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Hotel Selection with Safe Tourism Certificates in Covid-19 Pandemic Using SWARA and Fuzzy COPRAS Methods

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Abstract

The virus, which emerged in Wuhan, China, has taken the whole world under its influence in a short time. The World Health Organization declared this period as the "pandemic period", which means a global epidemic, due to the spread of the virus to the world in a short time. This period has undoubtedly been a period when many habits changed for everyone. Vacation habit is also one of the habits that change during this period. Especially in the summer months, people who spend their holidays in hotels had to be more sensitive in choosing the hotel due to the continuation of the pandemic period. While different criteria were considered in hotel selection before, the criterion of having a safe tourism certificate has become the most important criterion due to the pandemic. Businesses with this certificate can provide service without any problems as they take all precautions during the pandemic period. In this study, a hotel selection problem that takes into account the criteria of safe tourism certificate is discussed. In this study, a hotel selection problem that takes into account the safe tourism certification criteria is discussed. In the study, Stepwise Weight Assessment Ratio Analysis (SWARA) and fuzzy logic based The Complex Proportional Assessment (COPRAS) methods were used to solve the problem of choosing the most suitable hotel. As a result of the study, ten hotel alternatives were evaluated according to the criteria of safe tourism certificate during the pandemic period and the most suitable hotel was selected.

Key Words: Hotel Selection, Safe tourism certificate, Multi-criteria decision making, SWARA method, fuzzy COPRAS method

SWARA ve Bulanık COPRAS Yöntemlerini Kullanarak COVID-19 Pandemisinde Güvenli Turizm Sertifikasına Sahip Otel Seçimi

Öz

Çin'in Wuhan kentinde ortaya çıkan virüs, kısa sürede tüm dünyayı etkisi altına almıştır. Dünya Sağlık Örgütü virüsün kısa sürede dünya geline yayılması sebebiyle bu dönemi küresel salgın anlamına gelen "pandemi dönemi" olarak ilan etmiştir. Bu dönem kuşkusuz herkes için pek çok alışkanlığın değiştiği bir dönem olmuştur. Tatil alışkanlığı da bu dönemde değişen alışkanlıklardan biridir. Özellikle yaz aylarında otellerde tatil yapan insanların pandemi döneminin de devam etmesi sebebiyle otel seçiminde daha hassas davranmaları gerekmiştir. Daha önce otel seçiminde farklı kriterler göz önünde bulundurulurken, pandemi sebebiyle güvenli turizm sertifikasına sahip olma kriteri en önemli kriter haline gelmiştir. Bu sertifikaya sahip işletmeler pandemi döneminde tüm tedbirleri aldığı için herhangi bir problem olmadan hizmet verebilmektedirler. Bu çalışmada güvenli turizm sertifikası kriterlerini dikkate alan bir otel seçim problemi ele alınmıştır. Çalışmada en uygun otel seçim problemini çözmek için çok kriterli karar verme yöntemlerinden Stepwise Weight Assessment Ratio Analysis (SWARA) ve bulanık mantık tabanlı Complex Proportional Assessment (COPRAS) yöntemleri kullanılmıştır. Çalışma sonucunda pandemi döneminde on otel alternatifi güvenli turizm sertifikası kriterlerine göre değerlendirilerek ve en uygun otel seçilmiştir.

Anahtar Kelimeler: Otel Seçimi, Güvenli turizm sertifikası, Çok kriterli karar verme, SWARA yöntemi, bulanık COPRAS yöntemi

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Introduction

Tourism activities emerge in line with the desires of people to travel, see new places, relax, have fun, do sports and expand their culture, and so on. The tourism sector, where historical, natural, and geographical attractions are at the forefront is one of the world's fastest-growing industries. With the large numbers of tourists and tourism revenues, tourism is an important source of additional income, foreign exchange, employment, and tax revenue for many countries. The companies in the sector need to get more shares from the increasing tourism movements both nationally and internationally. Therefore, hotel enterprises have a desire to get more shares from the mentioned tourism movements by emphasizing their attractiveness (Zheng, Ji, Lin, Wang, & Yu, 2020, p. 2).

Turkey judging in particular, geographic location, beachfront protects the natural beauty, historical places with unique characteristics. There are archaeological sites and leading in one of the tourist destinations locations in Turkey for the world tourism investments showing continuous improvement. Turkey is surrounded on three sides by the sea which makes it appealing for summer vacations. The coronavirus that emerged in December 2019 has changed many habits of people around the world. These changing habits have also greatly influenced people's behavior, attitudes, and preferences. One of the most important of these changing preferences is undoubtedly the holiday habit (Zhang, Zhao, Cai, & Xiao, 2020, p. 3). While most of the people postponed their vacation during the pandemic period, some did not postpone their vacation on the condition that it was a safe environment. During this period, especially the demand for detached villas outside the hotel increased, but with the emergence of the safe tourism certificate concept, the demand for hotels was not bad in this period. Thanks to hotels with safe tourism certificates, people can learn about the pandemic rules of the hotel before going to the hotels, and it also means that the hotel works following the pandemic rules. During this period, many hotels tried to gain the trust of the people by obtaining a safe tourism certificate because they lost customers and had great difficulty in generating income. In this way, both people will have a comfortable holiday and the hotels will continue to work (Sohrabi, Ziarati, & Keshtkaran, 2020, p. 427).

This study focuses on evaluating the most appropriate hotel alternative with safe tourism certificates during the pandemic period. It is aimed to decide the most suitable hotel by considering the criteria of a family who wants to have a holiday during the pandemic period. Since many criteria and alternatives must be taken into consideration together during the decision-making phase, this problem can be called a Multi-Criteria Decision Making (MCDM) problem. The problem is solved by using the fuzzy Complex Proportional Assessment (COPRAS) and Step-Wise Weight Assessment Ratio Analysis (SWARA) which are two MCDM methodologies. Considering the safe tourism certificate criteria in the problem, the most suitable one among 10 hotels is decided. During the decision-making phase, family members took part as decision-makers. At the first stage, the criteria weights are determined using the SWARA methodology. At the last stage, hotel alternatives are evaluated with fuzzy numbers and sorting was done using the COPRAS method. The most suitable hotel among 10 hotels is decided. The reason for choosing this method is that it is a popular method and there are few studies in the literature. On the other hand, this method let decision-makers to decide priorities and achieve results with a minimum of binary comparisons. Finally, there can be more than one decision-maker in this method. The advantage of the COPRAS method is that thanks to the calculated performance index, the values are taken by the alternatives can be expressed numerically and this makes it easier to compare between alternatives.

The rest of the study is structured as follows. In the background section, a literature review about hotel selection and methodologies are provided. The purpose of the study and the stages of the method used in the study are mentioned in the main focus of the chapter section. A detailed explanation of the methods used in the study is mentioned in the multi-criteria fuzzy methods section. The problem of hotel selection and the implementation stages of the methods are discussed in the solutions and recommendations section. Finally, future research directions and conclusions are provided as separate sections.

Literature Review

It has been observed that with the increase in the number of hotels with safe tourism certificates, people tend to prefer these hotels in terms of a holiday. Deciding on the most suitable hotel with a safe tourism certificate is not just the way to choose a hotel that offers affordable prices. Undoubtedly, people who want to have a holiday take into account many criteria other than price. For example, many criteria such as distance, capacity, and social facilities of the hotel are also taken into consideration. Although

these criteria vary from person to person, there are studies in the literature on hotel preference. There are some studies in the literature that look at how MCDM methods can be used in tourism. This section provides a literature review about MCDM based hotel selection studies as well as SWARA and fuzzy COPRAS methods literature.

Hotel Selection

Murat & Çelik (2007, p. 2) determined the best hotel alternative by evaluating the hotels in Bartin Province in terms of service quality with the Analytic Hierarchy Process (AHP) method. Carrasco et al. (2012) proposed a multilingual MCDM model to evaluate hotel service quality according to the SERVQUAL scale. Manap (2006, p. 157) used the AHP method in choosing a tourism center. In the study, subjective and objective criteria were evaluated in terms of seven criteria to determine the most suitable center for tourists.

Akıncılar & Dağdeviren (2014, p. 264) developed a mixed model in which weights were determined by using the AHP to evaluate the quality of hotel websites, and hotel rankings were determined using the preference ranking organization method for enrichment evaluations. Zaman, Botti, & Thanh (2016, p. 132) examined the weights of hotel criteria using AHP on the TripAdvisor.com website. Yu, Wang, & Wang, 2017, p. 47) proposed an MCDM method to solve problems with hotel selection on tourism websites. Zheng et al. (2020) proposed a heuristic approach for hotel selection. Peng, Wang, & Wang (2021, p. 2) used MULTIMOORA to evaluate hotels. The reader may also refer to Pahari, Ghosh, & Pal (2018, p. 205), Abuhashesh, Al-Khasawneh, Al-Dmour, & Masa'Deh (2019, p. 3), Kim, Lee, & Han (2019, p. 998), and Kwok & Lau (2019, p. 96) for further hotel selection studies. Since all these studies were taken into account before the pandemic period, the changing criteria and the situation of the hotels were undoubtedly ignored.

SWARA Methodology

The SWARA method has been applied in various fields in the literature. These studies include conflict resolution (Keršuliene, Zavadskas, & Turskis, 2010, p. 243), evaluation of investment alternatives for the sustainability of energy systems (Zolfani & Saparauskans, 2013, p. 408), product design (Zolfani et al., 2013a, p. 154), location selection (Zolfani et al., 2013b, p. 7111), thermal insulation selection (Ruzgys, Volvačiovas, Ignatavičius, & Turskis, 2014, p. 103), investment selection (Zolfani & Bahrami, 2014, p. 534), personnel selection (Dahooie, Abadi, Vanaki, Vanaki, & Firoozfar, 2018, p. 6; Karabašević, Stanujkić, & Urošević, 2015, p. 43; Karabašević, Stanujkić, Urošević, & Maksimović, 2016a, p. 2; Stanujkic, , Djordjevic, & Karabasevic, 2015a, p. 53; Urosevic, Karabasevic, Stanujkic, & Maksimovic, 2017, p. 75; Zolfani & Banihashemi, 2014, p. 191), light source selection (Nakhaei, Lale Arefi, Bitarafan, & Kildienė, 2016, p 1982), packaging design (Stanujkic, Karabasevic, & Zavadskas, 2015b, p. 181), material selection (Yazdani, Zavadaskas, Ignatius, & Abad, 2016, p. 382), ERP software selection (Shukla, Mishra, Jain, & Yadav, 2016, p. 120), evaluation of enterprises according to their corporate social responsibilities (Karabašević, Paunkovic, & Stanujkic, 2016b, p. 43), server selection (Yurdoğlu & Kundakcı, 2017, p. 253), risk assessment (Valipour, Yahaya, Md Noor, Antuchevičienė, & Tamošaitienė, 2017, p. 524), contractor firm selection (Çakır, 2017, p. 79), supplier selection (Toklu, Çağıl, Pazar, & Faydalı, 2018, p. 113; Adalı & Işık, 2017, p. 56) and performance evaluation (Özbek & Demirkol, 2018, p. 72) can be given as examples. In these studies, the SWARA method was generally used in determining the criteria weights and was implemented together with other MCDM methods.

Fuzzy COPRAS Methodology

In the COPRAS method, considering alternative and criteria values as crisp values is insufficient for decision-making in the real world because decision makers' evaluations contain uncertainty. To eliminate this uncertainty and insufficiency, the fuzzy COPRAS method has been developed by Nguyen, Dawal, Nukman, Aoyama, & Case, (2015: 5, p. 2). There are studies in various fields in the literature with the fuzzy COPRAS method. These studies include the evaluation of rural building renewable alternatives (Zavadskas & Antucheviciene, 2007, p. 436), air conditioner selection (Adali & Işık, 2016, p. 124), evaluation of work strategies (Fouladgar, Yazdani-Chamzini, Zavadskas, & Haji Moini, 2012, p. 164), determining the best wind farm location (Chatterjee & Bose, 2013a, p. 2) machine tool evaluation (Nguyen et al., 2015), six sigma project selection (Çakır & Özdemir, 2016, p. 167), supplier selection (Zarbakhshnia, Soleimani, & Ghaderi, 2018, p. 307; Khorasani, 2018, p. 17; Nourianfar & Mortazer, 2013, p. 231), performance evaluation (Turanoğlu Bekar, Çakmakçı & Kahraman, 2016, p. 663; Ebrahimi, 2016, p.

333), strategic planning for the urban transportation system (Hatefi, 2018, p. 99), vendor selection (Chatterjee & Bose, 2013b, p. 535) and risk analysis (Yazdani, Alidoosti, & Zavadskas, 2011, p. 27).

As seen in the comprehensive literature review, it has not been seen that SWARA and fuzzy COPRAS methods have been evaluated together in hotel selection before. In addition, there is no other study that takes into account the criteria of "safe tourism certificate" during the pandemic period. Therefore, this study is the first study that takes into account both the use of methods and the criteria of safe tourism certificate. In this context, it is planned to fill the gap in the literature with this study.

Multi-Criteria Based SWARA and Fuzzy COPRAS Integration

In this part of the study, the steps of the SWARA and fuzzy COPRAS method used for choosing the most suitable hotel are mentioned. Since fuzzy modeling was used in the study, fuzzy logic and verbal variables are addressed firstly. Then the SWARA method is explained in detail. Finally, the fuzzy COPRAS method is given with its steps.

Fuzzy Logic

The concept of fuzzy logic was first introduced by Lotfi A. Zadeh. Many decision-making problems and solutions are too complex to be understood quantitatively. Fuzzy logic theory likens the uncertainty in using approximate information and making decisions to human questioning. Since fuzzy logic is very close to human thinking logic, decisions taken according to this logic are more accurate (Zadeh, 1965; Zadeh, 1975, p. 99).

While everything is expressed as 0 or 1 in classical logic, in fuzzy logic there is an expression that corresponds to the binary logic system. The classical logic set is expanded by assigning membership degrees to variables. It is used to explain the uncertainties caused by the complexities in the system and the differences in people's perceptions. As the complexity increases, the definition of the system increases as well and the meaningful expressions goes towards ambiguity and imprecision causes fuzziness. Thus, it is possible to express more easily and accurately with fuzzy logic (Yalçın & Özdemir, 2008, p. 75).

Fuzzy set theory enables data to be classified with boundaries that cannot be precisely defined. Thus, the solution to real-world problems is provided by using fuzzy set theory. Linguistic expressions are often involved in these problems. For example, it is not entirely clear what linguistic expressions such as low, medium, and much correspond to quantitatively. These expressions, which are qualitative through fuzzy sets, become quantitative (Yalçın & Özdemir, 2008, p. 78).

Fuzzy set theory was developed to express linguistic variables in the decision-making process to analyze the ambiguity and subjectivity in human judgments. Fuzzy multi-criteria decision-making models are used to overcome qualitative or incomplete information (Opricovic, 2011, p. 12983). In fuzzy set logic, an element can belong to more than one set to a certain degree of membership value. In classical set logic, an element is included or not included in any set.

Fuzzy numbers are defined as a convex, normalized, finite-continuous membership function and fuzzy set defined in real numbers. The fuzzy number is normal and convex, normality means that the highest membership value is 1 (Baykal & Beyan, 2004). Generally, triangular and trapezoidal fuzzy numbers are used in studies. In this study, since triangular fuzzy numbers are used, these numbers are focused on.

Triangular fuzzy numbers are a special kind of fuzzy numbers expressed as $A=(l, m, u)$. The parameters l, m, and u are real numbers representing the smallest possible value, the most likely value, and the largest possible value, respectively.

A verbal variable is a variable that can take words in a language as its variable value (Zadeh, 1975, p. 99). The words mentioned are those for which the boundary condition cannot be expressed clearly in classical set theory. The verbal variable may need to be defined based on fuzzy sets because the meaning of some words shows complexity or ambiguity. Verbal variables help to describe concepts that cannot be expressed clearly (Özkan, 2003).

SWARA Methodology

The first study on the SWARA approach was published by Keršuliene in 2010. This process is used to evaluate the criteria that should be used in the evaluation of alternatives, starting with the most

important weight ratio and decreasing in importance. The experts vote each of criteria and the ones that aren't important are removed. The steps of the SWARA approach are as follows (Keršuliene et al., 2010, p. 244):

Step 1: Based on their expertise, each decision-maker evaluates the criteria in order of priority, from most important to least important. Experts award the most significant criterion a score of one. The experts then re-evaluated this evaluation between 0 and 1 by 0.05 multiples. Equation (1) is used to perform this computation.

$$r_j^k; j = 1,...n, k = 1,...,l; 0 \le r_j^k \le 1 \quad (1)$$

Step 2: For each criterion, the relative mean importance value is determined. Equation (2) is used to calculate the average of the relative relevance scores assigned to the criteria by the decision-makers.

$$M_j = \frac{\sum_{k=1}^{l} r_j^k}{l} \quad (2)$$

Step 3: The relative average importance ratings of all criteria are used to rank them. The comparative significance level of the average values of the criterion is calculated as a result of the comparison. The values are calculated using a paired comparison and the j+1 criterion to determine the significance ratio.

Step 4: Equation (3) is used to calculate the coefficient value *Nj* for all criterion. *Nj* is the coefficient of the criterion that has the highest value.

$$N_j = M_j + 1 \quad (3)$$

Step 5: Equation (4) must be used to obtain the *Mj'* value for all criterion. *Mj* '=1 is recognized as the relative weight of the first-ranked criterion, and the ranking based on *Mj* is considered during the calculation of *Mj* '.

$$M_j^{'} = \frac{M_{j_{j-1}}^{'}}{N_j}; M_{j-1} > M_j \quad (4)$$

Step 6: Equation (5) is used to get the final weights for all criteria. The values of *Mj* ' are normalized with this calculation, and weights are gathered as w_j.

$$W_j = \frac{M_j^{'}}{\sum_{j=1}^{n} M_j^{'}} \quad (5)$$

Fuzzy COPRAS Methodology

COPRAS method was firstly proposed by Zavadskas & Kaklauskas (1996, p. 94). Alternatives are ranked according to their importance and benefit values. The method aims to maximize the utility values of criteria values used in the evaluation of alternatives. The COPRAS was developed with the help of fuzzy logic to overcome uncertainty in decision makers' evaluations and Fuzzy COPRAS was implemented.

The fuzzy COPRAS method's solution steps are as follows (Yazdani et al., 2011; Fouladgar et al., 2012; Hsieh, Lu, & Tzeng, 2004, p. 573):

Step 1: First of all, alternatives and criteria are determined by decision-makers. Then, these determined criteria and alternatives are evaluated by the experts by using the verbal variables in Table 1.

Step 2: Decision matrices created by decision-makers are transformed into a unified decision matrix with the help of Equation (6) to show the number of *K* decision-makers.

$$X_{ij} = (X_{ij1}, X_{ij2}, X_{ij3})$$

$$X_{ij1} = \min\left\{X_{ij1k}\right\}, X_{ij2} = \frac{1}{K}\sum_{k=1}^{K} X_{ijk2}, X_{ij3=\max\left\{X_{ijk3}\right\}} \quad (6)$$

Table 1. *Fuzzy scale (Chang, Watada, & Ishii, 2012)*

Verbal Variables	Fuzzy Numbers (Criteria)	Fuzzy Numbers (Alternative)
Very Low (VL)	(0, 0, 0.25)	(0, 0, 2.5)
Low (L)	(0, 0.25, 0.5)	(0, 2.5, 5)
Moderate (M)	(2.5, 5, 7.5)	(2.5, 5, 7.5)
High (H)	(0.5, 0.75, 1.0)	(5, 7.5, 10)
Very High (VH)	(0.75, 1.0, 1.0)	(7.5, 10, 10)

Step 3: Best Nonfuzzy Performance Value (BNP) values are obtained by clarifying the values in the combined fuzzy decision matrix created by decision-makers with the help of Equation (7) and converting them to exact values.

$$BNP = \frac{(u-l)+(m-1)}{3}+1 \quad (7)$$

Step 4: The normalized decision matrix is obtained with the help of Equation (8).

$$\overline{X_{ij}} = \frac{X_{ij}}{\sum_{i=1}^{m} X_{ij}}; i = 1,...,m \text{ and } j = 1,...,n \quad (8)$$

Step 5: The weighted normalized decision matrix is obtained with the help of Equation (9).

$$X_{ij} = \overline{X_{ij}}.w_j; i = 1,...,m \text{ and } j = 1,...,n \quad (9)$$

Step 6: Equation (10) is used to calculate the total of the values in the weighted normalized decision matrix for benefit type criteria, where larger values imply better status in attaining the goal. The total of the values in the weighted normalized choice matrix is then determined for cost type criteria using Equation (11), with lower values indicating better status in accomplishing the goal (Das, Sarkar, & Ray, 2012, p. 230).

$$P_i = \sum_{j=1}^{q} X_{ij} \text{ (benefit criteria)} \quad (10)$$

$$R_i = \sum_{j=q+1}^{n} X_{ij} \text{ (cost criteria)} \quad (11)$$

Step 7: The relative importance values (Q_i) of the alternatives are calculated with the help of Equation (12).

$$Q_i = P_i + \frac{\sum_{i=1}^{m} R_i}{R_i \sum_{i=1}^{m} \frac{1}{R_i}} \quad (12)$$

Step 8: The highest relative importance value is calculated with the help of Equation (13).

$$L = \max Q_i; i = 1,...,m \quad (13)$$

Step 9: The performance index values (N_i) of the alternatives are calculated with the help of Equation (14).

$$N_i = \frac{Q_i}{Q_{\max}}.100\%; i = 1,...,m \quad (14)$$

Hotel Selection Considering Safe Tourism Certificate Criteria

The Objective of the Study

During holidays, people are faced with the problem of choosing the most suitable hotel for accommodation while evaluating tourism alternatives. Especially during the pandemic period that we are in, this problem has become a situation that needs to be evaluated correctly. The concept of a "safe tourism certificate" has emerged to make this situation less hesitant in terms of both the hotels and the customers. Choosing the hotels with this certificate in the first place in terms of accommodation is one of the most important criteria in this process. Choosing the most suitable hotel can be called a multi-criteria decision problem because it includes many criteria. The goal of this research is to find the best hotel having a "safe tourism certificate" during the COVID period for a family. SWARA and fuzzy COPRAS methods were used together in this study to solve this problem. Safe tourism certificate criteria and 10 hotels are considered simultaneously.

Implementation of SWARA and Fuzzy COPRAS Integration

In the study, the selection of the most suitable hotel is made in two stages. These stages are as follows:

Stage 1 - Determination of criteria weights

Undoubtedly, the most important criterion for hotel selection during the COVID epidemic is the "safe tourism certificate" criterion. To obtain this certificate, there are criteria determined by the scientific committee established by the Ministry of Health in our country. These criteria are also published by Turkey Tourism, Promotion and Development Agency (www.tga.gov.tr). A hotel that passes certain procedures can obtain this document depending on whether it meets the criteria or not. These criteria cover all the details in the process starting from the check-in to the leave process of the customers to the hotel. In this study, the problem of choosing the most suitable hotel for a family who wants to have a holiday by considering these criteria is discussed. Mother and father have been chosen as decision-makers in the family. First of all, the criteria used for this document were evaluated according to their priorities with the SWARA method.

Stage 2 – Determination of the most suitable hotel alternative

After determining the criteria weights, it is necessary to decide the most appropriate hotel/s for holiday. The fuzzy COPRAS method is used for this decision process. One of the most appropriate solutions to model problems under uncertainty is modeling them in a fuzzy environment. For this reason, fuzzy logic has been used in this study. Using linguistic data instead of exact expressions is one of the most important reasons for using fuzzy logic.

Application of the Methods to the Problem

In this part of the study, the hotel selection problem faced by a family is discussed. Safe tourism certification criteria are taken into account in this problem. Although the criteria for safe tourism certification are determined by authorized institutions, the priority of these criteria for families may change. The SWARA method was used to determine the weights of the criteria according to their importance level. Among the family members, the mother and father took part in the study as Decision Makers (DM). After determining the criterion weights, the most suitable hotel alternative was decided. For this, the fuzzy COPRAS method was used. The hierarchical structure of the problem is shown in Figure 1.

Determination of Criteria Weights Using SWARA Method

Two people took part in the study as decision-makers. These people first determined the importance of the criteria in the hotel selection problem. While performing this rating, the number as much as the number of criteria was determined and the criteria are listed in Table 2. After grading the criteria, decision-makers gave the value 1.00 to the most important criterion for them. The next criteria were scored again in a multiple of 0.05. After the scoring is obtained, r_j^k values are shown in Table 3. For all of the criteria, the average importance score of the decision-making importance (r_j) was calculated with the help of Equation (2) and the values obtained are shown in Table 4.

Table 2. *Ranking of Criteria by Decision-Makers According to Their Importance*

	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8
DM_1	4	3	2	1	6	7	5	8
DM_2	3	2	4	1	7	8	6	5

Table 3. *Scoring the Criteria According to Their Importance*

	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8
DM_1	0,75	0,85	0,90	1,00	0,55	0,50	0,60	0,40
DM_2	0,85	0,95	0,80	1,00	0,65	0,55	0,70	0,75

Table 4. *Average Importance Scores of Decision-Makers*

r_j	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8
Average	0,80	0,90	0,85	1,00	0,60	0,53	0,65	0,58

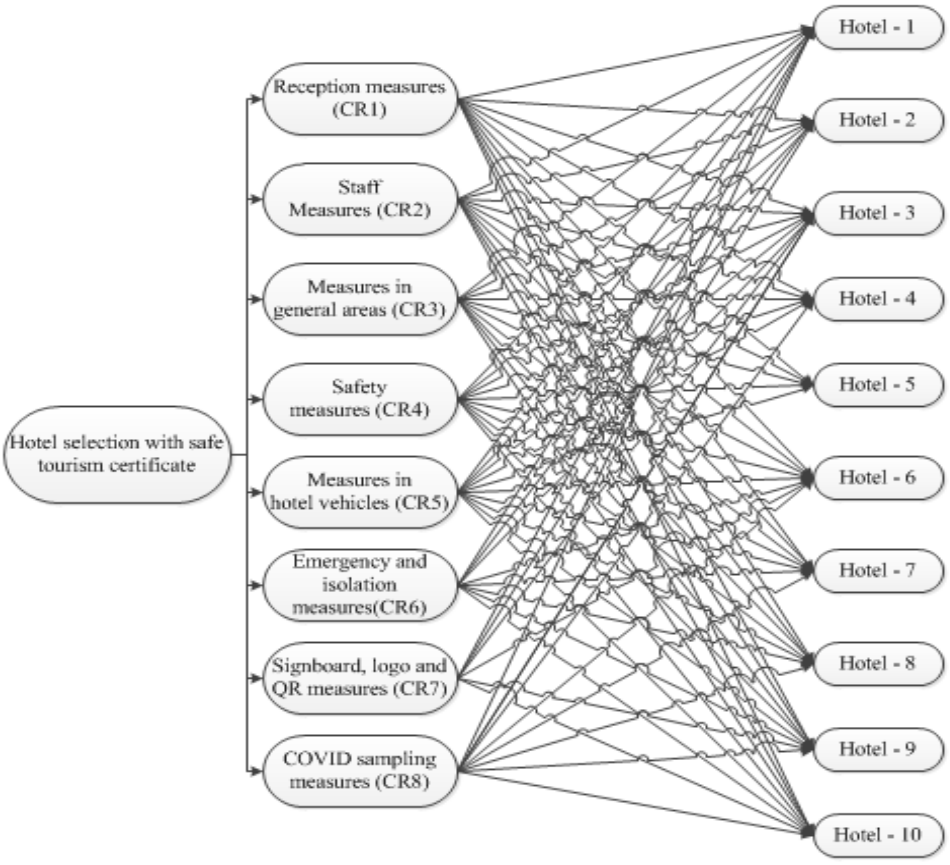

Figure 1. *The Hotels and Criteria Structure*

The criteria are listed in descending order according to their importance, and the comparative significance of the average values for the criteria (M_j) is shown in Table 5.

The coefficient value of the criteria (N_j) was calculated using Equation (3) and the results are provided in Table 6.

Table 5. *Comparison of the Criteria According to the Average Importance Score*

	CR4	CR2	CR3	CR1	CR7	CR5	CR8	CR6
r_j	1,00	0,90	0,85	0,80	0,65	0,60	0,58	0,53
M_j	-	0,10	0,05	0,05	0,15	0,05	0,02	0,05

Table 6. *Coefficient Values of the Criteria*

	CR4	CR2	CR3	CR1	CR7	CR5	CR8	CR6
N_j	1	1,10	1,05	1,05	1,15	1,05	1,02	1,05

Relative weights ($M_j^{'}$) values for all criteria were calculated using Equation (3) and the results are provided in Table 7. The adjusted weight of the first criterion was accepted as $M_j^{'}$ =1.

Table 7. *Relative Weight Values of the Criteria*

	CR4	CR2	CR3	CR1	CR7	CR5	CR8	CR6
$M_j^{'}$	1	0,91	0,86	0,82	0,72	0,68	0,67	0,64

The final weights for all criteria were calculated using Equation (4) and the results are provided in Table 8.

Table 8. *Final Weight Values of the Criteria*

	CR4	CR2	CR3	CR1	CR7	CR5	CR8	CR6
W_j	0,16	0,14	0,14	0,13	0,11	0,11	0,11	0,10

Considering the weight values in Table 8, it was seen that the criterion with the highest weight (CR4) was "safety measures". The criterion with the lowest weight (CR6) is the "emergency and isolation" criterion.

Evaluation of Hotels Using Fuzzy COPRAS Method

The fuzzy COPRAS approach was used to evaluate hotel alternatives after the SWARA method was used to determine the criteria weights, and the best hotel was chosen as follows:

Hotel alternatives were evaluated by two decision-makers by using the scale in Table 1, and fuzzy decision matrices were created for each decision-maker by using the fuzzy number equivalents of the relevant verbal variables. These decision matrices are shown in Table 9 and Table 10. The decision matrices created by the decision-makers were transformed into a combined decision matrix using Equation (7) and values are shown in Table 11.

Table 9. *Fuzzy Decision Matrix Formed by the First Decision-Maker*

	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8
Hotel - 1	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)
Hotel - 2	(5,7.5,10)	(7.5,10,10)	(5,7.5,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)
Hotel - 3	(5,7.5,10)	(7.5,10,10)	(5,7.5,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)
Hotel - 4	(7.5,10,10)	(7.5,10,10)	(5,7.5,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)
Hotel - 5	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(5,7.5,10)	(5,7.5,10)	(7.5,10,10)
Hotel - 6	(0,2.5,5)	(7.5,10,10)	(2.5,5,7.5)	(2.5,5,7.5)	(5,7.5,10)	(7.5,10,10)	(2.5,5,7.5)	(7.5,10,10)
Hotel - 7	(5,7.5,10)	(5,7.5, 10)	(2.5,5,7.5)	(2.5,5,7.5)	(7.5,10,10)	(5,7.5,10)	(2.5,5,7.5)	(5,7.5,10)
Hotel - 8	(0,2.5,5)	(0,0, 2.5)	(2.5,5,7.5)	(2.5,5,7.5)	(2.5,5,7.5)	(0,0,2.5)	(0,2.5,5)	(2.5,5,7.5)
Hotel - 9	(0,2.5,5)	(0,0, 2.5)	(0, 2.5,5)	(2.5,5,7.5)	(2.5,5,7.5)	(0,2.5,5)	(5,7.5,10)	(0,2.5,5)
Hotel - 10	(2.5,5,7.5)	(0,2.5, 5)	(2.5,5,7.5)	(0,2.5,5)	(2.5,5,7.5)	(5,7.5,10)	(5,7.5,10)	(2.5,5,7.5)

The combined fuzzy decision matrix in Table 11 was clarified with the help of Equation (8) and the results obtained are shown in Table 12. The clarified decision matrix is normalized with the help of Equation (9). The normalized decision matrix is shown in Table 13. By using the criterion weight values in Table 8, weighting normalized decision matrix with the help of Equation (10) was obtained and the values are shown in Table 14. Pi values with the help of Equation (11), Ri values were calculated with the help of Equation (12). The relative importance values of the alternatives were calculated using Equation (13). With the help of Equation (14), the highest relative importance value (Qmax) was calculated and the alternative with the highest relative importance was found as the HOTEL - 5 with a value of 0.108. The performance index values of the alternatives were calculated using Equation (15) to show the performance index of the best alternative. The calculated values were provided given in Table 15. The last column in Table 15 shows the preference rankings of the alternatives as a result of the calculation using the fuzzy

COPRAS method. According to Fuzzy COPRAS calculation results, hotels are listed from the most suitable to worst as 5, 4, 8, 2, 9, 1, 3, 7, 6, 10. Finally, the family choose the HOTEL – 5 for their holiday decision considering safety tourism certificate criteria.

Table 10. *Fuzzy Decision Matrix Formed by the Second Decision-Maker*

	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8
Hotel - 1	(2.5,5,7.5)	(7.5,10,10)	(7.5,10,10)	(5,7.5,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)
Hotel - 2	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(2.5,5,7.5)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)
Hotel - 3	(5,7.5,10)	(7.5,10,10)	(5,7.5,10)	(2.5,5,7.5)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)
Hotel - 4	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(2.5,5,7.5)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)	(7.5,10,10)
Hotel - 5	(5,7.5,10)	(5,7.5,10)	(7.5,10,10)	(5,7.5,10)	(7.5,10,10)	(0,2.5,5)	(5,7.5,10)	(7.5,10,10)
Hotel - 6	(7.5,10,10)	(7.5,10,10)	(2.5,5,7.5)	(0,2.5,5)	(5,7.5,10)	(7.5,10,10)	(2.5,5,7.5)	(7.5,10,10)
Hotel - 7	(5,7.5,10)	(5,7.5,10)	(5,7.5,10)	(2.5,5,7.5	(5,7.5,10)	(5,7.5,10)	(5,7.5,10)	(5,7.5,10)
Hotel - 8	(2.5,5,7.5)	(0,2.5,5)	(2.5,5,7.5)	(0,2.5,5)	(5,7.5,10)	(0,2.5,5)	(2.5,5,7.5)	(2.5,5,7.5)
Hotel - 9	(0,2.5,5)	(0,2.5,5)	(2.5,5,7.5)	(0,2.5,5)	(2.5,5,7.5)	(0,2.5,5)	(2.5,5,7.5)	(0,2.5,5)
Hotel - 10	(0,2.5,5)	(0,2.5,5)	(2.5,5,7.5)	(0,2.5,5)	(2.5,5,7.5)	(5,7.5,10)	(5,7.5,10)	(0,2.5,5)

Table 11. *Combined Fuzzy Decision Matrix*

	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8
Hotel - 1	(2.5, 7.5, 10)	(7.5, 10, 10)	(7.5, 10, 10)	(5, 8.75, 10)	(7.5, 10, 10)	(7.5, 10, 10)	(5, 8.75, 10)	(7.5, 10, 10)
Hotel - 2	(5, 8.75, 10)	(7.5, 10, 10)	(5, 8.75, 10)	(2.5, 7.5, 10)	(7.5, 10, 10)	(7.5, 10, 10)	(7.5, 10, 10)	(7.5, 10, 10)
Hotel - 3	(5, 7.5, 10)	(7.5, 10, 10)	(5, 7.5, 10)	(2.5, 7.5, 10)	(7.5, 10, 10)	(7.5, 10, 10)	(7.5, 10, 10)	(7.5, 10, 10)
Hotel - 4	(7.5, 10, 10)	(7.5, 10, 10)	(5, 8.75, 10)	(2.5, 7.5, 10)	(7.5, 10, 10)	(7.5, 10, 10)	(7.5, 10, 10)	(7.5, 10, 10)
Hotel - 5	(5, 8.75, 10)	(5, 8.75, 10)	(7.5, 10, 10)	(5, 8.75, 10)	(7.5, 10, 10)	(0, 5, 10)	(5, 7.5, 10)	(7.5, 10, 10)
Hotel - 6	(0, 6.25, 10)	(7.5, 10, 10)	(2.5, 5, 7.5)	(0, 3.75, 10)	(5, 7.5, 10)	(7.5, 10, 10)	(2.5, 5, 7.5)	(7.5, 10, 10)
Hotel - 7	(5, 7.5, 10)	(5, 7.5, 10)	(2.5, 5, 10)	(2.5, 5, 7.5)	(5, 8.75, 10)	(5, 7.5, 10)	(2.5, 6.25, 10)	(5, 5, 10)
Hotel - 8	(0, 3.75, 7.5)	(0, 1.25, 5)	(0, 3.75, 5.7)	(0, 3.75, 7.5)	(2.5, 6.25, 10)	(0, 1.25, 5)	(0, 3.75, 7.5)	(2.5, 5, 7.5)
Hotel - 9	(0, 2.5, 5)	(0, 1.25, 5)	(0, 3.75, 7.5)	(0, 3.75, 7.5)	(2.5, 5, 7.5)	(0, 2.5, 5)	(2.5, 6.25, 10)	(0, 2.5, 5)
Hotel - 10	(0, 3.75, 7.5)	(0, 2.5, 5)	(2.5, 5, 7.5)	(0, 2.5, 5)	(2.5, 5, 7.5)	(5, 7.5, 10)	(5, 7.5, 10)	(0, 3.75, 5)

Table 12. *Clarified Decision Matrix*

	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8
Hotel - 1	6,67	9,17	9,17	7,92	9,17	9,17	7,92	9,17
Hotel - 2	7,92	9,17	7,92	9,17	9,17	9,17	9,17	9,17
Hotel - 3	7,5	9,17	7,5	9,17	9,17	9,17	9,17	9,17
Hotel - 4	9,17	9,17	7,92	9,17	9,17	9,17	9,17	9,17
Hotel - 5	7,92	7,92	9,17	7,92	9,17	5	7,5	9,17
Hotel - 6	5,42	9,17	5	7,5	7,5	9,17	5	9,17
Hotel - 7	7,5	7,5	5,83	5	7,92	5	6,25	10
Hotel - 8	3,75	2,08	5	7,5	6,25	2,08	3,75	5
Hotel - 9	2,5	2,08	3,75	7,5	5	2,5	6,25	2,5
Hotel - 10	3,75	2,5	5	2,5	5	7,5	7,5	2,91

Table 13. *Normalized Decision Matrix*

	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8
Hotel -1	0,107	0,135	0,138	0,108	0,118	0,135	0,110	0,122
Hotel -2	0,128	0,135	0,120	0,125	0,118	0,135	0,128	0,122
Hotel -3	0,121	0,135	0,113	0,125	0,118	0,135	0,128	0,122
Hotel -4	0,148	0,135	0,120	0,125	0,118	0,135	0,128	0,122
Hotel -5	0,128	0,117	0,138	0,108	0,118	0,074	0,105	0,122
Hotel -6	0,087	0,135	0,075	0,102	0,097	0,135	0,070	0,122
Hotel -7	0,121	0,110	0,088	0,068	0,102	0,074	0,087	0,133
Hotel -8	0,060	0,031	0,075	0,102	0,081	0,031	0,052	0,066
Hotel -9	0,040	0,031	0,057	0,102	0,064	0,037	0,087	0,033
Hotel -10	0,060	0,037	0,075	0,034	0,064	0,110	0,105	0,039

Table 14. *Weighted Normalized Decision Matrix*

	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8
Hotel -1	0,017	0,019	0,019	0,014	0,013	0,015	0,012	0,012
Hotel -2	0,020	0,019	0,017	0,016	0,013	0,015	0,014	0,012
Hotel -3	0,019	0,019	0,016	0,016	0,013	0,015	0,014	0,012
Hotel -4	0,024	0,019	0,017	0,016	0,013	0,015	0,014	0,012
Hotel -5	0,020	0,016	0,019	0,014	0,013	0,008	0,012	0,012
Hotel -6	0,014	0,019	0,011	0,013	0,011	0,015	0,008	0,012
Hotel -7	0,019	0,015	0,012	0,009	0,011	0,008	0,010	0,013
Hotel -8	0,010	0,004	0,011	0,013	0,009	0,003	0,006	0,007
Hotel -9	0,006	0,004	0,008	0,013	0,007	0,004	0,010	0,003
Hotel -10	0,010	0,005	0,011	0,004	0,007	0,012	0,012	0,004

Tablo 15. *P_i, R_i,Q_i,and Q_i(%100) values*

	P_i	R_i	Q_i	Q_i (%100)
Hotel -1	0,069	0,052	0,102	94,44
Hotel -2	0,072	0,054	0,104	95,96
Hotel -3	0,070	0,054	0,102	94,13
Hotel -4	0,076	0,054	0,107	98,94
Hotel -5	0,070	0,045	0,108	100,00
Hotel -6	0,057	0,045	0,094	87,15
Hotel -7	0,056	0,042	0,096	89,02
Hotel -8	0,038	0,025	0,107	98,74
Hotel -9	0,032	0,024	0,102	94,82
Hotel -10	0,030	0,035	0,079	72,94

Conclusions, Limitations, and Suggestions

The virus that emerged in the last month of 2019 has affected the whole world. This sudden development has profoundly affected the daily lives of countries and people. The virus, which became an epidemic in a short time, spread rapidly, cause the death of millions of people worldwide. Experts consider it certain that we will live with this virus, which has been in our lives for more than a year, for a long time. In this case, while we have to get used to living with the virus, it is expected by everyone that our daily habits will be the same as before.

One of the situations that people do not want to compromise during and after the virus period is the holiday habit. Since many days and hours of the week are spent both in traffic and at work, everyone deserves a good holiday. In the absence of a pandemic, people would first decide their expectations from the holiday, the time and duration of the holiday for their holiday needs. They would then gather information about advertisements, websites, or alternative hotels by consulting friends. During the information gathering process, they would take into account the agencies along with past holiday experiences, holiday advertisements, and promotions. After this stage, they would look at the transportation, price, and services of the resort. Finally, they would make a final decision on the hotel and pay for their holiday needs. Since holiday habits have changed a lot during this epidemic period, the safe tourism certificate criteria become the most important criteria before deciding the hotel.

In this study, a hybrid method that takes into account the criteria of safe tourism certification is proposed for the selection of a hotel. In this proposed method, is was tried to decide on the most suitable one among ten hotels, taking into account the safe tourism criteria of a family who would like to go on vacation. The SWARA methodology was used to decide criteria weights. The fuzzy logic-based COPRAS method was used to decide on the most suitable hotel alternative according to the determined criteria. Using these methods, the hotel that best suits the criteria out of 10 was decided. The hotels determined in the study were taken into account according to the safe tourism certificate category. Two hotels are considered for each star category, and the fifth hotel and the fourth hotel are five-star hotels.

The difficulty of pandemic conditions prioritizes the safe tourism certificate criterion in hotel selection. This certificate has become a prerequisite for customers during the pandemic period for tourism mansions. Since the conditions of the pandemic period were taken into account in this study, only the criteria for safe tourism certification were considered. Apart from these criteria, there are many criteria in the literature for hotel selection. Many criteria such as route, price, food quality can be taken into consideration at the same time in terms of future studies. However, new models with many decision-makers can be developed using the survey method. Moreover, the comparison of the results can be made by using different fuzzy MCDM methods, since hotel selection includes uncertainty in terms of criteria.

Ethical Declaration

In the writing process of the study titled "*Hotel Selection with Safe Tourism Certificates in Covid-19 Pandemic Using SWARA and Fuzzy COPRAS Methods",* there were followed the scientific, ethical and the citation rules; was not made any falsification on the collected data and this study was not sent to any other academic media for evaluation. Since the data set is used in this article, ethics committee approval is not required.

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TÜRKÇE GENİŞ ÖZET

Turizm aktiviteleri özellikle bireylerin gündelik yoğun tempolu yaşamlarından farklı olarak kendilerine zaman ayırmak, yeni yerler görmek, eğlenmek, dinlenmek, seyahat etmek, spor yapmak ve kültürel açıdan kendilerine zenginlik katabilmek gibi birçok farklı içeriğe sahiptir. Dünyada hızlı bir sektör olarak genişlemeye devam eden bu sektöre ön planda tarihi, doğal ve coğrafi çekicilikler ön planda durmaya devam etmektedir. Turizm bu çekiciliklere ilave olarak ülkelere ciddi gelir getirdiği gibi aynı zamanda istihdam ve vergi geliri açısından da ekonomik bir ilave katkı sunmaktadır. Turizm pastasında küresel rekabet yüksek olduğu için uluslararası ve ulusal düzeyde tüm firmalar bu pastadan yüksek pay almak istemektedirler. Bu sektörde bulunan otel işletmeleri en yüksek payı alabilmek adına en yüksek düzeyde müşterileri cezbetmek için yoğun rekabet ortamında rakipleriyle kıyasıya mücadele etmektedir. Türkiye açısından bakıldığında özellikle doğal güzellikleri, coğrafik konumu, ören yerleri, sahilleri ve artan turizm yatırımları birçok turistin küresel ölçekte dikkatini çekmektedir. Bunula birlikte diğer ülkelere kıyasla yüksek düzeydeki hizmeti makul fiyatlara sunması da bu dikkatin bir başka sebebidir. İklimsel olarak da birçok mevsimde özellikle güney sahilinin turizme elverişli olması sebebiyle de dikkat çekmektedir.

2019 Aralık ayında Çin'in Wuhan kentinde ortaya çıkan Koronavirüs salgını dünya genelinde insanların birçok alışkanlığı değiştirmiştir. Değişen bu alışkanlıklar insanların davranışlarını, tutumları ve tercihlerini de büyük ölçüde etkilemiştir. Bu değişen tercihlerden en önemlilerinden birisi de hiç kuşkusuz tatil alışkanlığıdır. İnsanların çoğu pandemi döneminde tatil yapmayı ertelerken bazıları da tatilini güvenli ortam olmak şartıyla ertelememiştir. Bu dönemde özellikle otel dışında müstakil villalara olan talep artmıştır ancak güvenlik sertifikası kavramının ortaya çıkması ile otellere olan talep de bu dönemde kötü olmamıştır. Güvenlik sertifikası almış oteller sayesinde insanlar otellere gitmeden önce otelin pandemi kuralları hakkında bilgi sahibi olabilmektedirler ve aynı zamanda otelin pandemi kurallarına uygun olarak çalıştığı anlamına gelmektedir. Bu dönemde de birçok otel müşteri kaybettiği için ve gelir elde etmede büyük zorluk yaşadığı için güvenlik sertifikası alarak insanların güvenini kazanmaya çalışmıştır. Bu sayede gerek insanlar rahat bir şekilde tatilini yapmış olacak gerekse de oteller çalışmalarına devam etmiş olacaktır.

Bu çalışma, pandemi döneminde en uygun otel alternatiflerini güvenli turizm sertifikaları ile değerlendirmeyi amaçlamaktadır. Pandemi döneminde tatil yapmak isteyen bir ailenin kriterleri dikkate alınarak en uygun otele karar verilmesi hedeflenmektedir. Karar verme aşamasında birçok kriter ve

alternatifin birlikte göz önünde bulundurulması gerektiğinden dolayı Çok Kriterli Karar Verme (ÇKKV) problemidir diyebiliriz. Yapılan bu çalışma otel seçim problemini dikkate alarak, ÇKKV metodolojisi olan Bulanık Karmaşık Orantılı Değerlendirme (COPRAS) ve Adım Adım Ağırlık Değerlendirme Oranı Analizi (SWARA) kullanılarak çözülmüştür. Problemde güvenli turizm belgesi kriterleri göz önünde bulundurularak 10 otel arasından en uygun olanına karar verilmiştir. Karar verme aşamasında, aile üyeleri karar vericiler olarak yer almıştır. İlk aşamada, kriter ağırlıkları SWARA metodolojisi kullanılarak belirlenmiş, sonrasında ise otel alternatifleri bulanık sayılarla modellenerek COPRAS yöntemi ile sıralama yapılmıştır. 10 otel arasından en uygun otele karar verilmiştir. Hesaplamalar sonucunda kriterlere en uygun şekilde uyan otellerin sırası 5, 4, 8, 2, 9, 1, 3, 7, 6, 10 şeklindedir.