AN INTEGRATED APPROACH FOR PRIORITIZING THE DEALERS ON THE BASIS OF ORGANIZATIONAL PERFORMANCE MEASUREMENTS

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Keywords

Organizational Performance, MCDM, Dealership System, Fuzzy Logic

Abstract

Large-scale organizations using the dealership system to serve in different geographic regions should measure and assess the performance of dealers according to various indicators to ensure the same service quality and efficiency of all dealers. These organizations need to evaluate the performance of the dealers by considering these indicators, called organizational performance criteria (like efficacy, efficiency, ethics etc.) In order to maintain the existence of the enterprises in a competitive business environment, the ranking of the dealers in terms of the organizational performance measurements and determining the unproductive ones to carry out research for these cases is very important. In this study, a two-stage integrated framework was used to solve the problem. In the first stage of the study, the Fuzzy Analytic Hierarchy Process (FAHP) method was used to determine the weight of organizational performance criteria. Used scale in the fuzzy AHP section of this study, based on triangular fuzzy numbers. In the next stage, the decision matrix was constructed by taking the dealers as an alternative. Using the PROMETHEE I and II methods, that is based upon the pairwise superiority comparison between the alternatives, dealers were ranked according to the performance criteria. Within the scope of this study, seven dealers were compared on the basis of four organizational performance criteria. There is no accuracy in the organizational structures within the framework of the choice criteria and the linguistic expression of some of the choice criteria handled at the same time induce a more precise conclusion. Thus, within this study, to employ fuzzy logic in weighting the criteria is considered appropriate. The results were made more comprehensible thanks to visualization tools of PROMETHEE method.

ÖRGÜTSEL PERFORMANS ÖLÇÜTLERİ BAZINDA BAYİLERE ÖNCELİK VERİLMESİ İÇİN BÜTÜNLEŞİK BİR YAKLAŞIM

Anahtar Kelimeler

Organizasyonel Performans, ÇKKV, Bayiilik Sistemi, Bulanık Mantık

Öz

Farklı coğrafi bölgelerde hizmet vermek için bayilik sistemini kullanan büyük ölçekli kuruluşlar, tüm bayilerinde aynı hizmet kalitesini ve verimliliğini sağlamak için bayilerin performansını çeşitli göstergelere göre ölçmeli ve değerlendirmelidir. Bu kuruluşların, kurumsal performans kriterleri adı verilen bu göstergeleri dikkate alarak bayilerin performansını değerlendirmeleri gerekir. İşletmelerin rekabetçi bir iş ortamında varlığını sürdürebilmek için bayilerin örgütsel performans kriterlerine göre sıralanması ve verimsiz olanların belirlenmesi çok önemlidir. Bu çalışmada, bahsedilen sorunu çözmek için iki aşamalı bir bütünleşik yaklaşım kullanılmıştır. Çalışmanın ilk aşamasında örgütsel performans kriterlerinin ağırlığını belirlemek için Bulanık Analitik Hiyerarşi Süreci (FAHP) yöntemi kullanılmıştır. Bir sonraki aşamada ise bayiiler alternatif olarak değerlendirilmişir. Bayiler, alternatifler arasındaki ikili üstünlük karşılaştırmasına dayanan PROMETHEE yöntemi kullanılarak performans kriterlerine göre sıralanmıştır. Örgütsel yapılarda ele alınan seçim kriterlerinin bazılarının dilsel ifadesi daha doğru bir sonuç doğurabilmektedir. Bu nedenle, bu çalışmada ölçütlerin ağırlıklandırılmasında bulanık mantık kullanılması uygun olarak kabul edilmektedir. PROMETHEE yönteminin görselleştirme araçları sayesinde sonuçlar daha anlaşılır hale geldiği için alternatiflerin sıralanmasında ise PROMETHEE yöntemi kullanılmıştır.

Araştırma Makalesi		Research Article	
Başvuru Tarihi	: 18.07.2019	Submission Date	: 18.07.2019
Kabul Tarihi	: 21.08.2019	Accepted Date	: 21.08.2019

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1. Introduction

Businesses attach importance to serving in different geographical regions for maintaining their financial assets for many years. For a business, one of the easiest ways to provide services in different geographical regions is to create a dealership system. Nowadays, many large organizations have the dealership system (DS) to maintain equal service quality in different geographical regions in terms of growing their market share and improving their recognition level. In addition to these reasons, these organizations also employ the DS to manage their organizational structure and establish dominance over all system easily. Although many large companies adopt the dealership system, this system has difficult processes to manage. One of these difficult processes is to evaluate the performances of the dealers. The results of this evaluation are of great importance for the company using the dealership system. According to the results of this evaluation, companies may decide to continue or terminate their relationship with the dealers. To give such an important decision, evaluation criteria must be selected carefully. These organizations that used the DS need to measure and evaluate the organizational performances (OP) of the dealers according to the several indicators to provide same service quality and efficiency in all dealers. These criteria should be the criteria that will measure the organizational structure precisely and clearly demonstrate the performance of the dealer. Evaluation of dealers in terms of OP is critical to ensure stronger coordination and communication skills, and control mechanism among dealers (Efil, 2013).

In related literature, there are several determined OP criteria. Generally, sales performance of dealers has been taken into account while evaluating dealers' performance (DP). However, in addition to sales performance of dealers, different measurements should be considered if DP is desired to evaluate more comprehensive and logical. An objective and comprehensive evaluations of DP is crucial for both one-centered company and dealers with regards to relationship quality between dealers and the company, creating mutual trust environment and other strategic decisions. It is observed that a decision problem rises when the performance evaluation criteria and dealers which are desired to assess are taken into account. Ranking of the dealers according to the OP measurements and determining the ineffective ones are important for the competitiveness and continuity of the business. To rank dealers, multi-criteria decision-making approaches can be employed. The research questions discussed in this study can be expressed as follows: a) What are the criteria to be used in evaluating the performances of dealers in terms of organization and the sub-criteria that affect them? b) What are the weights of the selected criteria when evaluating the performance of a dealer and how they should be calculated? c) What analytical method can provide detailed information if dealers are to be evaluated in terms of selected performance evaluation criteria?

In this paper, to solve this decision problem efficiently, a two-stage integrated multi criteria decision making (MCDM) approach was proposed. The first stage of this integrated approach was determined as Fuzzy Analytic Hierarchy Process (FAHP) to weight OP criteria. It is considered appropriate to utilize fuzzy logic reasoning in weighing the criteria since there is no certainty in the organizational structures within the framework of the selection criteria and the linguistic expression of the selection criteria handled leads to a more accurate conclusion. Similarly, in the second stage of our study, namely to rank the dealers, the PROMETHEE method which is based on the pairwise superiority comparison between the alternatives was utilized.

In this section of the study, a brief literature review of dealership system and organizational performance measurements is given, because there are limited sources on this topic in the literature. Boyce, Nieminen, Gillespie, Ryan, and Denison (2015) investigated the relationship between organizational performance and culture in their study. Data collected from 95 franchise automobile dealerships over 6 years were used to determine which notion comes first. In this study statistical analysis was used. The results of the study show that organizational culture comes first. Gonzalez-Padron, Akdeniz, and Calantone (2014) presented an approach to benchmark dealer performance in a business-to-business setting through a rigorous efficiency analysis of sales staff allocation. The authors of that study used Data Envelopment Analysis (DEA) models on data collected from a survey of self-reported financial and statistical information. They wanted to assess dealer efficiency and compared the efficiency scores to traditional financial benchmarking. Small, Hicks, McGovern, Scurry and Whipp. (2015) focused on lean production in assessing performance of motor dealership systems. The Balanced Scorecard (BSC) method, which is a performance measurement system and contains four basic approaches (e.g. financial, customer, internal process and innovation and learning), was used. With this study, BSC was identified as a suitable performance measurement tool that can include Lean evaluation metrics. Soares, Abaide and Bernardon (2014) used multi-criteria decision-making methods to allocate budget among electricity distribution companies. They considered organizational performance statistics as a criterion in their study. Biondi, Calabrese, Capece, Costa, and Di Pillo (2013) used DEA method to assess the efficiency of dealers in an automotive industry. The authors also examined the market share as well as the efficiency of the dealers. They used four inputs (number of salespeople, number of outlets, number of days since the dealership received the mandate of sale, number of local businesses) and two outputs (sales and quality of service) to implement DEA. Fraser, Tseng and Hvolby (2012) investigated whether a quality culture is being developed in the dealership network in South Australia by considering principles of total quality management. The authors designed a questionnaire survey to conduct their study. Chen, Yan and Wi (2011) used balance score-card and Analytic Network Process (ANP) to assess dealers' performance in automotive supply chain. Akdeniz, Gonzalez-Padron and Calantone (2010) employed a stochastic approach, namely Stochastic Frontier Analysis (SFA) to estimate how efficiently a dealer utilizes its marketing capabilities. Rajagopal (2009) investigated the effects of customer services efficiency and market effectiveness on dealer performance. To achieve this aim, the authors employed Servequal Method in the study. Arrunada, Vazquez and Zanarone (2009) studied the impact of organizational choice on the performance of Spanish car dealerships. The authors used a systematic random sample of 179 franchised dealerships and the entire population of 71 vertically integrated dealerships operating in Spain to examine the effect of organizational design of outlet performance. Farley, Hayes and Kopalle (2004) addressed a gap in the international literature aimed at understanding the impact of the marketing mix on choosing and upgrading business-to-business financial services dealers.

To the best of our knowledge, no studies have been found which integrates two MCDM approaches to measure the organizational performance of dealers. Thus, this paper utilizes Fuzzy Analytic Hierarchy Process (FAHP) method and PROMETHEE method to address the issue. The aim of this study is to provide an integrated approach to the literature that can be used to evaluate dealers. At the same time, an objective assessment was made by taking into consideration the organizational performance criteria. Due to the nature of organizational performance evaluation criteria, the use of fuzzy logic was needed. This was solved by Fuzzy AHP.

The reason why Promethee I and II methods were used in evaluating the dealers is that Promethee methods allow the use of realistic values in the evaluation matrix.

The remainder of this paper as follows. Section 2 presents used methodology in this study. Section 3 gives a real-world application. Finally, results and discussion are given in Section 4.

2. Methods

Fuzzy AHP

AHP was developed by Thomas L. Saaty (1970) in the 1970s and it is an efficient multi-criteria decision-making method to calculate weights of the criteria. The superiority attributes of AHP are ease-of-use and in addition to objective evaluations, it allows decision makers to use subjective assessment in their decision-making process (Yıldırım and Önder, 2015). The superiority of the AHP method can be explained as that regardless of whether the criteria are tangible or intangible, the AHP method can calculate their weight. At the same time, all criteria and alternatives can be expressed in a hierarchical structure according to their weight (Russo and Camanho, 2015). AHP is based on pairwise comparisons and matrix operations. Researchers can use this method effectively in different and complex decision-making problems. Fuzzy logic, developed by Zadeh in 1961, is also frequently utilized by researchers in decision making process to gain more accurate results in such circumstances where the decision environment is uncertainty (Zadeh, 1965). In the literature, there are various studies that employed fuzzy extension of MCDM techniques (Deveci, Canitez and Gokasar 2018; Wang and Tsai, 2018; Teniwut, Marimin and Djatna 2019; Suganthi, 2018; Tosarkani and Amin, 2018; Gül, 2018). The readers who seek more information in this topic can benefit from Dağdeviren, Yavuz and Kilinc (2009).

The reason why the AHP method is used to obtain the weights of the criteria in this study is that it is a preferred method in the literature for the same purpose. However, as a natural result of the difficulty of expressing the criteria with crisp values because of the structure of evaluation criteria, fuzzy numbers were utilized during the pairwise comparisons of the criteria. At the same time, decision-makers can generally feel more relax when evaluating criteria using linguistic scales than using crisp numbers.

Linguistic evaluation scale used in the first stage of this study is given in Table 1. As can be seen, triangular fuzzy numbers were employed during the evaluations of criteria.

The triangular fuzzy numbers are a special class of fuzzy numbers, a triangular fuzzy number ($\tilde{A}$) denoted by three real numbers ($l \leq m \leq u$), and the membership function is defined by these numbers. In the fuzzy number $\tilde{A}$ denoted by (l, m, u), m denotes the most feasible value of the fuzzy number, and the values l and u represent the upper and lower boundaries, i.e. the scope of fuzziness (Dağdeviren, 2007).

Table 1
Linguistic scale for importance

Linguistic scale for importance	Triangular fuzzy scale	Triangular fuzzy reciprocal scale
Just equal	(1, 1, 1)	(1,1,1)
Equally important (EI)	(1/2, 1, 3/2)	(2/3, 1,2)
Weakly more important (WMI)	(1, 3/2, 2)	(1/2,2/3,1)
Strongly more important (SMI)	(3/2, 2, 5/2)	(2/5,1/2,2/3)
Very strongly more important (VSMI)	(2, 5/2, 3)	(1/3,2/5,1/2)
Absolutely more important (AMI)	(5/2, 3, 7/2)	(2/7,1/3,2/5)

The geometric mean operator and alfa cut method were utilized for defuzzification process to obtain criteria weights in crisp value. The α-cut method is used to obtain a set of closed values for different α values from $\tilde{A}$ = (l_a, m_a, u_a) fuzzy number (Dağdeviren, 2007).

The α-cut of A fuzzy set is defined as follows:

$$A_\alpha = \{\alpha \in [0,1] \mid \mu_A(x) \geq \alpha\}$$

PROMETHEE Methods

Preference **R**anking **O**rganization **Meth**od for **E**nrichment **E**valuations (PROMETHEE) method was developed by Brans in 1985. PROMETHEE is a priority determining method which was developed to achieve more suitable selection with respect to decision makers' desire in selecting and ordering problem (Yıldırım and Önder, 2015). The PROMETHEE methods allow decision makers to rank the alternatives in terms of both partial and complete (Dağdeviren and Eraslan, 2008). Because they were employed to solve the decision-making problem, the PROMETHEE I (partial ranking), PROMETHEE II (complete ranking) methods were explained in detail in this study. In literature, only Promethee I and II methods are not available. Brans and Mareschall (2005) developed derivatives of the Promethee method called PROMETHEE III (sorting based on intervals), PROMETHEE IV (sorting for continuous states), PROMETHEE V (sorting with segmentation constraints), and PROMETHEE VI (sorting in which the human brain is represented). (Yıldırım and Önder, 2015; Brans and Mareschal,2005).

To implement the PROMETHEE method in a decision-making problem appropriately requires two additional types of information (Dağdeviren 2008):

(1) The weights of the predetermined criteria

(2) Preferences function of criteria and their related details.

One of the reasons why using the Promethee I and II in this study is that Gaia representation of the Promethee methods really helps to decision-maker to determine the best alternative on a three-dimensional plane. The GAIA plane is built on the results of the PROMETHEE method and gives the decision maker an advantage over the PROMETHEE method compared to other multi-criteria decision-making methods (Genç, 2013). Seeing the results of the conflicting criteria on a three-dimensional plane, the decision maker can decide more effortlessly and quickly with the help of the GAIA geometric representation. The other reason for using it that the PROMETHEE methods allow decision-maker to use different preferences function for each criterion and use different threshold values. The application steps of Promethee I and II are as follows (Dağdeviren and Eraslan, 2008):

Step 1: Determine alternatives, criteria and weights of criteria

The data matrix for $A = (A_1, A_2, A_3 \ldots A_k)$ alternatives evaluated by the criterion $c = (c_1, c_2, \ldots, c_k)$ and with the weights of these criteria $w = (w_1, w_2, \ldots, w_k)$ is shown in Table 2.

Table 2

The data matrix

Criteria	A_1	A_2	A_3	…	w
c_1	$c_1(a)$	$c_1(b)$	$c_1(c)$	…	w_1
c_2	$c_2(a)$	$c_2(b)$	$c_2(c)$	…	w_2
…	…	…	…	…	…
c_k	$c_k(a)$	$c_k(b)$	$c_k(c)$	…	w_k

Step 2: Determine preference functions and their parameters

In the PROMETHEE method, preference function of the criteria should be determined to make a decision. There are six preference functions in the method: 1) Normal, 2) U type, 3) V type, 4) level type, 5) linear type and 6) Gaussian functions (see Table 3).

Table 3
Preferences Functions (Brans and Vincke, 1985)

Type	*Parameter*	*Function*
Normal	-	$p(x) = \begin{cases} 0, & x \le 0 \\ 1, & x > 0 \end{cases}$
U type	L	$p(x) = \begin{cases} 0, & x \le l \\ 1, & x > l \end{cases}$
V type	M	$p(x) = \begin{cases} x/m, & x \le m \\ 1, & x \ge m \end{cases}$
Level Type	q, p	$p(x) = \begin{cases} 0, & x \le q \\ 1/2, & q < x \le q+p \\ 1, & x > q+p \end{cases}$
Linear Type	s, r	$p(x) = \begin{cases} 0, & x \le s \\ (x-s)/r, & s \le x \le s+r \\ 1, & x \ge s+r \end{cases}$
Gaussian Type	Σ	$p(x) = \begin{cases} 0, & x \le 0 \\ 1-e^{-x^2/2\sigma^2}, & x \ge 0 \end{cases}$

Step 3. Determining associate preference functions

The associate preference function for alternative pairs is calculated with the help of Eq. (1).

$$P(A_1,A_2)=\begin{cases}0, & c(A_1)\le c(A_2)\\ p\left[c(A_1)-c(A_2)\right], & c(A_1)>c(A_2)\end{cases} \quad (1)$$

Step 4. Calculation of associate preference indexes:

The preference index of alternative pairs evaluated by *k* criteria having weights w_i *(i = 1,2, ..., k)* is calculated by Eq. (2).

$$\pi(A_1,A_2)=\frac{\sum_{i=1}^{k} w_i \times P_i(A_1,A_2)}{\sum_{i=1}^{k} w_i} \quad (2)$$

Step 5. Compute positive and negative *Φ* values

The positive and the negative superiorities are calculated using Eq. (3) and Eq. (4), respectively.

$$\phi^+(A_1)=\sum \pi(A_1,x) \qquad x=(A_2,A_3,A_4,\ldots..) \quad (3)$$

$$\phi^-(A_1)=\sum \pi(x,A_2) \qquad x=(A_2,A_3,A_4,\ldots..) \quad (4)$$

Step 6. Obtain partial ranking using PROMETHEE I

For the two alternatives such as "A1" and "A2", the following considerations apply in determining the partial priorities.

If any of the following conditions are satisfied, the alternative "A1" is preferred to the alternative "A2".

$$\phi^+(A_1)>\phi^+(A_2) \quad \text{and} \quad \phi^-(A_1)<\phi^-(A_2) \quad (5)$$

$$\phi^+(A_1)>\phi^+(A_2) \quad \text{and} \quad \phi^-(A_1)=\phi^-(A_2) \quad (6)$$

$$\phi^+(A_1)=\phi^+(A_2) \quad \text{and} \quad \phi^-(A_1)<\phi^-(A_2) \quad (7)$$

If the condition given below is satisfied, the alternative "A1" and the alternative "A2" are indifferent.

$$\phi^+(A_1)=\phi^+(A_2) \quad \text{and} \quad \phi^-(A_1)=\phi^-(A_2) \quad (8)$$

If any of the following conditions are satisfied, the alternative "A1" cannot be compared with the alternative "A2".

$$\phi^+(A_1)>\phi^+(A_2) \quad \text{and} \quad \phi^-(A_1)>\phi^-(A_2) \quad (9)$$
$$\phi^+(A_1)<\phi^+(A_2) \quad \text{and} \quad \phi^-(A_1)<\phi^-(A_2)$$

Step 7. Obtain final ordering using PROMETHEE II

With the PROMETHEE II method, with the help of Eq (10), the exact order of alternatives is determined. The complete ranking is determined by the evaluating exact priorities.

$$\phi(A_1)=\phi^+(A_1)+\phi^-(A_1) \quad (10)$$

Depending on the exact priority value calculated for the two alternatives "A1" and "A2", the following decisions are taken:

If $\phi(A_1) > \phi(A_2)$ *, then alternative "A1" is preferred.*

If $\phi(A_1) = \phi(A_2)$ *, then alternatives are not different.*

In the second stage of this study, Visual PROMETHEE software was used to obtain ranking of alternatives.

3. Application

The aim of this study is to find the best dealer among seven different dealers with respect to determined organizational performance criteria. In this study, determined criteria and their sub criteria that were adapted from Efil (2013) are given in Table 4.

Table 4
Main criteria and sub criteria

Main Criteria	Sub criteria
Efficiency (C1)	Degree of reaching market share Low error in production Employee satisfaction
Efficacy (C2)	Return on investment Sales productivity Sales profitability Raw material productivity Employee productivity
Ethics (C3)	Employment ratio Legal responsibilities Brand perception Service quality
Responsiveness (C4)	Response time to customers Compliance with due dates Positive feedback from customers

It is possible to explain criteria in that way (Efil, 2013):

Efficiency (C1) measures the level of achieving the aims of organization, such as quality, amount, due date, costs, and prices. Efficiency is defined as the percentage of actual output quantity over expected output quantity. Efficiency is related to output of a process as well as achieving organizational aim.

Efficacy (C2) is generally based on consumed resources to achieve an organizational aim. It can be identified as percentage of actual used resources over planned resources. To illustrate, an organization that desires to evaluate sales productivity takes sales over total labor costs into account. There are some arguments about the relationship between efficiency and efficacy. However, an efficacious organization may not be able to conduct their processes in an effective way.

Ethics (C3) criteria measures accuracy, objectivity and equality of the conducted activities in the organization with respect to related organizational groups. This criterion can be transferred into practice via giving equal financial resources, providing the same level of goods and services and allocating equal amount of money among their organizational group.

Responsiveness (C4) criteria is generally related to the satisfactory degree of achievement of organizational objectives.

All pairwise comparisons and evaluations in this study were done by an expert who knows the structure of the company and sector of it entirely and who spends about 20 years in the related sector. For the initial solution of the problem, we calculated weights of main criteria and sub criteria. Related calculations can be seen in Table 5 and Table 6, respectively.

Table 5
Weights of main criteria

	Efficiency			Efficacy			Ethics			Responsiveness			Weights
Efficiency	1.00	1.00	1.00	0.50	1.00	1.50	2.00	2.50	3.00	1.00	1.50	2.00	0.334
Efficacy	0.67	1.00	2.00	1.00	1.00	1.00	0.40	0.50	0.67	1.00	1.50	2.00	0.232
Ethics	0.33	0.40	0.50	1.50	2.00	2.50	1.00	1.00	1.00	0.50	1.00	1.50	0.227
Responsiveness	0.50	0.67	1.00	0.50	0.67	1.00	0.67	1.00	2.00	1.00	1.00	1.00	0.207

Table 6
Local and global weights of main criteria and sub criteria

Main Criteria	Main Criteria Weight	Sub-Criteria	Sub-Criteria Local Weights	Sub-Criteria Global Weights
C1	0.334	C11	0.427	0.142
		C12	0.287	0.096
		C13	0.287	0.096
C2	0.232	C21	0.211	0.049
		C22	0.243	0.056
		C23	0.208	0.048
		C24	0.196	0.045
		C25	0.142	0.033
C3	0.227	C31	0.281	0.064
		C32	0.229	0.052
		C33	0.293	0.067
		C34	0.198	0.045
C4	0.207	C41	0.335	0.069
		C42	0.383	0.079
		C43	0.282	0.058

According to the result of the first stage, the most important organizational performance measurement criterion is *Efficiency (C1)*. The order of importance for the criteria is *Efficiency, Efficacy, Ethics and Responsiveness.* When Table 5 is examined, it is seen that degree of reaching market share, low error in production, employee satisfaction, and compliance with due dates have the highest value while employee productivity, raw material productivity, and service quality have the lowest value.

The map showing the locations of dealers of the company are given Figure 1. Information about the industry and structure of the company is kept confidential. The application in this article is in the energy sector.

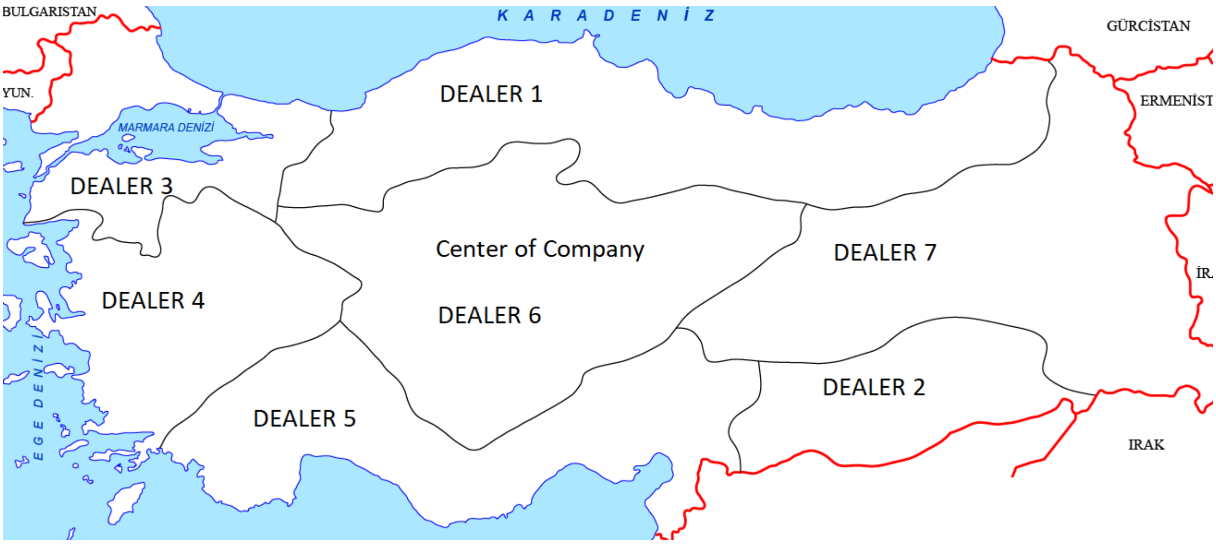

Figure 1. Geographical locations of dealers

Our decision matrix is given in Table 7. All criteria were aimed to be maximized. The value of alternatives with respect to the criteria, preferences function, and their parameters were determined by the expert group, who spend about 10 to 20 years in the company. The values of the decision matrix were determined, by three experts with the help of brainstorm. Alternative 1 corresponds with Dealer 1 and the rest of the alternatives are organized in the same pattern.

Table 7
Decision matrix

Criteria	Max	Alternatives							Preference functions	Parameter
		A1	A2	A3	A4	A5	A6	A7		
C1	√	75	80	85	65	85	90	70	V	s=10, r=10
C2	√	0.80	0.76	0.84	0.56	0.77	0.82	0.52	IV	q=0,20, p=0,10
C3	√	6	5	4	7	8	5	9	III	p=2
C4	√	7	9	9	5	6	8	4	V	s=2, r=2

The C1 criterion takes a value between 0 and 100 percent according to efficiency results of the dealers. The C2 criterion has a value between 0 and 1 according to the profitability and productivity values of the dealers. To evaluate dealer's performance with regards to C3 and C4 criteria, Saaty's 1-9 scale was used. There is no general opinion in the literature in determining the parameters of preference functions. When the mathematical representations of the preference functions are examined, it is understood that the parameters are very important in determining whether the alternative pairs are included in the calculation processes. The preferences functions are operated based on the differences of the values taken by the alternative pairs on the basis of the relevant criteria. For the first criterion, parameter values s = 10 and r = 10 were determined and linear type preference function was employed. From this information, the following inferences are made: If the difference in the value of alternative pairs based on C1 criteria is less than 10, it cannot be concluded that these two alternatives are better than each other. If the difference is between 10 and 20, the advantage value of the alternative is calculated by the mathematical equation in the preference function. In order for one of the alternative pairs to gain the net advantage over the other, the value of the relevant alternative on the basis of the C1 criterion must be at least 20 more than the other alternative.

The decision matrix and the criteria' weights were used as an input for the software of Visual PROMETHEE Academic Edition.

According to the results, the order of dealers is given as follows: Dealer 5>Dealer 1>Dealer 7>Dealer 6>Dealer 2>Dealer 4>Dealer 3 (Table 8).

The demonstration of alternatives according to ϕ values is shown in Figure 2.

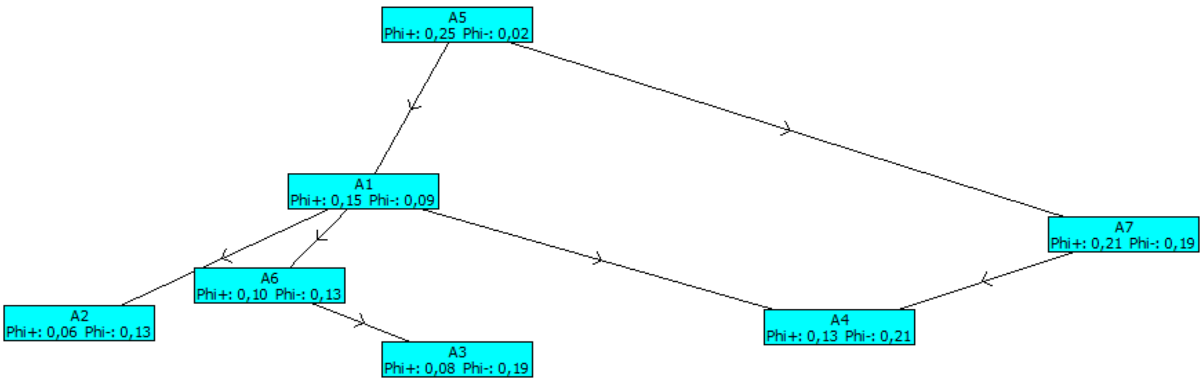

Fig. 2. Demonstration of alternatives according to Phi values

According to Eq. (10), the net priorities of the alternatives are calculated. Figure 3 shows the net priorities and the order of the alternatives.

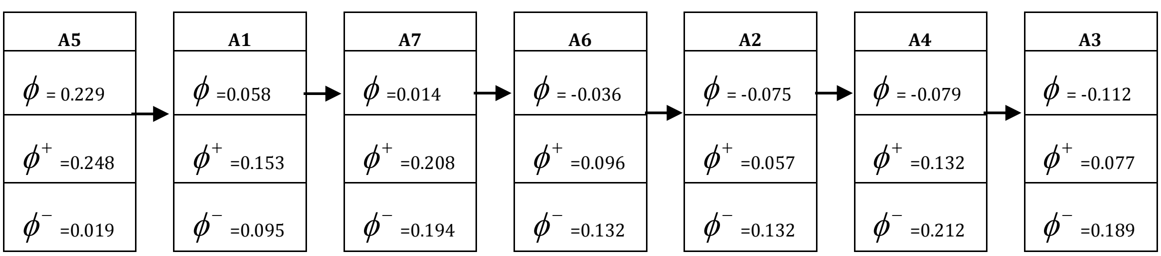

Figure 3. Complete ranking of the alternatives

GAIA representation of the alternatives and criteria obtained from Visual PROMETHEE is given in Figure 4. With the GAIA representation, decision-makers can easily see the direction of the criteria and alternatives on the plane. The red line in the GAIA representation shows the most suitable alternative according to the criteria. In light of this information, Dealer 5 is the best dealer.

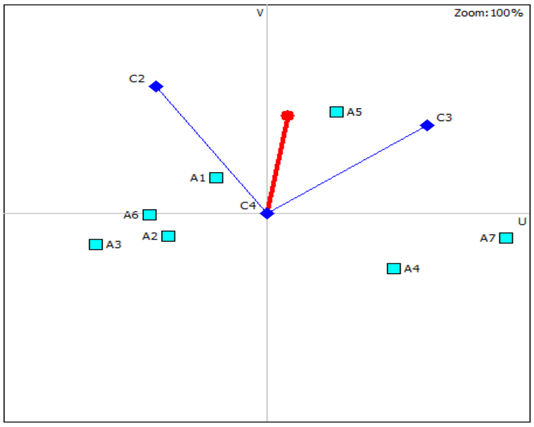

Figure 4. GAIA representation of alternatives and criteria

In the sensitivity analysis, it was observed that the increase in the value of the ethics criterion changed the ranking of the dealers. With the increase in the weight of the Ethic criterion, it is seen that the 7th dealer stands out (Please see Figure 5). Likewise, it is seen that there is a change in the alternative rankings as the weight of the effectiveness criterion changes. Previously the best dealer was dealer 5. If the weight of the efficiency criterion increase, the ranks of dealer 3, dealer 1 and dealer 6 increase (Please see Figure 6).

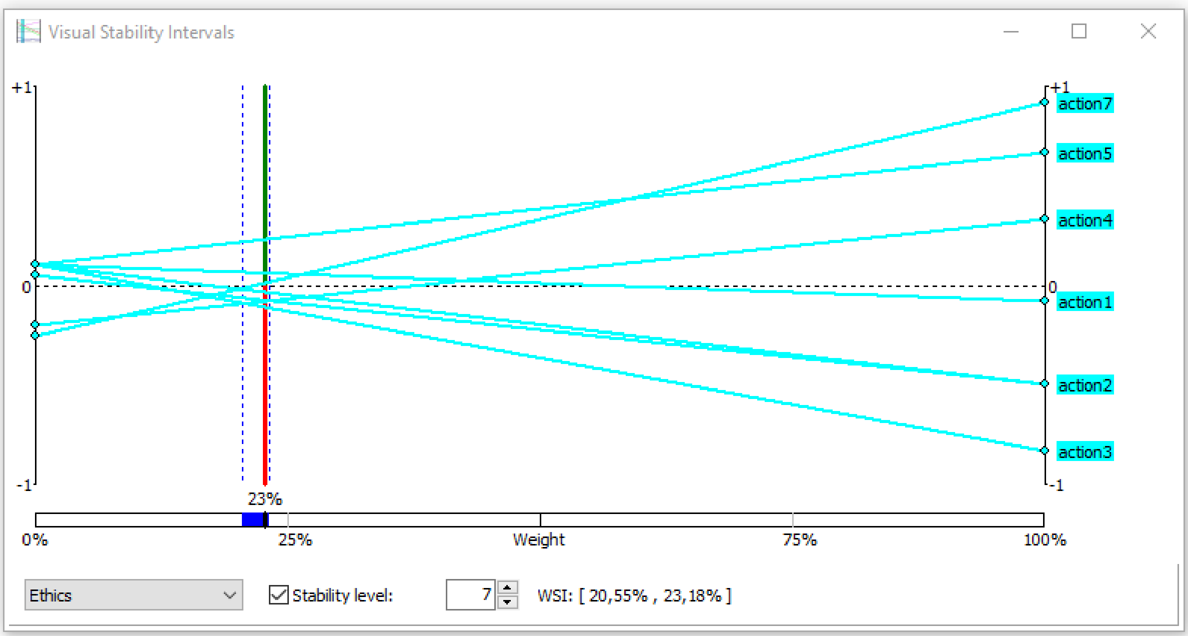

Figure 5. Sensitivity Analysis on the basis of the Ethics criterion

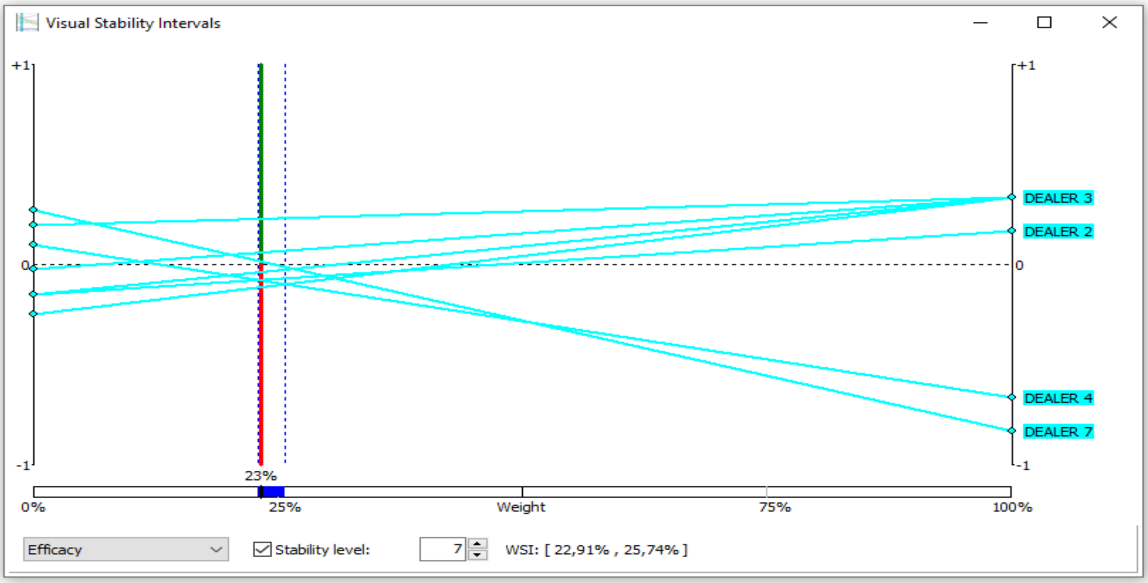

Figure 6. Sensitivity Analysis on the basis of the Efficacy criterion

4. Results and Discussion

The dealership system, which is a useful application for businesses in a challenging competitive environment, includes many benefits as well as difficult processes to be managed and evaluated. Evaluating the performances of the dealers appropriately is one of these difficult processes. The evaluation of the dealers is very important for the continuation of the dealership agreement and the prestige of the company. If this issue is considered in terms of strategic management approaches, the dealership system is a regional representative of a very large company and it is a system that needs to be regularly controlled. Addressing such a critical issue with only one criterion, such as the sales performance of the dealers, can create problems that are difficult to solve as time passed. This situation should be handled in a multi-faceted way and concluded with analytical methods. In this study, an integrated approach was proposed to solve this complicated and challenging problem. The FAHP method is the first step of the proposed solution method which has two stages. FAHP method was utilized in gaining the weights of evaluation criteria. After obtaining the weights of the criteria, the performance of the dealers according to the organizational performance criteria was evaluated with the help of the PROMETHEE method. The used criteria in the evaluation of the dealers were determined as criteria used in the evaluation of organizational performance in particular and on purpose. The aim is to shed light on the whole evaluation process in terms of strategic management According to the integrated approach, the best dealer for the company was determined as Dealer 5. However, the conducted sensitivity analysis was shown that the best dealer may change with respect to the weights of criteria. Our proposed approach gives a company the chance to evaluate their dealers effectively and faster than other subjective performance measurement methods. Companies can save time and money, which are the most important concerns for any company, by using our proposed approach. Adding different evaluation criteria to the decision problem makes the problem more complex and difficult. Therefore, in future studies, researchers can use different criteria and different MCDM techniques to solve this complex problem structure. In addition, the linguistic scale was given to experts while they were evaluating criteria with respect to each other. However, in the related literature, there are different linguistic scales, even different fuzzy sets like Hesitant fuzzy numbers. Researchers can employ these approaches in their future studies.

Conflict of Interest

No conflict of interest was declared by the authors.

References

Akdeniz, M.B., Gonzalez-Padron, T. & Calantone, R.J. (2010). An integrated marketing capability benchmarking approach to dealer performance through parametric and nonparametric analyses. *Industrial Marketing Management,* 39(1), 150-160. DOI: https://doi.org/10.1016/j.indmarman.2008.05.002.

Arrunada, B., Vazquez, L. & Zanarone, G. (2009). Institutional constraints on organizations: the case of spanish car dealerships, *Managerial and Decision Economics,* 30, 15-26. DOI: https://doi.org/10.1002/mde.1429

Brans, J. P. & Vincke, P. H. (1985). A preference ranking organization method, *Management Science*, 31, 647–656. DOI: https://doi.org/10.1287/mnsc.31.6.647

Brans, J.P. & Mareschal, B. (2005). *Promethee methods multiple criteria decision analysis: State of the art surveys*. New York, USA: Springer.

Boyce, A.S., Nieminen, L.R.V., Gillespie, M.A., Ryan, A.M. & Denison, D.R. (2015). Which comes first, organizational culture or performance? A longitudinal study of causal priority with automobile dealerships, *Journal of Organizational Behavior*, 36, 339–359. DOI: https://doi.org/10.1002/job.1985.

Biondi, S., Calabrese, A., Capece, G., Costa, R. & Di Pillo, F. (2013). A new approach for assessing dealership performance: an application for the automotive industry, *International Journal of Engineering Business Management.* 5(18), DOI: https://doi.org/10.5772/56662.

Chen, M., Yan, W. & Mi, W. (2011). A performance evaluation strategy towards dealers in the automotive supply chain (Book Chapter), *Advances in Maritime Logistics and Supply Chain Systems,* 157-170.

Dağdeviren, M. (2008). Decision making in equipment selection: An integrated approach with AHP and PROMETHEE. *Journal of Intelligent Manufacturing*, 19, 397-406. DOI: https://doi.org/10.1007/s10845-008-0091-7

Dağdeviren, M., Yavuz S. & Kılınç. N. (2009). Weapon selection using the AHP and TOPSIS methods under fuzzy environment. *Expert Systems with Applications*, 36, 8143-8151. DOI: https://doi.org/10.1016/j.eswa.2008.10.016

Dağdeviren, M. (2007). Bulanık analitik hiyerarşi prosesi ile personel seçimi ve bir uygulama*. Gazi Üniversitesi Mühendislik-Mimarlık Fakültesi Dergisi,* 22(4), 791-799. Retrieved from http://dergipark.org.tr/gazimmfd/issue/6674/88430

Dagdeviren, M. & Eraslan, E. (2008). PROMETHEE sıralama yöntemi ile tedarikçi seçimi, *Gazi Üniversitesi Mühendislik – Mimarlık Fakültesi Dergisi*, 23(1), 69-76. Retrieved from http://dergipark.org.tr/gazimmfd/issue/6675/88291

Deveci, M., Canıtez, F. & Gökaşar, I. (2018). WASPAS and TOPSIS based interval type-2 fuzzy MCDM method for a selection of a car sharing station, *Sustainable Cities and Society,* 41, 777-791. DOI: https://doi.org/10.1016/j.scs.2018.05.034.

Efil, İ. (2013). İşletmelerde Yönetim ve Organizasyon. Bursa, Turkey: Dora Yayınları.

Fraser, K., Tseng, B. & Hvolby, H. (2012) TQM in new car dealerships: a study from the firms' perspective, *The TQM Journal*, 25(1), 5-17. DOI: https://doi.org/10.1108/17542731311286397.

Farley, J.U., Hayes, A.F. & Kopalle, P.K. (2004). Choosing and upgrading financial services dealers in the US and UK, *International Journal of Research in Marketing*, 21(4), 359-375. DOI: https://doi.org/10.1016/j.ijresmar.2004.08.001

Gonzalez-Padron, T., Akdeniz, M.B. & Calantone, R.J. (2014). Benchmarking sales staffing efficiency in dealerships using extended data envelopment analysis, *Journal of Business Research,* 67(9), 1904-1911. DOI: http://dx.doi.org/10.1016/j.jbusres.2013.11.022.

Genç, T. (2013). PROMETHEE Method and GAIA Plane, *Afyon Kocatepe Üniversitesi, İİBF Dergisi,* 121-142. Retrieved from http://hdl.handle.net/11630/1501

Gül, M. (2018). A review of occupational health and safety risk assessment approaches based on multi-criteria decision-making methods and their fuzzy versions, *Human and Ecological Risk Assessment*, 24(7), 1723-1760. DOI: https://doi.org/10.1080/10807039.2018.1424531

Rajagopal, R. (2009). Effects of customer services efficiency and market effectiveness on dealer performance, *International Journal of Services and Operations Management,* 5(5), 575-594. Retrieved from https://core.ac.uk/download/pdf/6929278.pdf.

Russo, R. & Camanho,R. (2005) Criteria in AHP: a Systematic Review of Literature, *Procedia Computer Science*, 55 , 1123 – 1132. DOI: https://doi.org/10.1016/j.procs.2015.07.081.

Saaty, T. L. (1970). How to Make a Decision: The Analytic Hierarchy Process. *European Journal of Operational Research,* 48, 9-26. Retrieved from http://www.sciencedirect.com/science/article/pii/0377-2217(90)90057-I

Suganthi, L. (2018). Multi expert and multi criteria evaluation of sectoral investments for sustainable development: An integrated fuzzy AHP, VIKOR / DEA methodology, *Sustainable Cities and Society* 43, 144-156. DOI: https://doi.org/10.1016/j.scs.2018.08.022

Small, A., Hicks, C., McGovern, T., Scurry, T. & Whipp, M. (2015). A balanced scorecard for evaluating the performance of motor dealerships. Paper presented at the 23rd International Conference on Production Research. Manila, Philippines.

Soares, B. N., Abaide, A. R., & Bernardon, D. (2014). Methodology for prioritizing investments in distribution networks electricity focusing on operational efficiency and regulatory aspects, Paper presented at 49th International Universities Power Engineering Conference (UPEC), Romania.

Tosarkani, B.M. & Amin, S.H. (2018), A multi-objective model to configure an electronic reverse logistics network and third party selection, *Journal of Cleaner Production*, 198, 662-682. DOI: https://doi.org/10.1016/j.jclepro.2018.07.056

Teniwut, W.A., Marimin, M., & Djatna, T. (2019), Gis-based multi-criteria decision making model for site selection of seaweed farming information centre: A lesson from small Islands, Indonesia, *Decision Science Letters*, 8(2),137-150. DOI: https://doi.org/10.5267/j.dsl.2018.8.001

Wang, T.C., & Tsai, S.Y. (2018). Solar panel supplier selection for the photovoltaic system design by using fuzzy multi-criteria decision making (MCDM) approaches, *Energies,* 11(8), 1989. DOI: https://doi.org/10.3390/en11081989

Yıldırım, F.B. and Önder, E. (2015). İşletmeciler, mühendisler ve yöneticiler için operasyonel yönetsel ve stratejik problemlerin çözümünde çok kriterli karar verme. Bursa, Turkey: Dora Yayıncılık, Bursa, Turkey.

Zadeh, L.A. (1965). Fuzzy sets, *Information and Control,* 8(3), 338-353. DOI: https://doi.org/10.1016/S00199958(65)90241-X