



# RECENT RESEARCHES ON SOCIAL SCIENCES

*Monographs and Studies of the Jagiellonian  
University - Institute of Public Affairs*

**EDITED BY**  
**ROMAN DORCZAK**  
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**RAFAŁ MUSIALIK**

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Institute of Public Affairs**

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**Edited by  
Roman Dorczak  
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# Green Star Hotel Selection with Fuzzy TOPSIS Method: Case of Istanbul

Ahmet Oztel, Ayhan Karakas, Ahmet Aslan

## 1. Introduction

Today, the tourism sector, as well as all over the world is in a rapid growth in Turkey. Hotel establishments constitute one of the most important building blocks of the tourism sector; It also provides a social service with the ability to meet the needs of traveling people such as accommodation, eating and drinking, entertainment and rest. Given the contributions made by the hospitality industry to employment, the economy and other sectors, the accommodation industry is the locomotive of the tourism industry and represents one of the most important subsystems.

Accommodation enterprises, which are an important subsystem of the tourism industry; which produces labor-intensive goods and services, sells a wide variety of goods and services to meet the needs of temporary accommodation, eating-drinking, part-time entertainment and other social needs of tourists with different components, makes production and sale under the same roof, are in close contact with the customer face to face. The aim of this study is to select the best green star hotel in Istanbul using the fuzzy TOPSIS method.

Today, hotel businesses are becoming increasingly difficult to sustain their assets without considering environmental issues, and hotel businesses have important duties, such as protecting the local environment and contributing to the local community (Yu-Chin, 2012). Environmental management practices in hotel businesses include waste recycling, waste management, energy conservation, water protection, legislative alignment, procurement policies and environmental education (Chan Wilco, 2009; Kotler, Bowen & Makens, 2010; Middleton, 2000) Increasing the number of customers who prefer environment-conscious businesses can be a good marketing strategy for them to position themselves as a green hotel in tourism businesses to gain competitive advantage (Kamal & Vinnie, 2007).

In addition to gaining a competitive edge, differentiating themselves from similar, but non-green operations, and fulfilling customers' needs for environmentally friendly hotels, green hotels eventually bring various benefits to the operation (e.g., reductions in energy consumption and operational costs, enhancement of the company's image, coping with government regulation, and positive public attention) (Han, Hsu, & Sheu, 2010b). Although, in the lodging industry, previous studies have examined environmental management/practices, green strategies related to the environmental policies, and customers' green preferences and attitudes toward green practices, little research has focused on hotel customers' decision-making processes when selecting a green hotel. More specifically, a thorough theoretical/empirical explanation regarding the formation of hotel selection criteria to choose a green hotel over the alternatives has been rare (Claver-Cortés, Molina-Azorín, Pereira-Moliner, & López-Gamero; Han, Hsu, & Sheu, 2010a).

## 2. Literature Review

### 2.1 Hotel Industry in Turkey

The essential functions of the hotels are to provide accommodation for the guests. Besides this service, they can also provide auxiliary and complementary units for the guests' eating and drinking, sports and entertainment needs. The first hospitality establishments, which are seen as inns and caravanserais, have developed and changed over the past years and as a result of increasing travel opportunities, the quality and quantity of the accommodation enterprises have increased. There is a transition from small accommodation businesses that only meet the need for overnight accommodation to accommodation businesses that are now trying to satisfy all kinds of desires of tourists. Changing tourism trends, differentiation in tourist demand and aggravating competition conditions require different businesses,

but they have to turn to offer goods and services that match the expectations of their customers. More than 85% of the bed capacity of the accommodation enterprises constitutes hotels. Hotels are divided into Tourism Operation Certificate and Municipality Certificate. The hotels with tourism operation certificate are classified according to the number of stars. This classification is 1, 2, 3, 4 and 5 stars. In Turkey, as of 2017, there are 3771 accommodation establishments and 935 000 bed capacity. In addition, the tourism sector accounts for 3 per cent of GDP and the export ratio of tourism revenues is 16.7 percent (TURSAB, 2018).

The tourism sector in Turkey, particularly after 1980, began to show a significant improvement and has become one of the sources of income that have contributed greatly to the country's economy. Indeed, Turkey has 38 million 620 thousand international tourists visited in 2017. Moreover, the foreign exchange income obtained from tourism in 2017 was realized as 26 billion 283 million dollars ([www.kultur.gov.tr](http://www.kultur.gov.tr)). The tourism sector is considered to be a driving force for the Turkey economy. Depending on these factors, it is stated that tourism provides employment to about 1.7 million people in Turkey. However, the World Tourism and Travel Council (WTTC) in the report mentions which was prepared for Turkey that this figure is a total of around 2.5 million (WTTC, 2013).

## 2.2 Green Hotel Concept

Tourists expect the hotel industry to pay attention to environmental concerns and operate in a sustainable way (Gokova, Yasar, Aslan, & Cetin, 2015; Gustin & Weaver, 1996). The accommodation sector is increasingly involved in corporate social responsibility. Many hotels are in several corporate social responsibility initiatives to serve the local community, to increase employee happiness and to protect the environment (Bohdanowicz & Zientara, 2009; S. Lee & Heo, 2009). According to Hacıoğlu & Girgin (2008), tourists are taking vacation decisions with the expectation of qualified tourism experiences that are revealed in accordance with the place where they will go. Therefore, it is necessary for consumers to understand their expectations for the protection of the environment and to meet these demands. Rising environmental awareness, increased tourist interest on green products, and voluntary more payments by tourists to green products; encourages hotel operators to obtain a green star certificate (Peattie & Crane, 2005). Today, in order to succeed in both national and international markets, it is necessary to invest in practices that do not destroy the environment and even protect the environment. Owners of "Green Stars" are trying not only to fulfill their social responsibilities but also to attract the attention of tourists with their environmental sensitivity works. Because tourists evaluate the price of a product they will buy, taking into account their impact on the environment (Ar & Tokol, 2010).

Green hotels, ecological hotels, eco-friendly hotels, green hotels, or green star hotels, which embrace sustainable tourism and nature-oriented hotel management activities, also help to save energy and help reduce the amount of waste left on to the environment. Environmental Management Systems evaluates the practices of environmental protection-related premises. Green star application has become a sustainable hotel management model that has been spread over the whole world, especially in Europe in recent years, and adopted as a new preference criterion by the customers. Hotel enterprises play an important role in ensuring environmental sustainability, as many activities that have significant impact on the environment, such as water, heating, cooling, lighting, laundry systems, etc., take place (Hsieh & Huang, 1998).

Within the scope of "Sustainable Tourism Facilities" project initiated by Turkish Ministry of Culture and Tourism and "Sustainable Tourism" is an "Environmental Label" application for environmentally friendly accommodation facilities. "Communiqué Pertaining to the Issuance of Accommodation Facility Responsible for Tourism Facilities Certificated Accommodation Facilities" (Communiqué No: 2008/3) has been published by the Official Gazette dated 22.09.2008 and numbered 27005. In the communiqué published in the Ministry, it is stated that "the consumption of energy, water and environmentally harmful substances and the reduction of the amount of waste, the increase of energy efficiency, the promotion of the use of renewable energy resources, the planning and realization of accommodation enterprises sensitive to environment from the investment stage, , awareness of environmental awareness, providing education and cooperation with related institutions and

organizations (Turkish Ministry of Culture and Tourism). The aim of the Ministry to carry out this practice is; the development of environmental awareness of the protection of the environment and the promotion of environmentally-friendly construction and management of tourist accommodation enterprises. Also, according to the Green Hotels Association (2012), green hotels can be defined as eco-friendly accommodation facilities that implement different green practices such as water and energy conservation, solid waste reduction and recycling and reuse of durable services.

### 2.3. Factors Affecting Tourists' Choice of Hotel

There are a lot of study in literature on the choice of hotel for tourists. In the hotel selection, MCDM techniques such as AHP (Analytic Hierarchy Process), Fuzzy TOPSIS, ELECTRE were used. Hotel managers need to be able to identify the factors that affect tourists' choices (Lockyer, 2005a; Mattila & O'Neill, 2003). The location of the hotel is an important factor affecting the decision of tourists to choose a hotel (Yang, Wong, & Wang, 2012). In fact, the factors that affect tourists' hotel choice are rather complicated (Lockyer, 2005b). The choice of location includes making a general distribution plan for the region, as well as traffic and transport conditions in the region, which are taken into account when selecting the location (Coltman, 1989). Whether the hotel is close to the city center or the tourist attractions, whether it is in a zone where transportation can be provided, and so on (Dogan & Gencan, 2013). Gray and Liguori (2003), pointed out a few issues in the study area: local economic environment, regional regulations, height limits of buildings, parking facilities, public facilities, traffic facilities and accessibility to regions, geographical factors, natural resources and size of the place. In addition, Pan (2002) categorized tourist hotel location selection factors: the suitability of the main station, traffic convenience and good visual perception, public facilities and other services, the implementation of specific regulations, and the flexible area. The basis of these discussions focuses on the overall facilities surrounding the hotel, the traffic conditions and future considerations for expandability. Knutson (1988) stated that business travelers consider five important factors when choosing a hotel: clean, comfortable, well-maintained rooms, convenient location, fast service, safe environment, friendly and courteous staff. Tourists have also taken into consideration 6 important factors when choosing a hotel through TripAdvisor: hotel location, cleanliness, quality of bed, comfort, equipment, service, money reserve. When a potential customer searches for a hotel through TripAdvisor, they pay attention to the comments of other customers (Zaman, Botti, & Thanh, 2016). Tourists want to get the most appropriate accommodation, food, entertainment, and other services they need during their travels with the highest quality service.

A number of studies have been conducted to examine the selection criteria that affect customers' hotel choice intentions (Lockyer, 2005b). It has been found that factors such as location, price, facility and cleanliness are influencing tourists' choice of hotels. Other criteria are location, size of guest rooms, staff, facilities and breakfast (Stringam, Gerdes Jr, & Vanleeuwen, 2010). In addition, Lockyer (2005b) found a relationship between price and location in his work. That is, if a person on a business trip wants to stay in a particular place, he/she will pay more for the accommodation, since the company will probably pay the accommodation fee. However, even if a customer does want to stay in a green star hotel, he may not choose that hotel if he does not afford it (Han et al., 2010b; Nicolau & Mas, 2006). In their work, Sparks and Browning (2011) emphasize that customers are the four main factors influencing hotel choice and trust perception. These; The purpose of interpretation is whether a consumer-rated numerical rating is presented along with the general value (positive or negative), frame and written text. As a result of the research; Consumers were affected by comments containing negative information, but positive comments were found to be reliable.

Lee et al. (2000) ve Hsieh & Huang (1998) , point out that the number of competitive stores in the region and the market share in commercial circles are important factors in choosing the location. The degree of proximity to competing regions is also an indicator of competitiveness. Ülgen & Gülmez (2016) , as the main criterion in their study using the AHP method for preferring one of the hotels within the chain hotel group with five star standard operating in Antalya, the closeness to the airport, the quality of service, the recommendation rate, the price performance , hotel hall, area and price. The order of importance of these criteria is as follows; 1-price, 2-service quality, 3-recommendation rate, 4-price-

performance ratio, 5-hotel carnage, 6-area (area of establishment), 7-proximity to the airport. As a result of this work Rixos Tekiorova hotel was chosen as the most suitable hotel.

In one study, it was researched how the influences of the criteria of potential hotel guests influence the decision-making process (Zaman et al., 2016). We have used these sites because of the increasing importance of hotel communication through the website of reviews, that is to say the importance of electronic communication in the mouth. We have used AHP on the criteria of TripAdvisor, and in a study on 250 tourists in Paris, the location, the quality of the bed, comfort-comfort, equipment, service, 6 as cleaning. The criteria for the study were reached as a result of interviews with tourists. The priorities in the criteria have changed according to the duration of income and stay. Cleanliness is the most important consideration in all criteria. The first order was in the remaining three days, while in the remaining three days it was cleaned. 69% of 250 tourists did not stay for 3 nights, and the result shows that sleep quality, comfort and weight of equipment increase during the stay. Those earning more than \$ 25,000 a year (36% responding) are looking for better location, comfort and additional services. Tourists have categorized criteria 1-9 according to their importance. (Zaman et al., 2016).

Chou, Hsu, & Chen, (2008) found 21 criteria for hotel selection in their study of location choice for an international hotel in Taiwan. Many of these criteria may also be important in selecting hotels for tourists. These criteria consist of four perspectives, 8 factors and 21 criteria. Perspectives are geographical conditions, traffic conditions, hotel features and operation management. For example, hotel features include; hotel leisure facilities, diversity of restaurants, local cultural compatibility of the hotel's features. As a result of the research, hotel properties, operations management perspectives have become the first and second important perspective. Internal development was the most important factor among the factors.

Aksoy & Ozbuk, (2017) determined 3 factors and 10 special criteria in their study on the selection of the most advantageous hotels in Istanbul by location. Factors are accessibility, city development and tourist attraction. With PSI method, 15 alternative hotels have been identified and also ratings of hotel locations of these 15 hotel customers from booking.com have been compared. Parallelism was found among the values. It was determined that the proximity of tram and metro is important in the selection of hotel.

Yang, Mao, & Tang, (2018) emphasizes the proximity of a hotel to attractions, airports, universities and public transport, as well as its proximity to green areas, water areas and local businesses. In this study, the factors related to location were determined as the ease of access to the points of interest, the suitability of transportation and the condition of the environment. 220 Los Angeles hotel and 8185 customer comments have been set up to reach the best hotel that satisfies tourists.

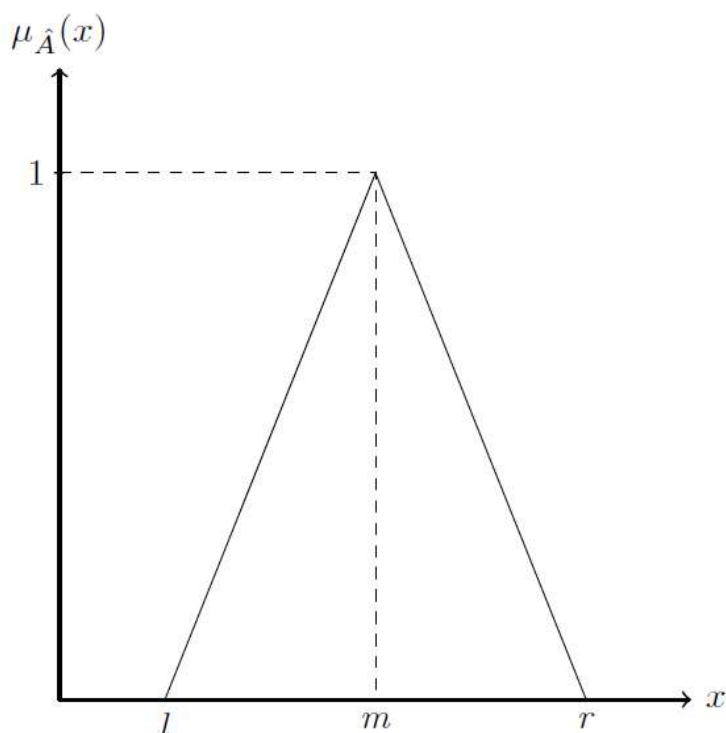
In Iran, the criteria that tourists place in hotel selection are the result of promenade and comfort, security and protection and network services being the most important factors. In this study, 308 people were surveyed (Sohrabi, Vanani, Tahmasebipur, & Fazli, 2012).

The category of the hotel (classification), the location (Yang et al., 2012), the facilities offered have a positive effect on the hotel room price and its rating. In another study, it was stated that the main factors influencing customers' decisions to choose a hotel were the suitability of their reputation, image and accessibility (Tsaur & Tzeng, 1996).

## 2.4. Triangular Fuzzy Numbers

A triangular fuzzy number  $\tilde{A}$  can be represented by a triangle  $(l, m, r)$ . Then the membership function of the triangular fuzzy number  $\tilde{A}$ :

$$\mu_{\tilde{A}}(x) = \begin{cases} 0, & x < l, \\ \frac{x-l}{m-l}, & l \leq x \leq m, \\ \frac{r-x}{r-m}, & m \leq x \leq r, \\ 0, & r < x. \end{cases} \quad (1)$$



**Figure 1.** Membership function of triangular fuzzy number  $\tilde{A}$

Let  $\tilde{A} = (l_1, m_1, r_1)$  and  $\tilde{B} = (l_2, m_2, r_2)$  are two triangle fuzzy numbers and  $k$  a scalar then, mathematical operations in triangular fuzzy numbers are defined as follows (Erol, Sencer, & Sari, 2011; Kaufmann & Gupta, 1988; T.-C. Wang & Chang, 2007):

$$\begin{aligned}\tilde{A} \oplus \tilde{B} &= (l_1 + l_2, m_1 + m_2, r_1 + r_2) \\ \tilde{A} \ominus \tilde{B} &= (l_1 - r_2, m_1 - m_2, r_1 - l_2) \\ \tilde{A} \otimes \tilde{B} &= (l_1 \times l_2, m_1 \times m_2, r_1 \times r_2) \\ \tilde{A} \oslash \tilde{B} &= (l_1/r_2, m_1/m_2, r_1/l_2) \\ k\tilde{A} &= (kl_1, km_1, kr_1) \\ (\tilde{A})^{-1} &= (1/r_1, 1/m_1, 1/l_1)\end{aligned}$$

The distance between two fuzzy numbers is (C.-T. Chen, 2000):

$$d(\tilde{A}, \tilde{B}) = \sqrt{\frac{1}{3}[(l_1 - l_2)^2 + (m_1 - m_2)^2 + (r_1 - r_2)^2]}$$

### 2.3.1. Fuzzy TOPSIS Method

Hwang and Yoon (1981) proposed TOPSIS (The Technique for Preference to Similarity to Ideal Solution), which investigates the nearest and farthest solution to respectively the ideal solution and the anti-ideal solutions. Chen (2000) proposed the fuzzy TOPSIS method. We can summarize the method as follows (T.-C. Wang & Chang, 2007):

### 2.3.2. Determination of Weight of Criteria

Since the weights of criteria in decision-making problems represent different meanings, they cannot all be assigned at the same level of importance (M.-F. Chen & Tzeng, 2004). A wide variety of weighting methods are proposed in the literature. For fuzzy numbers, determining the weights with linguistic variables is an effective method. For the linguistic expressions in this method "very low", "low",

"medium", "high" and "very high", the triangular fuzzy number assignments in Table 1 are made (M.-J. J. Wang & Chang, 1995).

**Table 1.** Linguistic scales for the importance weight of each criterion (C.-T. Chen, 2000; M.-J. J. Wang & Chang, 1995)

Linguistic variable	Corresponding triangular fuzzy number
Very low (VL)	(0,0.1,0.3)
Low (L)	(0.1,0.3,0.5)
Medium (M)	(0.3,0.5,0.7)
High (H)	(0.5,0.7,0.9)
Very high (VH)	(0.7,0.9,1.0)

Suppose that a decision group has  $k$  members; take  $\tilde{w}_j^k$  to present the fuzzy weight of  $j$ th criterion assessed by  $k$ th evaluator. To integrate the different opinions of evaluators, this study adopted the synthetic value notation to aggregate the subjective judgement for  $k$  evaluators, given by

$$\tilde{w}_j = \frac{1}{k}(\tilde{w}_j^1 + \tilde{w}_j^2 + \dots + \tilde{w}_j^k) \quad (2)$$

### 2.3.2.1 Construction of Fuzzy Decision Matrix

Given  $m$  alternatives,  $n$  criteria and  $k$  decision-makers, a typical fuzzy multi-criteria group decision-making problem can be expressed in matrix format as (T.-C. Wang & Chang, 2007):

$$\tilde{D} = \begin{bmatrix} \tilde{x}_{11} & \tilde{x}_{12} & \dots & \tilde{x}_{1n} \\ \tilde{x}_{21} & \tilde{x}_{22} & \dots & \tilde{x}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{x}_{m1} & \tilde{x}_{m2} & \dots & \tilde{x}_{mn} \end{bmatrix} \quad (3)$$

where  $\tilde{x}_{ij}$  represents the rating of  $i$ th alternative with respect to  $j$ th criterion evaluated by  $k$  evaluators  $i = 1, 2, \dots, m; j = 1, 2, \dots, n$ . In this study preferred the method of average value to integrate the fuzzy performance score  $\tilde{x}_{ij}^k$  for  $k$  evaluators concerning the same evaluation criteria, that is

$$\tilde{x}_{ij} = \frac{1}{k}(\tilde{x}_{ij}^1, \tilde{x}_{ij}^2, \dots, \tilde{x}_{ij}^k) \quad (4)$$

Where  $\tilde{x}_{ij}^k = (l_{ij}^k, m_{ij}^k, r_{ij}^k)$  is the rating  $i$ th alternative with respect to  $j$ th criterion evaluated by  $k$  evaluators.

The linguistic variables used by the evaluators are given in Table 2.

**Table 2.** Linguistic scales for the rating of each candidate green hotel

Linguistic variable	Corresponding triangular fuzzy number
Very poor (VP)	(0,1,3)
Poor (P)	(1,3,5)
Fair (F)	(3,5,7)
Good (G)	(5,7,9)
Very good (VG)	(7,9,10)

### 2.3.2.2 Normalization of Fuzzy Decision Matrix

In various MCDM problems, the raw data are normalized to recover the anomalies resulting from different measurement units and scales. However, the linear scales used in this study are intended to maintain the conversion normalization function in the range of normalized triangular fuzzy numbers [0,1]. If  $\tilde{N}$  represents the normalized fuzzy decision matrix, then:

$$\tilde{N} = [\tilde{n}_{ij}]_{m \times n}, i = 1, 2, \dots, m; j = 1, 2, \dots, n. \quad (5)$$

where;

$$\tilde{n}_{ij} = \left( \frac{l_{ij}}{r_j^+}, \frac{m_{ij}}{r_j^+}, \frac{r_{ij}}{r_j^+} \right) \quad (6)$$

$$r_j^+ = \max_i r_{ij} \quad (7)$$

### 2.3.2.3 Construction of Weighted Normalized Fuzzy Decision Matrix

Given the different weight of each criterion, the weighted normalized decision matrix can be calculated by multiplying the significance weights of the evaluation criteria and the values in the normalized fuzzy decision matrix. The weighted normalized decision matrix  $\tilde{V}$  is constructed as follows:

$$\tilde{V} = [\tilde{v}_{ij}]_{m \times n}, i = 1, 2, \dots, m; j = 1, 2, \dots, n. \quad (8)$$

$$\tilde{v}_{ij} = \tilde{n}_{ij} \otimes \tilde{w}_j \quad (9)$$

where,  $\tilde{w}_j$  is weight of the  $j$ th.

### 2.3.2.3 Determination of Fuzzy Ideal and Fuzzy Anti-Ideal Solutions

Fuzzy ideal point  $A^+$  and fuzzy anti-ideal solutions can be defined as

$$A^+ = (\tilde{v}_1^+, \tilde{v}_2^+, \dots, \tilde{v}_n^+) \quad (10)$$

$$A^- = (\tilde{v}_1^-, \tilde{v}_2^-, \dots, \tilde{v}_n^-) \quad (11)$$

where,  $\tilde{v}_j^+ = (1,1,1)$ ;  $\tilde{v}_j^- = (0,0,0)$ ;  $j = 1, 2, \dots, n$ .

### 2.3.2.4 Calculation of the Distances of Alternatives to Fuzzy Ideal and Fuzzy Anti-Ideal Solutions

$$d_i^+ = \sum_{j=1}^n d(\tilde{v}_{ij}, \tilde{v}_j^+); i = 1, 2, \dots, m. \quad (12)$$

$$d_i^- = \sum_{j=1}^n d(\tilde{v}_{ij}, \tilde{v}_j^-); i = 1, 2, \dots, m. \quad (13)$$

### 2.3.2.5 Obtain the Closeness Coefficient and Rank the Order of Alternatives

The closeness coefficient of each alternative is calculated by the following equation:

$$CC_i = \frac{d_i^-}{d_i^+ + d_i^-}; i = 1, 2, \dots, m. \quad (14)$$

The alternatives are sorted according to the descending order of the calculated proximity coefficients.

## 3. Application

In this study, five-star green hotel choice was made by Fuzzy TOPSIS method. As application data, 35 five-star green hotels operating in Istanbul were selected. Ten criteria were found to be appropriate. The decision matrix of the problem is given in Table 3. Since the fuzzy decision matrix takes up a lot of space, it has not been taken here.

An integrated fuzzy importance weight matrix for evaluation criteria was generated using the method of average value described in Eq. (4), and is presented in Table 2. To understand the importance order of these performance criteria for the pilots, the center of area (COA) method (Zhao & Govind, 1991) was utilized to defuzzify the triangular fuzzy numbers into corresponding best nonfuzzy performance (BNP) values. The BNP values presented in Table 4 reveal that the three most important

performance criteria for assessing green hotel were TripAdvisor customer ratings (C8), Price (C6) and Distance time to Sultanahmet Square (C4).

The results obtained by the Fuzzy TOPSIS method are given in Table 5. As you can see from the table, RADISSON BLU HOTEL ISTANBUL ASIA achieved the best performance. ELİTE WORLD BUSINESS, HILTON İSTANBUL KOZYATAĞI CONFERENCE CENTER & SPA, DİVAN İSTANBUL ASİA OTEL and WYNDHAM GRAND ISTANBUL EUROPE have created the top five most successful hotels. When we look at the closeness coefficient values of the first five, it is seen that there are very close performances between 0.502-0.5119. ISTANBUL POLAT RENAISSANCE HOTEL has achieved the lowest performance. ESER HOTEL PREMIUM & SPA, CROWNE PLAZA İSTANBUL ASIA, MIRACLE İSTANBUL ASIA HOTEL and HOLIDAY İNTANBUL CİTY have formed the most unsuccessful five stars.

**Table 3.** The decision matrix for green hotel selection problem

Hotel	Distance Time (min)				Traffic Intensity	Price (TripAdvisor)	Customer Ratings			
	Subway	Airport	Coach Station	Sultanahmet Square			Trivago	TripAdvisor	Hotels.com	Google
ATIK PAŞA FOUR SEASONS	2.70	25.00	13.00	0.45	2.00	1757.00	9.40	5.00	9.60	4.70
BİZ CEVAHİR OTEL	0.55	20.50	11.70	9.40	3.00	499.00	8.20	4.50	8.40	4.00
CONRAD OTELİ	3.10	23.80	11.20	6.50	2.00	748.00	8.50	4.50	9.00	4.50
CROWNE PLAZA İSTANBUL ASIA	13.30	4.60	34.30	43.00	1.00	4200.00	8.60	4.50	8.80	4.40
DEDEMAN PARK BOSTANCI OTEL&CONVENTION CENTER-DEDEMAN PARK BOSTANCI	1.00	29.20	15.00	23.60	2.00	246.00	8.30	4.00	8.60	4.30
DİVAN İSTANBUL	0.70	21.30	9.80	5.90	3.00	567.00	9.00	4.50	9.00	4.40
DİVAN İSTANBUL ASIA OTEL	2.60	8.00	29.60	38.10	1.00	225.00	8.50	4.50	8.80	4.40
DOUBLETREE BY HILTON İSTANBUL MODA	0.20	25.00	4.50	16.20	2.00	620.00	8.80	4.50	9.00	4.40
ELİTE WORLD BUSINESS	7.20	3.00	20.70	20.50	1.00	229.00	8.60	4.50	8.60	4.30
ESER OTEL PREMIUM & SPA	4.70	24.50	38.70	41.60	2.00	284.00	7.80	4.00	7.80	4.10
GRAND HYATT İSTANBUL	0.60	21.30	9.70	5.80	3.00	748.00	8.70	4.50	9.00	4.50
HILTON İSTANBUL KOZYATAĞI CONFERENCE CENTER & SPA	2.80	27.80	7.50	16.00	2.00	274.00	8.50	4.50	8.60	4.40
HİLTON OTELİ	1.10	23.60	10.30	6.40	2.00	846.00	8.50	4.50	8.40	4.50
HOLIDAY INN İSTANBUL CİTY	0.90	12.70	10.70	8.90	4.00	231.00	7.60	4.00	6.80	3.80
İSTANBUL POLAT RENAISSANCE OTEL	6.30	5.00	14.80	15.60	4.00	463.00	8.00	4.00	8.20	4.50
LİMAK EURASIA LUXURY HOTEL	6.70	34.00	23.00	24.40	2.00	331.00	8.40	4.50	8.60	4.30
MIRACLE İSTANBUL ASIA HOTEL	14.00	4.40	33.80	42.30	1.00	262.00	8.10	3.50	8.40	4.00
MÖVENPICK HOTEL İSTANBUL	0.28	23.60	8.80	12.30	1.00	514.00	8.70	4.50	8.80	4.40
PARK INN BY RADISSON İSTANBUL ATATÜRK AIRPORT OTEL	6.40	5.70	14.70	22.60	2.00	353.00	8.10	4.50	8.00	4.10
RADISSON BLU HOTEL İSTANBUL ASIA	3.00	25.00	11.50	21.60	1.00	262.00	8.50	4.50	9.00	4.40
RADISSON BLU CONFERENCE & AIRPORT HOTEL İSTANBUL	5.50	4.80	19.00	18.80	1.00	231.00	7.50	3.50	7.80	3.90
RADISSON BLU HOTEL İSTANBUL PERA	0.40	19.20	9.40	4.00	2.00	553.00	8.50	4.50	8.40	4.20
RADISSON BLU HOTEL İSTANBUL-ŞİŞLİ	0.60	20.00	7.90	8.20	2.00	546.00	8.50	4.50	8.60	4.30
RADISSON SAS BOSPHORUS	0.40	25.00	12.10	7.40	2.00	681.00	7.90	4.00	8.20	4.20
RAMADA PLAZA İSTANBUL	4.40	21.80	7.60	7.50	3.00	394.00	8.10	4.00	8.20	4.20
RAMADA PLAZA İSTANBUL TEKSTİL KENT	3.90	18.40	5.90	14.90	2.00	256.00	8.00	4.00	8.20	4.20
RENAISSANCE İSTANBUL POLAT BOSPHORUS HOTEL	2.30	23.20	11.60	8.70	2.00	567.00	8.30	4.50	8.60	4.40
SILENCE İSTANBUL HOTEL CONVENTION CENTER	3.40	23.20	13.00	21.60	1.00	316.00	8.30	4.00	9.00	4.20
SWISSOTEL THE BOSPHORUS	1.80	23.10	10.90	7.00	2.00	833.00	8.80	4.50	9.20	4.60
THE MARMARA TAKSİM	0.06	20.70	10.40	4.90	3.00	633.00	8.10	4.50	8.60	4.30
THE RITZ CARLTON	1.10	21.00	9.50	5.60	1.00	2191.00	9.00	4.50	9.20	4.60
THE ST. REGIS İSTANBUL	1.00	23.60	10.10	6.20	2.00	1382.00	9.10	5.00	9.80	4.60
WYNDHAM GRAND İSTANBUL EUROPE	6.00	5.90	15.10	22.00	2.00	287.00	8.80	4.50	9.20	4.40
WYNDHAM GRAND İSTANBUL KALAMIŞ MARİNA HOTEL	2.80	34.00	5.70	18.40	2.00	465.00	8.80	4.50	9.20	4.60
WYNDHAM GRAND İSTANBUL LEVENT	0.70	22.60	9.90	11.30	2.00	741.00	8.90	4.50	9.40	4.50

Traffic Intensity 1: Open, 2: Flow, 3: Intensive, 4: Very Intensive



## Green Star Hotel Selection with Fuzzy TOPSIS Method

**Table 4.** The fuzzy important weight, BNP and rank of each criterion

Criteria	Fuzzy importance weight	BNP value	Rank
C1	0.4333;0.6333;0.8333	0.6333	7
C2	0.4333;0.6333;0.8	0.6222	8
C3	0.3;0.5;0.7	0.5000	9
C4	0.5;0.7;0.8667	0.6889	3
C5	0.4333;0.6333;0.8333	0.6333	6
C6	0.5;0.7;0.8667	0.6889	2
C7	0.4333;0.6333;0.8333	0.6333	5
C8	0.5667;0.7667;0.9333	0.7556	1
C9	0.4333;0.6333;0.8333	0.6333	4
C10	0.2333;0.4333;0.6333	0.4333	10

**Table 5.** The Fuzzy TOPSIS results

HOTEL	A+	A-	CC	RATI NG
Atik Paşa Four Seasons	5.506	5.338	0.492	12
Biz Cevahir Otel	5.677	5.154	0.475	26
Conrad Oteli	5.534	5.308	0.489	17
Crowne Plaza İstanbul Asya	5.83	4.966	0.46	33
Dedeman Park Bostancı Otel&Convention Center	5.460	5.404	0.497	8
Divan İstanbul	5.758	5.055	0.467	28
Divan İstanbul Asya Otel	5.394	5.464	0.503	4
Doubletree By Hilton İstanbul Moda	5.600	5.241	0.483	22
<b>Elite World Business</b>	<b>5.30</b>	<b>5.56</b>	<b>0.51</b>	<b>2</b>
Eser Otel Premium & Spa	5.951	4.865	0.449	34
Grand Hyatt İstanbul	5.758	5.055	0.467	29
<b>Hilton İstanbul Kozyatağı Conference Center &amp; Spa</b>	<b>5.34</b>	<b>5.52</b>	<b>0.50</b>	<b>3</b>
Hilton Oteli	5.580	5.262	0.485	21
Holiday Inn İstanbul City	5.819	5.008	0.462	31
İstanbul Polat Renaissance Otel	5.975	4.835	0.447	35

Limak Eurasia Luxury Hotel	9	5.679	7	5.164	2	0.476	25
Miracle İstanbul Asia Hotel	4	5.820	3	4.984	3	0.461	32
Mövenpick Hotel İstanbul	3	5.509	7	5.331	8	0.491	14
Park Inn By Radisson İstanbul Atatürk Airport Otel	2	5.608	6	5.233	7	0.482	23
<b>Radisson Blu Hotel İstanbul Asya</b>	<b>04</b>	<b>5.30</b>	<b>99</b>	<b>5.55</b>	<b>19</b>	<b>0.51</b>	<b>1</b>
Radisson Blu Conference & Airport Hotel İstanbul	9	5.578	6	5.285	5	0.486	19
Radisson Blu Hotel İstanbul Pera	6	5.503	2	5.338	4	0.492	10
Radisson Blu Hotel İstanbul-Şişli	6	5.503	2	5.338	4	0.492	11
Radisson Sas Bosphorus	2	5.703		5.133	7	0.473	27
Ramada Plaza İstanbul	9	5.665	7	5.170	2	0.477	24
Ramada Plaza İstanbul Tekstilkent	6	5.452	6	5.416	3	0.498	6
Renaissance İstanbul Polat Bosphorus Hotel		5.534	3	5.308	6	0.489	18
Silence İstanbul Hotel Convention Center	9	5.450	2	5.403	8	0.497	7
Swissotel The Bosphorus	6	5.530	8	5.313		0.49	16
The Marmara Taksim	9	5.758	6	5.055	5	0.467	30
The Ritz Carlton		5.48		5.361	5	0.494	9
The St. Regis İstanbul		5.506	3	5.338	3	0.492	13
Wyndham Grand İstanbul Europe	6	5.408	3	5.452		0.502	5
Wyndham Grand İstanbul Kalamış Marina Hotel	2	5.531	8	5.318	2	0.490	15
Wyndham Grand İstanbul Levent	3	5.570	9	5.271	2	0.486	20

#### 4. Conclusions

Within the scope of the study, Radisson Blu Hotel Istanbul Asia was chosen as the best hotel by obtaining the highest closeness coefficient. Elite World Business and Hilton Istanbul Kozyatağı Conference Center & Spa are the second and third places with close scores. Criteria are ranked according to importance, TripAdvisor customer reviews, price and distance to Sultanahmet. The Google customer reviews criterion has been identified as the lowest importance criterion. However, tourists are evaluating the impact of a product that they will buy when making a hotel choice, taking into account their price. Tourists want to get the most appropriate accommodation, food, entertainment, and other services they need during their travels with the highest quality service.

Zaman et al. (2016) found that potential tourists in the study they conducted paid attention to TripAdvisor customer reviews when they preferred hotels. It can be said that Zaman, Botti and Thanh

Zaman et al. (2016) and this study have reached similar results. In addition, Sparks and Browning (2011) found that customers were influenced by comments containing negative information when selecting hotels, but positive comments were also found to be reliable. Again, it can be said that there are similarities in the results between Sparks and Browning (2011) and this study. Lockyer (2005b) found a relationship between price and location while conducting hotel selection. In this study, it can be said that the price and the distance of the hotel to Sultan Ahmet square are important criteria, so the results of the two works overlap each other.

Shieh, Hu and Gao (2014), in their study of tourists, chose hotels more often, wider, older, and closer to the airport.

As in other studies carried out in Social Sciences, this study has some limitations. For technical reasons, hotel security, noise map, crime map are not included in the study. These criteria can be included in future work.

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