Codifying and Prioritizing Strategies in Behnoush Company in Iran by Comparing Fuzzy TOPSIS and QSPM Methods

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ABSTRACT

Given the increasing growth of organizations at competing to get notification on market share, strategic planning required within organizations that received a large attention by scholars. In this study, according to the studies conducted in the past, strengths, weaknesses, opportunities, and threats and strategies were recognized in Behnoush Company located in Iran based on SWOT matrix. In this regard, a definition for key factors of success was used to categorize strategies using fuzzy TOPSIS and QSPM. Using fuzzy TOPSIS method, strategies "production of new products such as fruit juice to complete Product portfolio" were chosen as the most important strategy, and then strategies "branding" and "establishing new lines at Shirvan and Arak factories in Iran" as the offensive strategies ranked the second and third place. Furthermore, strategies "branding", "production of new products such as fruit juice to complete Product portfolio" and "bargaining to allot a percent of interest for healthy drinks products marketing" using QSPM method were chosen as the most important strategies. In the end, two methods of fuzzy TOPSIS and QSPM based on SAW matrix were compared. At this stage, two methods were considered as major objectives of organization. Finally fuzzy TOPSIS method was chosen as more proper method to rank strategies at Behnoush Company in Iran.

KEYWORDS: Strategic planning; ranking, SWOT matrix, fuzzy TOPSIS method; QSPM method, SAW method

1. INTRODUCTION

According to Behnoush Company, competition and competitive advantage at the world trade using a Systematic strategy and an organizational strategic planning can be achieved, mentioned that a deep understanding of *strengths and strategic areas within organization are all the axes that addressing them would help managers to have effective movement. This company despite having high competitive advantage and high sale rate in Iran has not contributed to export at world markets, mainly due to lack of proper markets, weakness at building customer database to recognize target customers and their needs, and finally production in accordance with their tastes and needs. Having a traditional look and attention into input resources existing at organization including educated force, high quality of products and marginal cost has distracted managers to consider other facets, and despite the large opportunities existing at different geographical regions to use these products, export rate at this organization to international markets has still remained just little. Another factor that has been mentioned competitors' entry to this market which jeopardizes company's status to* maintain market is concerned by managers. This study is examined given the strategic attitude in all facets as well as *strengths, weaknesses, opportunities, and threats, and a decision is adopted on how to move given the objectives and missions of organization so as to reach the aims. In this paper, we want to answer following questions: questions below are proposed:*

- *Which strategies are the most proper ones to develop market share at Behnoush Company?*
- *How is the ranking of these strategies using fuzzy TOPSIS method?*
- *How is the ranking of these strategies using QSPM method?*
- *Which of the methods above give us more proper results to rank strategies?*

2. MATERIALS AND METHODS

2.1. Fuzzy TOPSIS technique
Decision-Making stages using Fuzzy TOPSIS method are as follows:
Stage 1: obtain weights vector $w{\sim}j$
Stage 2: normalize matrix obtained from experts' views in relation to items that the new matrix would be as follows:

$$\bar{R} = \left[r_{ij}\right]_{m \times n} \qquad (1)$$

$$B \subseteq \{1, \dots, n\} \qquad (2)$$

$B \subseteq \{1, \dots, n\}$ *associates to indicators of interest and* $C \subseteq \{1, \dots, n\}$ *associated to indicators of cost.*

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$$r_{ij} = \left(\frac{a_i}{d_j} \cdot \frac{b_i}{d_j} \cdot \frac{c_i}{d_i} \cdot \frac{d_i}{d_i}\right) \quad j \subseteq B$$

$$r_{ij} = \left(\frac{a_{i-}}{d_j} \cdot \frac{b_{i-}}{d_j} \cdot \frac{c_{i-}}{d_i} \cdot \frac{d_{i-}}{d_i}\right) \quad j \subseteq C \qquad (3)$$

Stage 3: hence, weighted matrix would be as the one shown in formula 4.

$$\bar{V} = [\bar{v}_{ii}]_{m \times n}, i = 1,2,\dots,m, j = 1,2,\dots,n$$

$$\overline{v_{ij}} = \bar{r}_{ij} \times \overline{W}_j \qquad (4)$$

Stage 4: determine positive fuzzy ideal $FPIS^{\tilde{v}_j^*}$*, and negative fuzzy ideal* $FNIS^{\tilde{v}_j^*}$ *(Formula 5 and 6).*

$$\overline{v*}_i = \begin{cases} \max\limits_{f=1\dots m} \widetilde{v_{ij}} \; ; \; j \in B \\ \min\limits_{f=1\dots m} \tilde{v}_{ij} \; ; \; j \in C \end{cases} \qquad (5)$$

$$\overline{v-}_i = \begin{cases} \max\limits_{f=1\dots m} \widetilde{v_{ij}} \; ; \; j \in B \\ \min\limits_{f=1\dots m} \tilde{v}_{ij} \; ; \; j \in C \end{cases}$$

$$FPIS = \{\overline{v*}_i \,|\, j = 1,\dots,n\} \qquad (6)$$

$$FNIS = \{\overline{v-}_i \,|\, j = 1,\dots,n\}$$

Stage 5: calculate distances of sizes using Euclidean distance

$$D(\bar{a},\bar{b}) = \sqrt{\frac{1}{4}[(a_1 - b_1)^2 + (a_2 - b_2)^2 + (a_3 - b_3)^2 + (a_4 - b_4)^2]} \qquad (7)$$

Distance of each item from positive and negative ideal is calculated using Formulas 8 and 9:

$$d_i^* = \sum_{i=1}^n d(\widetilde{v_{ij}}, \widetilde{v_{ij}}), \; i = 1,\dots,m \qquad (8)$$

$$d_i^- = \sum_{i=1}^n d(\widetilde{v_{ij}}, \widetilde{v_{ij}}), \; i = 1,\dots,m \qquad (9)$$

Stage 6: calculate relative closeness to ideal and ranking (Formula 10)

$$C_{c_i} = \frac{d_i^-}{d_i^- + d_i^+} \qquad (10)$$

In real world due to incomplete information or inaccessible data, data generally are not absolute, yet are fuzzy. Hence, it has been mainly striven to use TOPSIS method using fuzzy data so as to prioritize selected strategies. Fuzzy values for variables have been shown for acceptance of each strategy in table 1.

Table 1. Variables to determine weigh of each criterion (Chen, 2000)

(0,0,1,2)	VL	Very low
(1,2,2,3)	L	Low
(2,3,4,5)	ML	Lower than average
(4,5,5,6)	M	Average
(5,6,7,8)	MH	Higher than average
(7,8,8,9)	H	High
(8,9,10,10)	VH	Very high

2.2. SAW method

This method is one of the most common Fuzzy Multicriteria Decision-Making Methods. These methods require calculating matrix using linear method. Since findings at each stage doing this method are all positive values, the expression below is used to calculate this matrix:

$$n_{ij} = \frac{a_{ij}}{\max a_{ij}} \qquad (11)$$

Thereafter, multiplying this matrix by weight of criteria, the value of A* is chosen that um of weight has to be high (Soltanpanah et al. 2010).

$$A^* = \left\{A_i \,|\, Max \sum_{j-1}^n n_y w_y\right\} \qquad (12)$$

2.3. RESEARCH METHOD

To rank strategies used at this organization, two questionnaires were used. To rank strategies, key factors of success as criteria were used and major objectives of Behnoush Company were used to compare Fuzzy and QSPM approaches. the first questionnaire includes two different parts that each include 15 questions to rank with Fuzzy and QSPM approaches ,

and the second questionnaire includes tables to carry out paired comparisons among major objectives of organization and importance of each of methods to major objectives of organization that distributed among statistical population followed by analysis of data from the first questionnaire. It should be noted that four questions attributed to gender, age, education status and working experience and one question attributed to demographic characteristics and one question attributed to an open question to get feedback from respondents' views and suggestions. To examine validity of questionnaires, content validity was used. For this, the questionnaires designed were all provided for experts at the field of management, and questions were modified. In the end, followed by confirmation by professors, the questionnaires were provided for statistical population. To measure reliability, Cronbach's Alpha was used. This value for the questions associated to Fuzzy TOPSIS and QSPM approaches and also the second questionnaire was obtained 0.75, 0.73 and 0.81 indicating high trust to questionnaire. Mathematically, there would not any need to calculate reliability at the second questionnaire, and the reason for this lies in paired comparison of items with each other that has lacked spectrum, so that doing calculations for reliability is not essential.

3. RESULTS

3.1. Behnoush Company strategies
Analysis of strengths and weaknesses, using opportunities and avoiding environmental threats caused strategies to be provided by experts. Table 2 shows the results.

Table 2. Behnoush Company strategies (Bayrami, 2010)

Weaknesses: *Low salary and lack of welfare facilities for personnel;* *Limited authorities on management;* *Divide company's interest in a year* *Low marketing budget;* *Lack of sufficient production capacity compared to market demand in high season;* *Low flexibility due to dependence on Oppressed and War Veterans*	**Strengths:** *Having brand name "DELESTER";* *Ability to produce in different packages;* *Company's reputation to assure and attract facilities;* *Environmental scattering of production(Tehran, Shiravan, Gachsaran, and Arak);* *Leadership of Alcohol-free beer market;* *Having cooking system in production of Alcohol-free beer;* *The massive sales with 140 distribution;* *Closeness of the main factory to main consuming market*	
Opportunities: *Closeness to market at Islamic countries and Welcome to Halal Food;* *Possibility to produce some raw material from the country;* *Market's tendency to consume tasty Alcohol-free beer;* *People's tendency to consumer natural products;* *Delegates' involvement and foreign machineries at Alcohol-free beer industry throughout the country;* *Reduce sale taxes on Alcohol-free beer from 15% to 2%*	**SO strategies:** *Producing new products like fruit juice to complete product portfolio;* *Establishing new line at Shiravan and Arak factories to increase production;* *Increasing export to Persian gulf countries;* *Use if brand*	**WO strategies:** *Bargaining to allot a percent of interest to healthy drinks products marketing;* *Increasing personnel's salary using decrease at taxes*
Threats: *Limitation on rating;* *Lack of stability at price of raw materials;* *Decrease in banking facilities at industry sector;* *Imports by foreign competitors without inclusion of rating law;* *Involvement by new companies and producers of soda pop at production industry of Alcohol-free beer market* *supply foreign products;* *increasing the time for process of importing raw materials and establish Documentary Credits due to sanctions;* *Reduction of suppliers of foreign materials;* *Large problems to get public licenses*	**ST strategies:** *Investment at supply chain;* *establishing Documentary Credits with high volume;* *justifying health and industry ministries to differentiate malt drinking from Alcohol-free beer;* *producing for commercial companies at Low season*	**WT strategies:** *devolving a part of production to new factories at this industry at High season;* *saving an amount of revenue per year to reduce banking costs*

3.2. Ranking strategies in Behnoush Company using Quantitative Strategic Planning Matrix (QSPM)

In this section, among the strategies from table 2, the most proper strategies were *prioritized using QSPM. The method of QSPM* is in a way that coefficient of all strengths and weaknesses as well as environmental threats and opportunities to all the strategies are measured. The sum of these coefficients for internal and external factors mentioned 1. Meanwhile, each of these factors included with appeal score, from 1 to 4 variables (without appeal (1), relatively appealing (2), logical appealing (3), so appealing (4). It should be noted that due to high volume of calculations, it is summarized in table 3.

Table 3. Ranking strategies using QSPM

Rank	Items
6	Production for commercial companies at Low season
10	Justifying health and industry ministries to differentiate malt drinking from Alcohol-free beer
4	Investment at supply chain
7	Increasing personnel's salary using decrease at taxes
11	Saving an amount of revenue per year to reduce banking costs
1	Branding
2	Producing new products like fruit juice to complete product portfolio
3	bargaining to allot a percent of interest to healthy drinks products marketing
5	establishing new line at Shiravan and Arak factories to increase production
8	Increasing export to Persian gulf countries
9	establishing Documentary Credits with high volume
12	devolving a part of production to new factories at this industry at High season

3.3. Ranking strategies in Behnoush Company using fuzzy TOPSIS
Matrix of decision making and fuzzy weight has been presented in table 4.

Table 4**.** Matrix of Decision making and fuzzy weight

	(8,9,10,10)	(7,8,8,9)	(4,5,5,6)	(2,3,4,5)	(7,8,8,9)
	C1	C2	C3	C4	C5
S1	(8,9,10,10)	(8,9,10,10)	(4,5,5,6)	(8,9,10,10)	(0,0,1,2)
S2	(0,0,1,2)	(2,3,4,5)	(2,3,4,5)	(2,3,4,5)	(4,5,5,6)
S3	(5,6,7,8)	(5,6,7,8)	(2,3,4,5)	(5,6,7,8)	(2,3,4,5)
S4	(2,3,4,5)	(4,5,5,6)	(0,0,1,2)	(0,0,1,2)	(5,6,7,8)
S5	(0,0,1,2)	(1,2,2,3)	(4,5,5,6)	(4,5,5,6)	(1,2,2,3)
S6	(7,8,8,9)	(7,8,8,9)	(7,8,8,9)	(7,8,8,9)	(4,5,5,6)
S7	(8,9,10,10)	(7,8,8,9)	(5,6,7,8)	(7,8,8,9)	(8,9,10,10)
S8	(2,3,4,5)	(7,8,8,9)	(8,9,10,10)	(8,9,10,10)	(7,8,8,9)
S9	(5,6,7,8)	(8,9,10,10)	(4,5,5,6)	(2,3,4,5)	(8,9,10,10)
S10	(2,3,4,5)	(2,3,4,5)	(7,8,8,9)	(5,6,7,8)	(7,8,8,9)
S11	(0,0,1,2)	(2,3,4,5)	(7,8,8,9)	(1,2,2,3)	(4,5,5,6)
S12	(2,3,4,5)	(2,3,4,5)	(1,2,2,3)	(4,5,5,6)	(0,0,1,2)

As shown in table 4, optimization of sale and purchase management and marketing management with very high score found as the most important key element for success at Behnoush Company, and improving financial resources management and total cost management with high score placed as the next key elements at success of Behnoush Company. Fuzzy normalized matrix has been proposed in table 5. This matrix indicates weights of each strategy given the key factors for success. Indeed, effect of weight of each of the key elements of success has been considered in weight of strategies. This matrix by applying formula four was formed.

Table 5. Fuzzy normalized matrix

	C1				C2				C3				C4				C5			
S1	0.04	0.81	1	1	0.56	0.72	0.8	0.9	0.16	0.23	0.25	0.36	0.16	0.27	0.4	0.5	0	0	0.08	0.18
S2	0	0	0.1	0.2	0.14	0.24	0.32	0.45	0.04	0.15	0.2	0.3	0.04	0.09	0.16	0.25	0.28	0.4	0.4	0.54
S3	0.4	0.54	0.7	0.8	0.35	0.48	0.56	0.72	0.08	0.15	0.2	0.3	0.1	0.18	0.28	0.4	0.14	0.24	0.32	0.45
S4	0.16	0.27	0.4	0.5	0.28	0.4	0.4	0.54	0	0	0.05	0.12	0	0	0.04	0.1	0.35	0.45	0.56	0.72
S5	0	0	0.1	0.2	0.07	0.16	0.16	0.27	0.16	0.25	0.25	0.36	0.08	0.15	0.2	0.3	0.07	0.16	0.16	0.27
S6	0.56	0.72	0.8	0.9	0.49	0.04	0.64	0.81	0.28	0.4	0.4	0.35	0.14	0.24	0.32	0.45	0.28	0.4	0.4	0.34
S7	0.64	0.81	1	1	0.49	0.64	0.64	0.81	0.28	0.4	0.4	0.54	0.14	0.24	0.32	0.45	0.35	0.72	0.8	0.9
S8	0.16	0.77	0.4	0.5	0.49	0.64	0.64	0.81	0.32	0.45	0.5	0.6	0.16	0.27	0.4	0.5	0.49	0.64	0.64	0.81
S9	0.4	0.54	0.7	0.8	0.56	0.72	0.8	0.9	0.16	0.25	0.25	0.36	0.04	0.09	0.16	0.25	0.36	0.72	0.8	0.9
S10	0.16	0.27	0.4	0.5	0.14	0.24	0.32	0.45	0.28	0.4	0.4	0.54	0.1	0.18	0.28	0.4	0.49	0.64	0.64	0.81
S11	0	0	0.1	0.2	0.14	0.24	0.32	0.45	0.28	0.4	0.4	0.54	0.02	0.06	0.08	0.15	0.28	0.4	0.4	0.54
S12	0.16	0.27	0.4	0.5	0.14	0.24	0.32	0.45	0.04	0.1	0.1	0.18	0.08	0.15	0.2	0.3	0	0	0.08	0.16

Table 6 shows sum of ideal points including positive, negative points, closeness coefficient, and final rank for strategies. To do this, equations 5-10 were employed.

Table 6. Sum of ideal points of positive, negative, closeness coefficient, and final rank of strategies

Items	d_i^+	d_i^-	C_{c_i}	Rank
Production for commercial companies at Low season	3.53	2.35	0.399	5
Justifying health and industry ministries to differentiate malt drinking from Alcohol-free beer	3.94	1.19	0.232	10
investment at supply chain	3.22	1.94	0.376	7
Increasing personnel's salary using decrease at taxes	3.69	1.43	0.279	8
Saving an amount of revenue per year to reduce banking costs	4.17	0.93	0.182	12
Branding	2.58	2.54	0.496	2
Producing new products like fruit juice to complete product portfolio	2.25	2.94	0.5656	1

Bargaining to allot a percent of interest to healthy drinks products marketing	2.64	2.50	0.485	**4**
Establishing new line at Shiravan and Arak factories to increase production	2.60	2.56	0.495	**3**
Increasing export to Persian gulf countries	3.14	2.00	0.388	**6**
Establishing Documentary Credits with high volume	3.77	1.34	0.262	**9**
Devolving a part of production to new factories at this industry at High season	4.05	1.07	0.210	**11**

As shown in table 6, "producing new products like fruit juice to complete product portfolio" with value of 0.565 has been chosen as the most important sub-criterion, and then "branding" and "establishing new line at Shiravan and Arak factories to increase production" with values of 0.496 and 0.495 are placed at second and third ranks. Also, "saving an amount of revenue per year to reduce banking costs" with value of 0.15 is the least important strategy at Behnoush company. To facilitate comparing outputs at both methods, sum of strategies given with priority using both methods *QSPM* and fuzzy TOPSIS have been given as follows in table 7.

Table 7. Comparing the priority of strategies using QSPM and fuzzy TOPSIS

Strategy	QSPM method	Fuzzy TOPSIS method
S1	6	5
S2	10	10
S3	4	7
S4	7	8
S5	11	12
S6	1	2
S7	2	1
S8	3	4
S9	5	3
S10	8	6
S11	9	9
S12	12	11

3.4. Comparing output of QSPM and fuzzy TOPSIS

Figure 1 shows a diagram of the relationship strategies for two methods QSPM and fuzzy TOPSIS, and Company's major objectives.
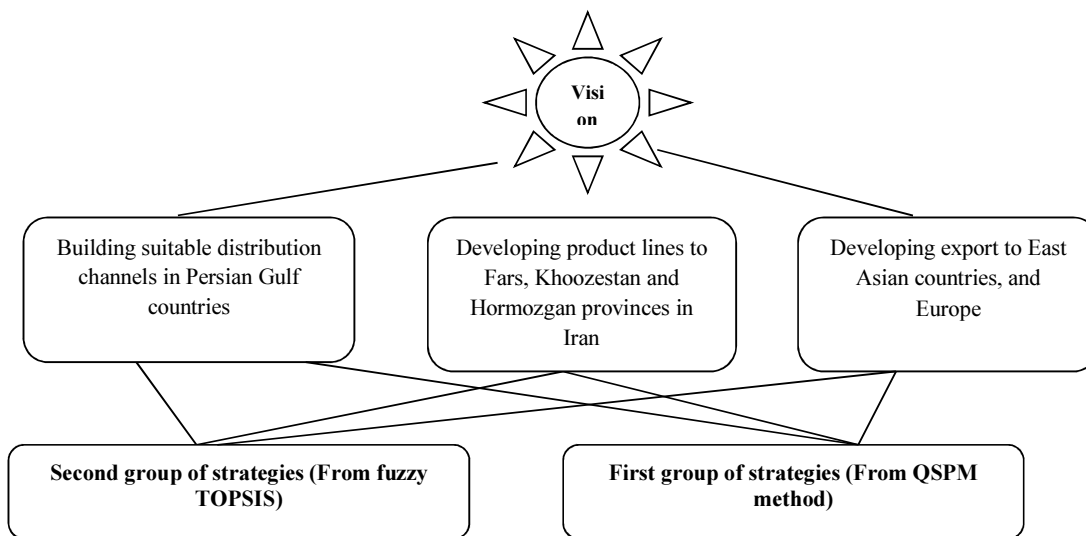

Figure 1. Relationship between strategies for two methods, and major objectives

Table 8 presents paired comparison of majors in views of experts.

Table 8. Matrix of paired comparison in views of experts

Vision	O1	O2	O3
O1	1	2	3
O2	-	1	1.2
O3	-	-	1

Given the paired comparison for the major objectives of Behnoush Company, with respect to influence in reaching to vision, based on table 9, it was specified that the objective "developing exports to east Asian countries, and Europe" with 41.1%, and "developing production lines to Hormozgan, Fars and Khuzestan provinces in Iran" with 21.5 % had the most and least importance to organizational vision, respectively. Table 9 shows weights from paired comparisons for objectives.

Table 9. Results of paired comparisons of major objectives in the Company

Long-term objectives of organization	Weights
Developing exports to east Asian countries, and Europe	0.411
Developing production lines to Hormozgan, Fars and Khuzestan provinces in Iran	0.215
Building proper distribution channels at Persian Gulf countries	0.347

Table 10 indicates to which extent each item affects other factors, obtained with regard to experts' views.

Table 10. Effect of objectives on other factors in Behnoush Company

Items	Developing exports to eastern Asian countries and Europe	Developing production lines to Hormozgan, Fars and Khuzestan provinces in Iran	Building proper distribution channels at Persian Gulf countries
First group (QSPM)	5	3	5
Second group (fuzzy TOPSIS)	9	5	7

Linear matrix from priority of methods has been proposed in table 11.

Table 11. Linear matrix using linear method

Items	Developing exports to eastern Asian countries and Europe	Developing production lines to Hormozgan, Fars and Khuzestan provinces in Iran	Building proper distribution channels at Persian Gulf countries
First group (QSPM)	0.55	0.6	0.71
Second group (fuzzy TOPSIS)	1	1	1

Using equation 11 and values from table 9, weights of each item are determined shown in table 12.

Table 12. Weights from applying SAW technique for set of first and second strategies

Strategy groups	Weight
QSPM group	**0.384417**
Fuzzy TOPSIS group	**0.615583**

As shown in table 12, it can be observed that weights for ranking strategies using methods QSPM and fuzzy TOPSIS were 0.384417 and 0.615586, indicating higher efficiency of fuzzy TOPSIS. Hence, according to obtained results, it can be stated that fuzzy TOPSIS method has given more proper results to rank strategies.

4.   CONCLUSION AND SUGGESTIONS

Followed by recognizing and defining factors above, in this study, 15 selected strategies at Behnoush Company using two fuzzy TOPSIS and QSPM methods were ranked. Results were relatively similar. The results from comparing TOPSIS and QSPM methods indicated that fuzzy TOPSIS method was more proper method to rank strategies at Behnoush Company. In this regard, fuzzy TOPSIS method was used to rank strategies. *"Producing new products like fruit juice to complete product portfolio"* as the most important strategy, and then strategies "branding", and "establishing new lines at factories of Shiravan and Arak to increase production" were in the second and third place. On the other hand, strategies "devolving a part of production to new factories at this industry at High season" and "saving an amount of revenue per year to reduce banking costs" were chosen as the least important strategies. These strategies were categorized as the defensive strategies. The strategies "branding", "producing new products like fruit juice to complete product portfolio" and "bargaining to allot a percent of interest to healthy drinks products marketing" using QSPM method were chosen as the most important strategies. Furthermore, "producing new products like fruit juice to complete product portfolio" and "branding" using both QSPM and *fuzzy TOPSIS* methods were chosen as the most important strategies. Using the first strategy that is accounted of strategies for product development, new marketing capabilities were provided for the organization so that market contributed largely at this industry, whereby new customers were found for such products. Diversity of production is of approaches that generally lead to emergence of new customers and increasing sale. Use of branding in both ranking methods was chosen as the most important strategy. In marketing, brands are conveyed as the differentiation on what competitors supply, and the more markets be complicated, the importance of brands at success of companies will increase (Agarwal and Rao, 1996). Hence, branding and managing it strategically can largely assure survival of organization. Since purchase decision for many consumers relies on brand of product rather than reality of product, so implementing this strategy requires another important problem as consumer satisfaction. According to what said above, it is suggested to managers at Behnoush *Company to take step to produce new products considering* target market and strive recognizing new brand names for products by having more advertisements. The stages to propose this suggestion include use of research and development sector by cooperation of sale sector so as to produce new product like Ice tea, whereby company managed to fill its drinking product portfolio that allotted a brand for such product so as to contribute to market besides other products. It should be noted that marketing affairs for this product are unavoidable. Hence, stockholders are asked to allot a percent of their interest to this. Other approaches for development of competitive power at this organization mentioned signing contract with commercial companies to produce by the next year to allot a part of prepared production projects. There exist large

companies at drinking market that due to having proper sale system and filling product portfolio ask production of goods with high quality, and this is a very good opportunity for Behnoush Company to establish new lines and use empty capacity to reduce *Overhead costs. Purchase* blow molding machineries is another approach to increase market share. Today, due to high cost of pet container in drinking industry, these companies take step to produce bottles at factory. Hence, it is suggested to this company to take step to purchase these machineries with their needing. It is suggested to researchers to use other Fuzzy Multicriteria Decision-Making Methods to rank strategies like Fuzzy ANP method, so as to reach better results. Meanwhile, it can use several method on the whole and compare their results using the methods such as vector, mean or moving mean. Furthermore, this study can be carried out for the whole drinking industry throughout the country and/or in a smaller dimension for *the* Non-carbonated beverage industry. The limitations found in this study can be mentioned as not having sufficient opportunity to develop the study in other branches of *Behnoush Company at cities of Shiravan and Gachsaran in Iran.*

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