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# EVALUATION OF SKI CENTERS' PERFORMANCE USING MULTIPLE-CRITERIA DECISION-MAKING METHODS

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**Abstract**

***Introduction.*** This study aimed to determine the criteria for the choice of nine different leading ski centers that serve actively in the ski tourism sector of Turkey, to calculate the criteria weights, and to measure the performance of these centers. ***Material and methods.*** In this context, the data were defuzzified using the CFCS method, and the fuzzy DEMATEL method was used to determine the criteria affecting the choice of ski centers. Then, the TOPSIS method was applied to measure the performance of ski centers by using the criteria weights obtained with the fuzzy DEMATEL method. ***Results.*** As a result of the analysis, the weights of the main criteria were found as follows: facility amenities, price, accessibility, accommodation, alternative tourism, and visitors' rating scores. Consequently, the top three ski resorts according to their scores are SC4, SC1, and SC9, respectively. The ski center which is coded SC9 is ranked at the bottom. ***Conclusions.*** The study examined the ski centers that actively operate in Turkey. This could be considered as a spatial decision-making problem. This study could be a road map for the performance evaluation in ski tourism. Moreover, the results will be beneficial for the ski centers to identify their deficiencies and carry out improvement works in attracting the increasing demand for skiing to their centers.

**Key words:** Ski Centers, Fuzzy, DEMATEL, TOPSIS, CFCS, Performance

## Introduction

Winter tourism is a type of tourism commonly performed at high altitudes of mountains that can receive snow depending on snowfall [1]. It consists of all activities carried out in a certain period of the year, including transportation, accommodation, eating-drinking, resting, entertainment, traveling, and sight-seeing in regions with suitable snow conditions and sloping lands for skiing [2]. Every year, 400 million ski lovers from around 80 countries visit ski runs across the world [3]. This profile has gained considerable momentum over the past decade, which is of great importance for the global ski destination market [3]. According to the world ski market report, there are 67 countries offering equipped outdoor ski areas covered with snow. Although there are several snowfields across the world, there are approximately 2,000 ski centers. Although the number of annual ski center visits varies depending on weather conditions, there are an estimated 400 million skier visits worldwide.

Despite being a middle-belt country, Turkey hosts winter tourism centers of national and international significance because of its specific location. However, today, Turkey gives winter tourism prominence with its ski centers including Uludag/Bursa, Palandöken/Erzurum, Erciyes/Kayseri, Kartalkaya/Bolu and Sarıkamış/Kars. Additionally, the Konaklı Ski Center, which was established in Erzurum within the scope of the 25th World University Winter Games in 2011, has the potential to be an important winter tourism center with many specific features [4]. According to the data from the Ministry of Culture and Tourism, Turkey had 29 winter tourism centers in 2020, nine of which were active, seven were partially active, and others were still projects at the design stage.

In the literature, there are many studies to determine the factors affecting the selection of winter tourism destinations. A study conducted in 1993 listed the factors affecting destination preferences as ski packages, familiarity, local culture, grooming, closeness to home, lodging, friendly people, crowding, difficulty, resort services, entertainment, snow conditions, hill and trail, choice, saving time, saving money, skiing more, social atmosphere, being challenging, ski variety, belonging, achievement, safety, fun, and excitement [5]. Accordingly, duration of snow cover, topographic conditions of ski-run, the number of sunny days, and accessibility in winter tourism centers were determined as important components of ski tourism [6]. Godfrey [7] aimed to determine the factors guiding the choice of ski resort destinations of a group of British skiers in Canada by examining the destinations' characteristics including snow conditions, terrain diversity, entry/exit facilities, access to slopes and accommodation, and they concluded that snow quality and ski area variety were the most valuable features. Riddington et al. [8] found that a skier's choice of a destination is influenced by ski destination characteristics (e.g. snow cover, type of ski slopes, and availability of accommodation) and the skier's characteristics (e.g. travel distance, expenditure per day) in their study on Scottish skiers. Findings by the Utah Ski and Snowboard Association [9] indicated that snow quality, proximity and accessibility to the ski site, lift ticket specials, lodging, and nightlife influence a return to Utah's ski centers.

Won et al. [10] listed the factors affecting people's choice of ski destinations as snow quality, travel time, cost, roads, and variety of activities. Won and Hwang [11] categorized Korean college skiers and snowboarders and proposed four different categories of skiers based on similarities in their preferences for four selection factors including entertainment and safety, ski variety, cost awareness, and time awareness. Falk [12] also reported that demand for winter tourism depends on national and international income, prices, transportation, costs, destination,

and climate change. Konu et al. [13] grouped Finnish ski resort tourists based on their ski destination selection characteristics. Hallmann et al. [14] emphasized the importance of waiting times and safety factors. Koşan [15] examined which factors of a ski center is important for skiers who visited Palandöken ski center in Erzurum. In that study, a qualitative exploratory approach was used for the assesment of the ski center and its enviroment.The study concluded that hospitality, infrastructure, the mix of existing activities, accessibility, and perceived target image were important factors for visitor satisfaction.

Another study determined the strengths and weaknesses of the Konaklı Ski Center by assessing its location and natural and human environmental properties [4]. Accordingly, the strengths of the center were the closeness to branded ski centers, presence of ski-runs with different difficulty levels, the possibility of artificial snow, high snow quality, long duration of snow cover, its international recognition due to the World University Winter Games held earlier, presence of tourism department within the university located in its region, presence of several natural, historical and tourist values in the region, presence of large areas for different activities and ski-runs in the region, presences of suitable areas for recreational activities such as camping and sports and high density and variety of transportation modes. However, its weaknesses were being 20 km away from the city center, lack of foreign language speaking staff, lack of accommodation facilities, and deficiencies in the surrounding landscape [4]. Additionally, ski schools, shops selling ski equipment/clothing [16], and even water slides, ice skating rinks, bike paths, zoos, tennis courts, and playgrounds were also provided in ski centers to increase visitor potential and revenues [17].

Multi-criteria decision-making (MCDM) approaches are used to develop useful decision-making tools when multiple conflicting criteria are taken into consideration for a given problem [18, 19]. In MCDM, weight computation plays a vital role in the decision-making process. The preferences from many alternatives such as center choices, hotel choices, and destination choices in the sector may be determined using multi-criteria decision-making methods. In the literature, Manap [20] used the Analytic Hierarchy Process (AHP) method for the selection of tourism destinations, hotel performance [21], five-star hotels selections [22].

Winter tourism is one of the fastest-growing tourism sectors across the world. It has a significant impact on the development of the economy and is considered one of the green industries. This study aimed to determine the criteria for the choice of nine different ski centers that serve actively in the ski tourism sector of Turkey, calculate criterion weights and measure the performance of these centers. In this context, the fuzzy DEMATEL method was used to determine the criteria affecting the choice of ski centers. The TOPSIS method was then applied to measure the performance of the ski centers by using the criterion weights obtained with the fuzzy DEMATEL method. In this study, the fuzzy DEMATEL technique was used in weighting the criteria. Fuzzy logic is required to address problems characterized by ambiguity and uncertainty, as people's judgment about preferences cannot be expressed with precise values, are often ambiguous, and difficult to predict [23, 24]. The data were collected using the survey method, in which questionnaires were filled out by tourists who visited at least 2 different ski centers and experts working at the nine different ski centers in Turkey. This study brings a different perspective to the industry with the integration of both model and application.

## Material and Methods

### *Fuzzy DEMATEL*

DEMATEL is a comprehensive method for building and analyzing a structural model involving causal relationships between complex factors. To lay the foundation for extending the DEMATEL method for making decisions in fuzzy environments, the essentials of the DEMATEL method and fuzzy logic are discussed below [25]. The Battelle Memorial Institute conducted a DEMATEL method project through its Geneva Research Centre [26, 27]. The DEMATEL method can be summarized as in some previous studies [28]. The version and steps of the version prepared by Fontela and Gabus [29] to implement the DEMATEL method developed by Wu and Lee [25]. The steps of Fuzzy DEMATEL are as follows:

**Step 1:** Creating a Fuzzy Initial Direct Relationship Matrix
**Step 2:** Finding the Normalized Fuzzy Pole Relationship Matrix
**Step 3:** Obtaining the Total Fuzzy Relationship Matrix
**Step 4:** Finding Sender and Receiver Groups
**Step 5:** Rinsing (Defuzzification)
**Step 6:** Determination of Criterion Weights

### *TOPSIS*

TOPSIS, one of the classical multi-criteria decision-making methods, was developed by Hwang and Yoon [30]. It is based on the concept that the chosen alternative should have the shortest distance from the positive ideal solution (PIS) and the farthest from the negative ideal solution (NIS). Yoon and Hwang [30, 31] introduced the TOPSIS method based on the idea that the best alternative should have the shortest distance from an ideal solution. They assumed that, if each attribute takes monotonically increasing or decreasing variation, then it is easy to define an ideal solution. Such a solution is composed of all the best attribute values that are achievable, while the worst solution is composed of all the worst attribute values that are achievable. The so-called benefit criteria/attributes are those for maximization, while the cost criteria/attributes are those for minimization. The best alternative is the one that is closest to the ideal solution and farthest from the negative ideal solution [32]. In the TOPSIS method, the decision matrix (A) must first be created. It consists of creating the standard decision matrix (R), creating the weighted standard decision matrix (V), creating the ideal ($S_i^+$) and negative ideal ($S_i^-$) solutions, calculating the separation measurements, and calculating the relative proximity to the ideal solution. TOPSIS steps are as follows:

**Step 1:** Creating the Decision Matrix
**Step 2:** Creating the Standard Decision Matrix (R)
**Step 3:** Creating the Weighted Standard Decision Matrix (V)
**Step 4:** Creating Ideal ($S_i^+$) and Negative Ideal ($S_i^-$) Solutions
**Step 5:** Calculation of Discrimination Criteria
**Step 6:** Calculation of Relative Affinity to the Ideal Solution (closeness coefficient index CCi)

### *Research Model and Data*

In this study, the criteria affecting the choice of ski tourism centers were determined by reviewing the literature and collecting the opinions of both managers and visitors of ski centers. A total of 6 main criteria and 21 sub-criteria were included in the research model, where the main criteria were Price, Availability, Accommodation, Facility Amenities, Alternative Tourism Areas and Visitor (Customer) Rating Score; and the sub-criteria were Accommodation, Facility (all-inclusive), Visitor Type, Distance to Airport, Distance to City Center, Distance to Accommodation Center, Number of Hotels, Fitness/Gym, Bed Capacity,

Ski-run Length, Number of Ski-runs, Artificial Snow, Length of Transport System, Cafe/Restaurant, Security Unit, Health Unit, Cultural Activity, Entertainment, Nature Activity, Thermal Activity, and Visitor Rating Score. The criteria are visualized as in Figure 1.

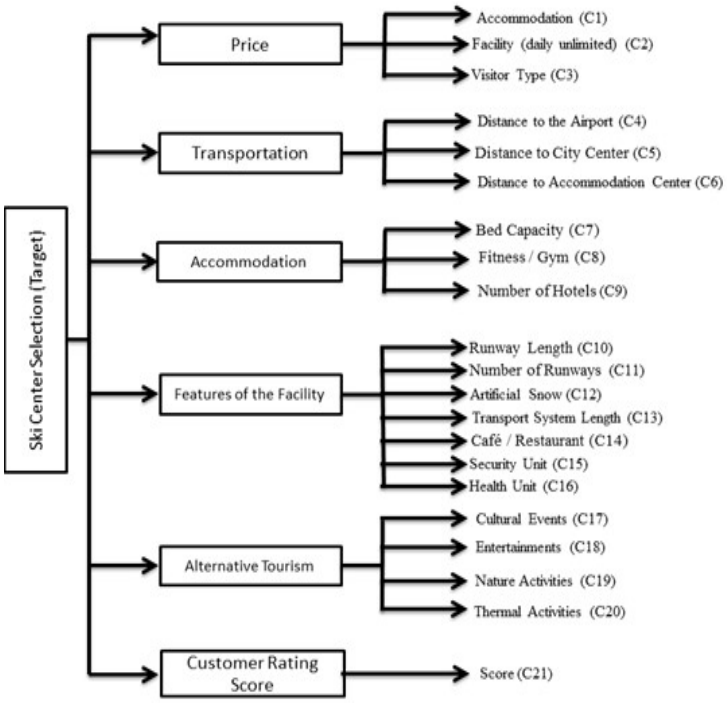



**Figure 6.** Criteria determined in ski center selection model

The data sources used to obtain the data of the study are shown in Table 1.

## Results

In this study, the weights for all criteria should be determined before the evaluation of ski center performance. Therefore, the data were defuzzified using the CFCS method and then analyzed using the fuzzy DEMATEL method. The questionnaires, prepared to calculate the weights of 6 main criteria and 21 sub-criteria, were applied to a total of 152 decision-makers, including tourists who visited at least 2 different ski centers and experts working at 9 different ski centers in Turkey. The initial direct relationship matrix for decision-maker 1 is presented in Table 2.

The Fuzzy Initial Direct Relationship Matrix was created for decision-maker 1 by using the fuzzy evaluation scale shown in Table 2. The normalization stage according to the steps of clarification calculated with the CFCS method is presented in Table 3.

After the Crisp values of all decision-makers were obtained, the mean scores of the decision-makers were obtained in the calculation of the net values. The results of the fuzzy DEMATEL analysis are presented in Table 4.

As a result of the analysis, the weights of the main criteria were found as follows: facility amenities (0.318), price (0.168), accessibility (0.180), accommodation (0.154), alternative tourism (0.141), and visitor rating score (0.058). For the main cri-

**Table 1.** Data Sources

| Criterion | Criterion | Data Source (Access 09-11.2020) |
|---|---|---|
| Price | Accommodation | Google MAPS |
| Price | Facility (daily unlimited) | Ski Resort Website |
| Price | Visitor Type | Ski Resort Website |
| Accessibility | Distance to the Airport | Google MAPS |
| Accessibility | Distance to City Center | Google MAPS |
| Accessibility | Distance to Accommodation Center | Google MAPS |
| Accommodation | Bed Capacity | Ministry of Culture and Tourism website |
| Accommodation | Fitness / Gym | Hotel / Travel Agencies Websites |
| Accommodation | Number of Hotels | Hotel / Travel Agencies Websites |
| Facility Features | Runway Length | Ski Resort Website |
| Facility Features | Number of Runways | Ski Resort Website |
| Facility Features | Artificial Snow | Ski Resort Website |
| Facility Features | Transport System Length | Ski Resort Website |
| Facility Features | Café / Restaurant | Google MAPS and Ski Resort Website |
| Facility Features | Security Unit | Google MAPS and Ski Resort Website |
| Facility Features | Health Unit | Google MAPS and Ski Resort Website |
| Alternative Tourism | Cultural Events | Hotels.com |
| Alternative Tourism | Entertainment | Hotels.com |
| Alternative Tourism | Nature Activities | Hotels.com |
| Alternative Tourism | Thermal Activities | Hotels.com |
| Visitor Rating Score | Score | Google MAPS |

**Table 2.** Initial direct relationship decision matrix created for main criteria

| Criterion | Price | Transportation | Accommodation | Facility Features | Alternative Tourism | Visitor Rating Scores |
|---|---|---|---|---|---|---|
| Price | No Effect | Less Effective | Less Effective | Very Little Effective | Very Little Effective | Very Little Effective |
| Transportation | Very Little Effective | No Effect | Very Little Effective | Very Little Effective | Very Little Effective | No Effect |
| Accommodation | No Effect | Very Little Effective | No Effect | Very Little Effective | No Effect | No Effect |
| Properties | Very High Effective | Very High Effective | Highly Effective | No Effect | Very High Effective | Less Effective |
| Alternative Tourism | Very Little Effective | Very Little Effective | Very Little Effective | Very Little Effective | No Effect | Very Little Effective |
| Visitor Rating Score | No Effect | No Effect | Very Little Effective | No Effect | Very Little Effective | No Effect |

**Table 3.** Normalization

| Criterion | Price | | | Transportation | | | Accommodation | | |
|---|---|---|---|---|---|---|---|---|---|
| **Price** | 0 | 0 | 0.25 | 0.25 | 0.5 | 0.75 | 0.25 | 0.5 | 0.75 |
| **Transportation** | 0 | 0.25 | 0.5 | 0 | 0 | 0.25 | 0 | 0.25 | 0.5 |
| **Accommodation** | 0 | 0 | 0.25 | 0 | 0.25 | 0.5 | 0 | 0 | 0.25 |
| **Facility Features** | 0.75 | 1 | 1 | 0.75 | 1 | 1 | 0.5 | 0.75 | 1 |
| **Alternative Tourism** | 0 | 0.25 | 0.5 | 0 | 0.25 | 0.5 | 0 | 0.25 | 0.5 |
| **Visitor Rating Scores** | 0 | 0 | 0.25 | 0 | 0 | 0.25 | 0 | 0.25 | 0.5 |
| | | | | | | | | | |
| **Criterion** | **Facility Features** | | | **Alternative Tourism** | | | **Visitor Rating Scores** | | |
| **Price** | 0 | 0.25 | 0.5 | 0 | 0.25 | 0.5 | 0 | 0.25 | 0.5 |
| **Transportation** | 0 | 0.25 | 0.5 | 0 | 0.25 | 0.5 | 0 | 0 | 0.25 |
| **Accommodation** | 0 | 0.25 | 0.5 | 0 | 0 | 0.25 | 0 | 0 | 0.25 |
| **Facility Features** | 0 | 0 | 0.25 | 0.75 | 1 | 1 | 0.25 | 0.5 | 0.75 |
| **Alternative Tourism** | 0 | 0.25 | 0.5 | 0 | 0 | 0.25 | 0 | 0.25 | 0.5 |
| **Visitor Rating Scores** | 0 | 0 | 0.25 | 0 | 0.25 | 0.5 | 0 | 0 | 0.25 |

**Table 4.** Fuzzy Dematel analysis results

| Criterion | Sub-Criterion | D | R | D+R | D-R | Wi (sub) | Wi |
|---|---|---|---|---|---|---|---|
| **Price** | Accommodation Fee | 5.232 | 6.601 | 11.834 | -1.368 | 0.325 | **0.168** |
| | Facility Fee | 8.580 | 5.456 | 14.037 | 3.124 | 0.392 | |
| | Facility Usage Visitor Type | 4.216 | 5.971 | 10.188 | -1.753 | 0.282 | |
| **Accessibility** | Distance to the Airport | 1.419 | 1.348 | 2.767 | 0.070 | 0.284 | **0.160** |
| | Distance to City Center | 1.024 | 2.374 | 3.401 | -1.351 | 0.376 | |
| | Distance to Accommodation Center | 2.158 | 0.877 | 3.035 | 1.281 | 0.338 | |
| **Accommodation** | Bed Capacity | 11.041 | 9.499 | 20.541 | 1.542 | 0.346 | **0.154** |
| | Gym / Fitness | 7.515 | 9.528 | 17.039 | -2.008 | 0.288 | |
| | Number of Hotels | 11.059 | 10.593 | 21.652 | 0.466 | 0.364 | |
| **Facility Features** | Ski-run Length | 1.1254 | 1.1785 | 2.3039 | -0.0531 | 0.131 | **0.318** |
| | Number of Ski-runs | 0.7108 | 1.1587 | 1.8695 | -0.4478 | 0.109 | |
| | Artificial Snow | 0.9992 | 1.2627 | 2.2618 | -0.2635 | 0.129 | |
| | Transport System Length | 2.1226 | 1.3517 | 3.4743 | 0.7708 | 0.202 | |
| | Café / Restaurant | 1.2922 | 1.4578 | 2.7500 | -0.1656 | 0.156 | |
| | Security Unit | 1.2928 | 1.2817 | 2.5745 | 0.0111 | 0.146 | |
| | Health Unit | 1.2081 | 1.0599 | 2.2680 | 0.1482 | 0.129 | |
| **Alternative Tourism** | Cultural Events | 2.439 | 2.539 | 4.978 | -0.099 | 0.255 | **0.141** |
| | Entertainment | 3.159 | 1.813 | 4.972 | 1.345 | 0.264 | |
| | Nature Activities | 2.864 | 2.702 | 5.566 | 0.162 | 0.286 | |
| | Thermal Activities | 1.041 | 2.450 | 3.491 | -1.408 | 0.193 | |
| **Visitor Rating Scores** | Score | - | - | - | - | - | **0.058** |

terion of price, the highest and lowest weights belonged to the facility fees (0.392) and the pricing by visitor type (0.282), respectively. For the main criterion of accessibility, the highest and lowest weights belonged to the distance to the city center (0.376) and the distance to the airport (0.284), respectively. For the main criterion of accommodation, the highest and lowest weights belonged to the number of hotels (0.346) and the fitness/gym (0.288), respectively. For the main criterion of facility amenities, the highest and lowest weights belonged to the length of the transport system (0.202) and the number of ski-runs (0.109), respectively. For the main criterion of alternative tourism, the highest and lowest weights belonged to the nature

**Table 5.** Initial decision matrix

| General W | | 0.168 | | | 0.16 | | | 0.154 | | | 0.058 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Criteria | | Price | | | Transportation | | | Accommodation | | | Visitor Rating Scores |
| w | | 0.055 | 0.066 | 0.047 | 0.046 | 0.061 | 0.054 | 0.053 | 0.044 | 0.056 | 0.058 |
| Max/Min | | min | min | max | min | min | min | max | max | max | max |
| NO | Ski Center | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C21 |
| 1 | SC1 | 266 | 75 | 1 | 166 | 63.9 | 49.8 | 2466 | 1 | 5 | 4.6 |
| 2 | SC2 | 0 | 0 | 1 | 97.1 | 33.4 | 23.8 | 2250 | 1 | 5 | 4.5 |
| 3 | SC3 | 282 | 0 | 1 | 141.7 | 31.4 | 37 | 1600 | 1 | 1 | 4.2 |
| 4 | SC4 | 235 | 80 | 1 | 149.7 | 45.7 | 33.2 | 1450 | 1 | 7 | 4.5 |
| 5 | SC5 | 225 | 90 | 1 | 0 | 0 | 11.4 | 1217 | 1 | 3 | 4.3 |
| 6 | SC6 | 230 | 120 | 1 | 127 | 14.4 | 3.9 | 1013 | 1 | 3 | 4.6 |
| 7 | SC7 | 87 | 70 | 1 | 160 | 39.7 | 34.2 | 800 | 1 | 1 | 4 |
| 8 | SC8 | 306 | 105 | 1 | 121 | 43.4 | 39.4 | 467 | 1 | 3 | 4.4 |
| 9 | SC9 | 315 | 80 | 1 | 124.9 | 7 | 0 | 110 | 1 | 1 | 4.5 |

| General W | | 0.318 | | | | | | | 0.141 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Criteria | | Facility Features | | | | | | | Alternative Tourism | | | |
| w | | 0.041 | 0.035 | 0.041 | 0.064 | 0.051 | 0.046 | 0.041 | 0.036 | 0.037 | 0.041 | 0.027 |
| Max/Min | | max | max | max | max | max | max | max | max | max | max | max |
| No | Ski Center | C10 | C11 | C12 | C13 | C14 | C15 | C16 | C17 | C18 | C19 | C20 |
| 1 | SC1 | 1297 | 22 | 1 | 22018 | 1 | 1 | 1 | 0 | 1 | 0 | 0 |
| 2 | SC2 | 2485 | 24 | 1 | 16145 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| 3 | SC3 | 2375 | 21 | 1 | 10380 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |
| 4 | SC4 | 2465 | 32 | 1 | 21.832 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| 5 | SC5 | 4500 | 3 | 1 | 5983 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
| 6 | SC6 | 2800 | 5 | 1 | 6263 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |
| 7 | SC7 | 3500 | 4 | 1 | 3250 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| 8 | SC8 | 2600 | 12 | 1 | 3621 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |
| 9 | SC9 | 1650 | 7 | 1 | 4547 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |

activities (0.286) and the thermal activities (0.193), respectively. After the weights of both the main criteria and sub-criteria in the research model were obtained, the TOPSIS method was used to evaluate the performance of the ski centers. Nine different ski centers were coded as SC (Ski Center). According to the method's steps, the initial decision matrix is presented in Table 5.

The normalized decision matrix and the weighted normalized decision matrix was calculated according to the TOPSIS method steps. As a result of the analysis, the performance results and ranking of the ski centers are given in Table 6. The ski center coded with SC4 was ranked the 1st with the highest $CC_i$ value, followed by the centers coded with SC1, and SC8, respectively. However, the $CC_i$ values of SC4 and SC1 were very close to each other. The center coded SC9 ranked the last with the CC value of 0.3091.

**Table 6.** Initial direct relationship decision matrix created for main criteria

| No | Ski Center | $S_i^-$ | $S_i^+$ | $CC_i$ | Rank |
|---|---|---|---|---|---|
| 1 | SC1 | 0.0772 | 0.0441 | 0.6362 | 2 |
| 2 | SC2 | 0.0577 | 0.0578 | 0.4995 | 4 |
| 3 | SC3 | 0.0523 | 0.0640 | 0.4501 | 5 |
| 4 | SC4 | 0.0724 | 0.0410 | 0.6385 | 1 |
| 5 | SC5 | 0.0466 | 0.0704 | 0.3984 | 8 |
| 6 | SC6 | 0.0508 | 0.0664 | 0.4337 | 7 |
| 7 | SC7 | 0.0524 | 0.0644 | 0.4487 | 6 |
| 8 | SC8 | 0.0605 | 0.0574 | 0.5128 | 3 |
| 9 | SC9 | 0.0365 | 0.0816 | 0.3091 | 9 |

## Summary and Conclusion

Many winter tourism centers have entered into service due to increased demand and government support. The results of this study have important theoretical and practical implications. The study has similarities with other studies of the criteria and priorities affecting the choice of ski centers. In this study, the criterion weights for the choice of ski centers were calculated using the fuzzy DEMATEL method, a fuzzy multi-criteria decision-making technique. The weights of the main criteria were ranked as facility amenities, price, accessibility, accommodation, alternative tourism, and visitor rating score. Rankings on the basis of weighted averages: price, visitor evaluation score, transportation, accommodation, facility amenities and alternative tourism. The results of this study are consistent with those of the studies conducted by Bojanic and Warnick [33] and Won et al. [10] in terms of the importance of these criteria. Since the main purpose of the ski center choice is skiing, studies emphasize that quality skiing conditions are an important criterion for the choice of ski centers, suggesting that facility amenities are of great importance [8, 11]. Packer [34] reported that approximately 71% of the visitors of ski centers come to the center with their vehicles. This shows why the sub-criterion of access to the city center has a higher weight than other sub-criteria. Studies have also emphasized accommodation as an important criterion for ski center visitors [7, 15]. Additionally, studies argue that alternative tourism areas such as nature and archeological sites affect the destination choice of ski center visitors, in terms of evaluating visitor ratings [4, 20].

Richards [35] often suggested that skiers may have a significant impact on other visitors by offering word-of-mouth recommendations and introducing ski centers they like to other visitors. This situation stated by Richards is thought to be valid for new visitors. In this study, it is seen that the criterion of visitor evaluation scores has the least effect compared to other criteria. However, when the main criteria are examined in terms of average, it is in the second place. Won and Hwang stated that the number of ski-runs is the least important factor in the ski center choice of visitors [11]. A similar result was reached in this study. The results of this study should be improved by primarily focusing on factors such as facility costs and amenities for visitor targets of ski center managers. Due to the increased number of winter tourism centers, it becomes difficult for ski lovers to choose among ski center alternatives.

The most important factor for the effectiveness of winter tourism centers in this decision-making process is the quality service the center offers and its ability to meet the demands and expectations of consumers. In this study, after the significance levels of the criteria affecting the choice of winter tourism centers were determined, the TOPSIS method was used to rank the performance of nine ski centers in Turkey. As a result, the performance of the most popular ski centers in Turkey was measured. Consequently, the top three ski resorts according to their scores are SC4, SC1, and SC9, respectively. The study used two different analysis methods to calculate the weights of the criteria for the choice of ski centers and evaluate the ski center performance. With this study, the factors and weights that are affected by ski lovers in their preference of ski centers are a guide for the centers. In addition, it will be beneficial for the centers to identify their deficiencies and carry out improvement works in attracting the increasing demand for skiing to their centers. Additionally, as the study examined the ski centers that actively operate in Turkey, this may be considered as a spatial decision-making problem.

## Limitations and Future Studies

In this study, the factors were determined as a result of a literature review and interviews with both ski center managers and visitors. Skiing is a long-standing industry, and it exists in many locations that are currently developing, but not yet well-known. Data collection of visitors in the winter tourism industry is not always well-organized. However, if a different set of selection criteria or different hierarchical levels were used, the results could be different. Future studies may add several different selection criteria while researching on different samples. The main focus of this study was to determine the weights of the factors affecting the visitors' ski center choices and rank the performance of nine active ski centers in Turkey. However, the study did not classify the visitors by differentiating them as skiers/non-skiers or skiers/snowboarders. Future studies on national and international ski destinations should consider different criteria to better understand the choices of non-skiers, local and foreign skiers, or snowboarders. Additionally, they may include different factors such as playgrounds for children [33], snow quality, the possibility of skiing in the evening, and access to slopes [10]. Snow condition, or more importantly, "lack of snow" is a structural factor that prevents participants from skiing [30]. Therefore, future studies should examine the effects of selected parameters on the relative importance of choosing a ski center for different purposes [37]. The study used fuzzy multi-criteria decision-making models as the research method. Future studies may use different analysis methods such as different multi-criteria decision-making techniques, structural equation modelling or cluster analysis methods. Some developed methodologies used to measure tourists' perception or satisfaction, destination image or [38] loyalty could be integrated for identifying the weakest reasons (criteria) and provide a valuable input for managerial decision making processes. Thus, they may introduce different perspectives on how much each criterion contributes to the choice of ski centers.

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