Q44. What scores do you assign to each Alternatives with respect to the sub-attribute YO?
Q45. What scores do you assign to each Alternatives with respect to the sub-attribute BP?
Q46. What scores do you assign to each Alternatives with respect to the sub-attribute YD?
Q47. What scores do you assign to each Alternatives with respect to the sub-attribute TD?
Q48. What scores do you assign to each Alternatives with respect to the sub-attribute PB?
Q49. What scores do you assign to each Alternatives with respect to the sub-attribute EG?
Q50. What scores do you assign to each Alternatives with respect to the sub-attribute EF?

Question	Attributes	Alternatives	(0,0,20) very low	(0,20,40) low	(30,50,70) medium	(60,80,100) high	(80,80,100) very high
Q28	ÜD	ÜBS					√
		CBS					√
		MBS		√			
		FBS		√			
		KBS					√

(*continued*)

Question	Attributes	Alternatives	(0,0,20) very low	(0,20,40) low	(30,50,70) medium	(60,80,100) high	(80,80,100) very high
Q29	AD	ÜBS			√		
		CBS				√	
		MBS		√			
		FBS		√			
		KBS					√
Q30	FD	ÜBS			√		
		CBS			√		
		MBS		√			
		FBS		√			
		KBS					√
Q31	KD	ÜBS			√		
		CBS			√		
		MBS				√	
		FBS	√				
		KBS					√
Q32	TN	ÜBS					√
		CBS			√		
		MBS		√			
		FBS		√			
		KBS				√	
Q33	DF	ÜBS				√	
		CBS				√	
		MBS		√			
		FBS			√		
		KBS					√
Q34	TG	ÜBS			√		
		CBS					√
		MBS					√
		FBS			√		
		KBS					√
Q35	DP	ÜBS		√			
		CBS				√	
		MBS	√				
		FBS		√			
		KBS					√
Q36	NS	ÜBS		√			
		CBS					√
		MBS			√		
		FBS		√			
		KBS					√
Q37	EA	ÜBS		√			
		CBS					√
		MBS		√			
		FBS		√			
		KBS					√
Q38	VU	ÜBS		√			
		CBS			√		
		MBS			√		
		FBS			√		
		KBS					√
Q39	FU	ÜBS					√
		CBS					√

(*continued on next page*)

(*continued*)

Question	Attributes	Alternatives	(0,0,20) very low	(0,20,40) low	(30,50,70) medium	(60,80,100) high	(80,80,100) very high
		MBS			√		
		FBS		√			
		KBS				√	
Q40	MK	ÜBS					√
		CBS				√	
		MBS			√		
		FBS		√			
		KBS					√
Q41	RS	ÜBS				√	
		CBS					√
		MBS			√		
		FBS			√		
		KBS					√
Q42	RK	ÜBS		√			
		CBS		√			
		MBS		√			
		FBS			√		
		KBS					√
Q43	RE	ÜBS				√	
		CBS			√		
		MBS					√
		FBS		√			
		KBS			√		
Q44	YO	ÜBS					√
		CBS					√
		MBS					√
		FBS			√		
		KBS				√	
Q45	BP	ÜBS		√			
		CBS		√			
		MBS			√		
		FBS					√
		KBS	√				
Q46	YD	ÜBS					√
		CBS			√		
		MBS					√
		FBS			√		
		KBS		√			
Q47	TD	ÜBS			√		
		CBS			√		
		MBS			√		
		FBS	√				
		KBS					√
Q48	PB	ÜBS			√		
		CBS			√		
		MBS			√		
		FBS		√			
		KBS					√
Q49	EG	ÜBS		√			
		CBS			√		
		MBS		√			
		FBS			√		
		KBS					√

(*continued*)

Question	Attributes	Alternatives	(0,0,20) very low	(0,20,40) low	(30,50,70) medium	(60,80,100) high	(80,80,100) very high
Q50	EF	ÜBS	√				
		CBS		√			
		MBS			√		
		FBS	√				
		KBS					√

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