

SUPPLIER SELECTION WITH FUZZY VIKOR METHOD IN FOOD AND BEVERAGE ENTERPRISES (TURKEY)¹

Yiyecek-İçecek İşletmelerinde Bulanık Vikor
Yöntemi ile Tedarikçi Seçimi (Türkiye Örneği)

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ABSTRACT: It has been researched that the applicability of the fuzzy vikor method as a supplier selection technic takes place in food and beverage enterprises for a long time. The main purpose of the study is determining the applicability of both qualitative and quantitative datas within the frame of cluster theory. In order that questionnaire which is part of a quantitative method and semi structured interview which is part of a qualitative method have been conducted in food and beverage enterprises. Study has been carried out with senior managers in food and beverage enterprises whose qualitative dimension level are high. The study has been conducted on 746 food and beverage enterprises in major cities such as Adana, Afyonkarahisar, Ankara, Antalya, Aydın, Balıkesir, Bolu, Bursa, Çanakkale, Denizli, Diyarbakır, Edirne, Erzurum, Eskişehir, Gaziantep, Hatay, İzmir, İstanbul, Kahramanmaraş, Kayseri, Kocaeli, Konya, Kütahya, Manisa, Mersin, Mardin, Muğla, Nevşehir, Ordu, Sakarya, Samsun, Sivas, Şanlıurfa, Tekirdağ, Trabzon, Van. As a consequence of this; usage of fuzzy vycor method in food and beverage enterprises is quite effective. Thanks to Applied mixed method; the fuzzy vikor method as a supplier selection method in food and beverage enterprises has revealed the advantages of themselves in the near future if it would be used in the correct way. Besides; it has been determined that the productivity level of food and beverage enterprises can be rised in case the fuzzy method is used in correct way.

Keywords: Food and Beverage Enterprises, Supplier Selection, Vikor Method.

ÖZ: Endüstriyel işletmelerde uzun bir süredir uygulanan bulanık vikor yönteminin yiyecek-çecek işletmelerinde yeni bir tedarikçi seçim tekniği olarak uygulanabilirliği araştırılmıştır. Araştırmannın temel amacı olarak sayısal verilerle birlikte, aynı zamanda da

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sayısal olmayan verilerin bileşkesi bulanık küme teorisi çerçevesinde uygulanabilirliğinin tespitine yöneliktir. Bu tespitin gerçekleştirilebilmek amacıyla yiyecek-İçecek işletmelerinde nicel veri toplama tekniğinden birisi olan anket ve nitel veri toplama tekniği olan yarı yapılandırılmış görüşme tekniği uygulanmıştır. Araştırma, çeşitli büyüklüklerde ama niteliksel boyutu yüksek yiyecek-içecek işletmelerinde üst düzey yöneticiler ile gerçekleştirilmiştir. Araştırma, Türkiye'nin yüksek nitelikli yiyecek-içecek işletmelerinin yoğun olarak bulunduğu Adana, Afyonkarahisar, Ankara, Antalya, Aydın, Balıkesir, Bolu, Bursa, Çanakkale, Denizli, Diyarbakır, Edirne, Erzurum, Eskişehir, Gaziantep, Hatay, İzmir, İstanbul, Kahramanmaraş, Kayseri, Kocaeli, Konya, Kütahya, Manisa, Mersin, Mardin, Muğla, Nevşehir, Ordu, Sakarya, Samsun, Sivas, Şanlıurfa, Tekirdağ, Trabzon, Van gibi büyük şehirlerde 746 adet yiyecek-içecek işletmesi ile gerçekleştirilmiştir. Araştırma sonucunda yiyecek-içecek işletmelerinde bulanık vikor yönteminin yiyecek-içecek işletmelerinde etkin şekilde uygulanabilirliği sonucuna ulaşılmıştır. Uygulanan karma desen, Türkiye'de faaliyet gösteren yiyecek içecek işletmeleriyle derinlemesine bir araştırma sonucunda bulanık vikor yöntemi ile tedarikçi seçiminin yiyecek-içecek işletmelerinde uygulanabilirliği ve uygulanması halinde sağlayacağı faydalar ortaya çıkarmıştır. Ayrıca vikor yönteminin uygulanması ile yiyecek-içecek işletmelerine doğru tedarikçi seçimindeki verimlilik düzeyi artabileceği tespit edilmiştir.

Anahtar Kelimeler: Yiyecek-İçecek İşletmeleri, Tedarikçi Seçimi, Vikor Yöntemi.

INTRODUCTION

Today, together with annihilated the limits of globalization phenomenon, competition conditions began to force the continuity of enterprises. Enterprises began to investigate different methods during production process together with increased efficiency of competition as a result of globalization. One of the foremost method is supplier selection methods. Thus, a correct supplier selection method ables to help to increase the customer satisfaction, to decrease the costs together with raising the competitiveness of enterprises (Boer, 2017; Zhang, et al., 2016; Frost, et al, 2016; Avçıkurt, et al., 2010).

One of the foremost decision to make for enterprises is supplier selection. The process of supplier selection which is multi scaled decision make problem has a feature that especially continues its importance among today with a critical decision make process. Especially recent times, enterprises In order to answer the customer requests quickly depending on the rapid development on technology and globalization, along with its own achievements, also the supplier's achievements have become an indispensable phenomenon. Thus, producing high class and low cost products can be possible if and only if it is possible with an accurate supplier selection. Likewise, supplier selection

process within the food and beverage enterprises which produce complex product is quite important. Supplier selection serves a function in continuity of vital functions of consumers, as well as it effects highly the customer satisfaction, costs and competitive superiority in food and beverage enterprises. In this context, supplier selection in food and beverage enterprises have been enlarged upon as more complex and fragile subject than other enterprises (Jiang, et al., 2017; Com and Phil, 2016; Kaplan, et al., 2016; Van, et al., 2016).

SUPPLIER SELECTION PROCESS IN FOOD AND BEVERAGE ENTERPRISES

Suppliers are the major fact of supply chain, selecting the right supplier expedient to enterprise's strategies and objectives is quite an important decision problem. The competitiveness of the whole supply chain can be increased if supplier becomes a part of well managed-designed supply chain. Supplier selection which includes many qualitative and quantitative facts are consisted of hierarchical structure together with addressing the many different actions in enterprise is multi purposed decision problem. The main goal of supplier selection is to identify the high quality probable supply firms which address the enterprise's needs in the level of affordable price as a continuous and unproblematic form. Selecting process is a comparison of suppliers by using the mutual cluster. However; evaluating the probable suppliers differs from each other depending on enterprise requirement. Selecting supplier is one of the foremost decisions for organizations. Especially; in recent years there have been various studies came to light which support the significancy of supply selection. (Bellido and Heras, 2017; Şen, 2007: 38; Özel and Özyörük, 2007; Bevilacqua et al., 2006; Boer and Wegen, 2003: 109).

Nowadays purchaser-supplier relations depending on improved conception of supply chain has been specified as instead of short- term relation, it is based upon the long term relations as joint ventures. Therefore selection decision of suppliers based on making long-term contacts for enterprise managers should be tackled as a critical decision process. (Türer et al., 2008: 38). As a matter of fact producing high quality and low cost products for enterprises; only if it's possible with an accurate supplier selection. (Glock, 2008: 332). A right supplier selection provides a relevant cost in purchasing product; at the same time affects the development of competitive advantage positively. (Xia and Wu, 2007; 494). Especially recent times, enterprises in order to answer the customer requests quickly depending on the rapid development on technology and globalization, along with its own achievements, also the supplier's achievements have become an indispensable phenomenon.

The process of supplier selection which is multi scaled decision make problem has a feature that especially continues its importance among today with a critical decision make process. (Boer and Wegen, 2003). Food and beverage enterprises use approximately 3000 different kind of products in service production owing to be the enterprise which produce complex products. Producing high quality products in a massive product kinds is possible if only selecting the right supplier in an efficient way. (Dulmin and Mininno, 2003; Boer et al., 2001; Sarkis and Talluri, 2002; Albayrakoğlu, 2006; Avcıkurt et al. 2010).

SUPPLIER SELECTION METHODS: AHP (ANALYTIC HIERARCHY PROCESS) TO BAHP AND FUZZY VIKOR METHODS IN FOOD AND BEVERAGE ENTERPRISES

In addition concrete conception made by individuals, abstract conception is an effective way to decide their daily life and there is an uncertainty between these concepts. In cases where the number of measure in make decision problems is more than one, various scientific methods have been propounded with an attempt to find a solution to these kind of problems. (Alp and Gündoğdu, 2012: 9). Naturally; supplier selection in modern food and beverage enterprises is a major issue. Especially among the increasing competition environment; enterprises prefer long-term relation of supplier. (Avcı Öztürk and Başkaya, 2012). To do this, that is inevitable that enterprises should take strategical decisions. These strategical decisions are granted for long terms in general and that contains an uncertainty. (Seçme and Özdemir, 2008). As a consequence of this; people investigated several solutions and came up with fuzzy logic. The right decision are taken by using different methods considering this logic due to the similarity to the thinking logic of human. Due to analytic hierarchical process which belongs to the multi-criteria decision methods is not suitable to take decisions in an uncertain situation; it has been aggregated with fuzzy logic then BAHP (Fuzzy analytical hierarchy process) revealed (Göksu and Güngör, 2008; Mikhailov and Tsvetinov, 2004). Evaluating at intervals is more reliable than instead of making evaluation which includes the accurate values and decision maker. In this context; not only White and black colours and also the greyscale in between them are taken in consideration within fuzzy logic. That logic shows similarity with regard to suitability for consideration system for human.

AHP and BAHP presents efficient solutions to multi-criteria decision problems. The decision components related to decision problems are configured in different levels of hierarchy. The purpose is at the top level of hierarchy, on the other hand possible alternatives are at the bottom of hierarchy. One or more decision criterias are configured at the medium level of hierarchy. AHP enables decision makers to determine the weight of criterias and to make paired comparison

between criterias. Besides AHP, does not enable to reflect the human thoughts and attitudes in criteria comparison. On the other hand, BAHP is known an analytic instrument which is used to modeling the unconfigured problems among various fields such as management sciences, economic, social and human senses. Therefore BAHP shines up with identifying and analyzing the problems that not contains accurate datas. BAHP aims to select the alternatives within the hierarchical structure by evaluating and taking advantage of the theory of fuzzy clustral. (Siew, 2016; Ustasüleyman and Perçin, 2012; Alp and Gündoğdu, 2012; Toksarı and Toksarı, 2011; Sofyalıoğlu, 2009).

Fuzzy logic is a method which aims to bring the decision feature of human specific to machines fundamentally. Because in real life solutions are considered generally as wrong, partially true or true in a definite possibility. Fuzzy logic, as is evident from its name, enables rules of logic to having been implemented in a feasible and fuzzy form. True or false in classical logic softens the sudden transitions such as existent and not existent or 1 and 0. (Pradhan, 2016; Akyüz, 2012: 325; Günden and Miran, 2008; Tang and Beynon, 2005; Mon et al., 1994;).

There have been many criticism against the AHP although it found out an execution area in many decision problems. Primarily AHP; does not take in consideration current uncertainties related to options, decision and criterias of evaluations and it affects the decisions that will be made in future significantly. (Zhu et al., 1999; 450). The options have a possibility to change in sorting in case worse options than current options are added into the decision problem that is solved by AHP method. So; decision problems solved by AHP shows that does not always guarantee the reliable results. In the process of classical AHP Decision makers use the real values while evaluating, on the other hand Fuzzy Analytic Hierarchical Process can evaluate easier by using the fuzzy numbers or linguistic variables (Özgörmüş et al., 2005; 112).

Supplier selection process can be stated as multi-criteria decision problem in food and beverage enterprises. Selecting the proper inputs that will be used in the process of raw material and semi-manufactured products is an efficient way to gain success on production process. Linguistic variables are more available for supplier selection. That's why the usage of BAHP on supplier selection in the sense of food and beverage enterprises show results efficiently. AHP has high rate of honouring with regard not to rule out the uncertainties of execution area; in any case, the effectiveness of execution area is supposed to be low with regard not to predict the parametric variables (Sarioğlan, 2011; Wang at al., 2007).

The providing advantages of BAHP and fuzzy logic to food and beverage enterprises are sorted in the below. (Organ and Kenger, 2012: 121; Sarioğlan, 2011; Kiyak and Kahvecioğlu, 2003: 64):

- It is close to the consideration system and style of human
- A Mathematical model is not required all the time in the process of implementation
- The system can be set up more affordable because of that software is quite simple
- It is quite easy to understand the concept of fuzzy logic
- It is more feasible than other methods owing to its usage of membership value.
- Indefinite infos are used
- Nonlinear functions can be allowed to model
- Only if making use of expert individuals, A modeling or system based on fuzzy logic can be easily designed.
- Its in accord with traditional control methods.
- The usage of oral testimonies on fuzzy logic shows result more favourably.

It is assumed that the weights and evaluations within classical multicriteria decision problems are known exactly. But it is impossible to use certain statements in some occasions in real life. To solve this Fayed (1965) developed a theory of fuzzy logic. Thus; uncertain variables can be expressed with oral statement variables. And then several MCDM (Multi Criteria Decision Making) methods are developed. One of those is VIKOR method. VIKOR method are used among different fields of life recently. Concerning some of those studies; selection of personnel, selection of supplier, planning of water resources. Fuzzy VIKOR, is consisted of an algorithm which includes 10 different stages by using the values of fuzzy matrix. (Alguliyev et al., 2015; Yıldız, 2014; Shemshadia, et al., 2011). Fuzzy VIKOR has 10 different implementation stage. They are aforementioned below; (Ahmad et al., 2015; Nisel, 2014; Afful-Dadzia et al., 2014; Chatterjee et al., 2013; Samantra et al., 2012);

Step 1: Primarily in order to solve the problem, k number of decision maker, n number of alternative and m number of criteria are determined.

Step 2: Equivalentents of linguistic variables are identified as fuzzy numbers.

Step 3: With n number of decision maker are unified by using the equalizations as one evaluation to one.

Step 4: After obtained the single value for the whole criteria and alternatives, i and j criteriad fuzzy decision matrix and weight matrix are established.

Step 5: If we evaluate the j criteria in the meaning of benefit, the best and the worst values of criteria functions are determined by using the equivalent.

Step 6: Between equations, Fuzzy values are calculated with the help of minimum and maximum alternative equations.

Step 7: Equation values are calculated through index equivalent.

Step 8: In this stage clarified index values are calculated by averaging the numbers. After that, alternatives are sorted pursuant to obtained index values. The lowest index value means the best alternative.

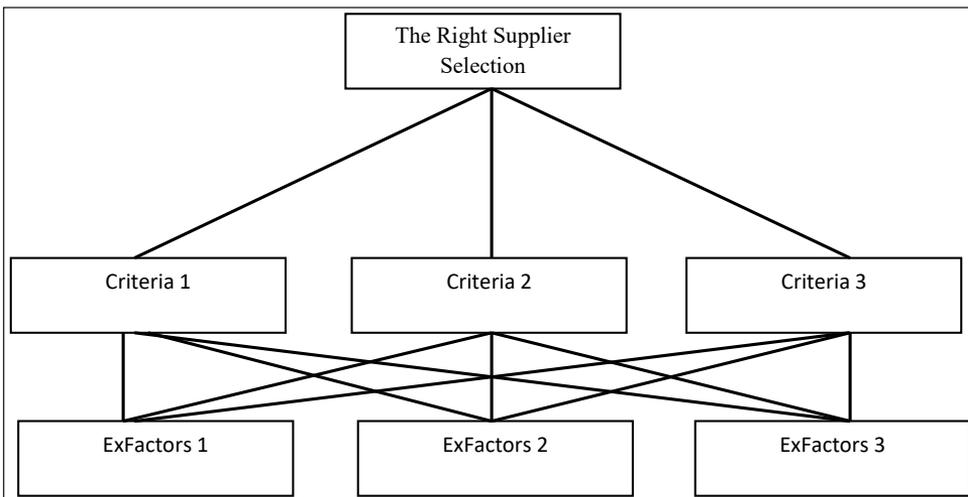
Step 9: In this stage it must be determined that the best alternative is a either conciliative solution or not. Conciliative solution is can be accepted to determine the best solution.

Step 10: The best alternative is chosen and implemented

THE RESEARCH METHOD

In the study; A research method related to applicability of VIKOR method to select the right supplier for food and beverage enterprises has been created. As it is seen on Table 1 exterior (factors uncontrollable) which are the main philosophy of fuzzy logic general economic situation, security, disposable income are in contact with the criterias (cost, net price, sustainability, delivery time etc.) and are selected for the right supplier selection as an ultimate goal. Determination of the values of qualitative and quantitative exterior factors are performed as part of the right supplier selection.

Table 1. The Supplier Selection Model of Fuzzy Vikor Method



Reference: Umamaheswari and Kumari, (2014).

DATA COLLECTION METHOD

In this study questionnaire method has been conducted as data collection method. So as to ensure the reliability and effectiveness of questionnaire, a pilot study has been conducted with the food and beverage generally First class restaurants and cafes) enterprises operating in Istanbul, Ankara, Bursa. The basic questionnaire form has been created after resulted findings of pilot study. Also Semi structured interview method which is a qualitative data collection method has been conducted along with questionnaire in Food and beverage enterprises. The research has been conducted with the senior managers of Food and beverage enterprises.

ANALYSIS OF DATAS

As a result of field research, obtained data has been analyzed by way of SPSS 22.0 computer programme. As an analysis method; demographical frequency analysis which belongs to food and beverage enterprises has been used. So as to determine the features pertain to the points or values which are belong to one or more variables of subjects within the scope of evaluating the implemented scale, frequency and percentage distribution of data has been made. (Büyüköztürk, 2016). Besides; in this study obtained data has been calculated by frequency analysis through the questionnaire method so as to test the applicability of Fuzzy Vikor method in food and beverage enterprises.

The opinions of senior managers related to the determination of obstacles in front of the applicability of fuzzy vikor method has been analyzed and the data which is obtained by semi structured interview put down on paper by transcription method. With this method quantitative data are supported with qualitative data.

FINDINGS

The data have been examined by two main chapters be about the demographical profiles of attendants/enterprises and implementation tendency level of fuzzy vikor method in food and beverage enterprises by means of analyzing as part of the study. The business capacity of food and beverage enterprises, number of employee, operating periods, location and operating fields of enterprises are demonstrated in Table 2. Primarily, business capacity of enterprises was analyzed. It is centered on the range of 51 and 250 guests that can be hosted simultaneously. The majority of enterprises employs in the range of below 50 employee and 51-100 employee.

Table 2. The Analyzing of Demographical Profiles of Food and Beverage Enterprises

Variables	Frequency(n)	Percentage(%)
Enterprises Capacity		
50 and below	79	10,59
51-100	107	14,34
101-150	164	21,99
151-200	188	25,21
201-250	171	22,91
250 and above	37	4,96
Total	746	100,0
The Number of Employee in Enterprise		
1-25	376	50,39
26-50	197	26,41
51-75	97	13,01
76-100	59	7,91
100 and above	17	2,28
Total	746	100
Operating Period of Enterprise		
2 years and below	169	22,65
2-5 years	193	25,87
6-10 years	156	20,91
11-15 years	124	16,62
16-20 years	52	6,97
21-25 years	38	5,09
25 years and above	14	1,89
Total	746	100
Location of Enterprise		
In city centre	627	84,09
Out of city centre	119	15,91
Total	746	100
The segment of Enterprise		
Restaurant	534	71,58
Cafe	166	22,24
Bar	32	4,29
Others	14	1,89
Total	746	100
The cities where enterprises are operating in		
Adana	19	2,55
Afyonkarahisar	11	1,47
Ankara	47	6,31
Antalya	71	9,48
Aydın	53	7,11
Balıkesir	12	1,62
Bolu	16	2,14
Bursa	37	4,96

Table 2. (Continuation)

The cities where enterprises are operating in		
Çanakkale	16	2,14
Denizli	21	2,82
Diyarbakır	3	0,41
Edirne	12	1,62
Erzurum	6	0,81
Eskişehir	31	4,16
Gaziantep	9	1,21
Hatay	15	2,01
İzmir	44	5,91
İstanbul	74	9,89
Kahramanmaraş	13	1,74
Kayseri	16	2,14
Kocaeli	24	3,22
Konya	13	1,74
Kütahya	7	0,94
Manisa	18	2,42
Mersin	13	1,74
Mardin	4	0,54
Muğla	49	6,54
Nevşehir	23	3,08
Ordu	5	0,67
Sakarya	14	1,89
Samsun	9	1,21
Sivas	8	1,07
Şanlıurfa	7	0,94
Tekirdağ	8	1,07
Trabzon	12	1,62
Van	6	0,81
Total	746	100

Although the operating periods of enterprises differs from each other, the majority part of them are dense in short-medium period operating enterprises. The majority of enterprises are built in citycentres but still there are a trace of enterprises built in countries. It has been determined that the significantly large part of food and beverage enterprises are operating as restaurant. Research has been carried out in 36 cities and the rates pursuant to the population density and potentials of enterprises have been attached into the research. In this context the density of field research has been conducted in cities which have high potential with food and beverage enterprises and population such as Istanbul, Ankara, Izmir, Antalya, Aydin, Muğla. Bursa. In accordance with these data; it has been determined that the cities which tourism activities are intense in and the reason of density in food and beverage enterprises share similarities.

In Table 3; the demographical profiles of managers were analyzed and demonstrated below table 2. The majority of attendants is (%86,70) male. In

this context; draw a conclusion that males are dominant in big scaled food and beverage enterprises significantly. The majority of manager attendants are in the age range of 26-50 (young and the beginning of middle age). It is assumed that this conclusion is derived from being dynamic industry of food and beverage sector.

Table 3. The Analyzes of Demographical Profiles of Managers in Food and Beverage Enterprises

Variables	Frequency(n)	Percentage (%)
Gender		
Male	647	86,70
Female	99	13,30
Total	746	100,0
Age		
21-25	29	3,89
26-30	102	13,69
31-35	118	15,81
36-40	167	22,39
41-45	133	17,83
46-50	91	12,19
50 and above	106	14,20
Total	746	100
The position of managers		
Owner	248	33,24
General Manager	143	19,17
Assistant Manager	128	17,18
Executive Chef	186	24,92
Restaurant Chef	41	5,49
Total	746	100,0
The recent got diploma degree		
Primary	26	5,41
Secondary	39	8,95
High School	179	41,27
Two year degree	221	28,63
Bachelor	268	14,76
Master	11	0,98
Doctorate	2	-
Total	746	100,0

The majority part (%33,24) is consisted of general managers, assistant managers and operating managers significantly. Although the majority part of managers are bachelor, the rational weight of managers who are two year degree and high school graduate is low. The 14 different prioritization has been conducted in order to be implementable of fuzzy vikor method within food and beverage

enterprises. In this context; the concerning applicability of fuzzy vikor have high rates from attendants. These are following such as; creating the decision maker group in order to select right supplier, revealing the evaluation criterias of supplier selection in enterprises, determining options for supplier selection, evaluating the specified criterias for supplier selection, converting the linguistic evaluations to fuzzy numbers, creating alternative decision matrixes from evaluated alternatives for supplier selection, determining the best and worst values for supplier selection, making rankings from clarified values for supplier selection and determining the best solutions for supplier selection.

Table 4. The Rational Weights Towards Steps of Supplier Selection Process by Fuzzy Vikor Method in Food and Beverage Enterprises

	Percentages (%)
The decision maker group can be created for supplier selection in food and beverage enterprise	64,06
Evaluation criterias can be found out for supplier selection in food and beverage enterprise	79,86
Options can be determined for supplier selection in food and beverage enterprise	74,63
Determined criterias can be evaluated for supplier selection in food and beverage enterprise	81,74
Determined options can be evaluated for supplier selection in food and beverage enterprise	80,53
Linguistic evaluations can be converted to fuzzy numbers for supplier selection in food and beverage enterprise	52,93
The fuzzy weights of evaluated criterias can be calculated for supplier selection in food and beverage enterprise.	42,21
Fuzzy decision matrixes of evaluated options can be created for supplier selection in food and beverage enterprise	50,52
The best and the worst fuzzy values can be determined for supplier selection in food and beverage enterprise	62,44
The distance between the best and the worst values of options can be calculated for supplier selection in food and beverage enterprise	51,46
The fuzzy set logic values of optional suppliers can be calculated for supplier selection in food and beverage enterprise	47,57
Fuzzy numbers can be clarified for supplier selection in food and beverage enterprise	49,31
The optional rankings of clarified values can be made for supplier selection in food and beverage enterprise	66,60
Reasonable solutions can be found for supplier selection food and beverage enterprise	63,65

The attendance level of propositions is low concerning; calculating the fuzzy weights of criterias for supplier selection in food and beverage enterprises, calculating the values of alternative suppliers with fuzzy logic, clarifying

the fuzzy numbers for supplier selection in food and beverage enterprises. The main reason of this low attendance is assumed that employee have insufficient cognitive knowledge level.

CONCLUSION AND SUGGESTIONS

As a result of research revealed findings after literature review and field research are mentioned in the study. The first chapter (literature) is about analytic hierarchical process (AHP) that is used in order to increase the efficiency of supplier selection in food and beverage enterprises and mentioned fuzzy vikor about the concept and applicability of BAHP. In second chapter, there are findings and analyzed data as a result of field research towards the applicability of fuzzy vikor method for supplier selection. It can be draw a conclusion that fuzzy vikor method in food and beverage enterprises is majorly applicable.

Although there is a conclusion that applicability of fuzzy vikor method in food and beverage enterprises; in order to increase the efficiency, creating new strategies and overcoming some obstacles are needed during the process. Drawed a conclusion after conducting the research by semi structured interview that there is a deficiency of senior managers about their knowledge levels and cognitive knowledge levels and lack of qualified employee. Related to these issues, some suggestions were developed:

- Absolutely, expert and qualified employee should be employed in the subject of supplier selection in purchasing department of food and beverage enterprises.
- Company executive that will use the product should be incorporated in the supplier selection process in Food and beverage enterprises.
- The purchasing department of enterprises should determine the objective supplier selection criterias within the frame of their purchasing policies.

In this study, a number of suggestions have been developed so as to increase the efficiency and applicability of fuzzy vikor method for supplier selection in food and beverage enterprises. A number of suggestions are required to be developed for the next studies in the subject of applicability of methods such as fuzzy TOPSIS, fuzzy axiomatic design etc. for supplier selection in food and beverage enterprises.

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