



DETERMINING THE MOST APPROPRIATE HOTEL WITH FUZZY AHP METHOD

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Abstract

Choosing suitable accommodation is very important when planning a trip. This study, through the fuzzy analytical hierarchy process (FAHP), aims to support tourists' decision-making in choosing the optimal accommodation based on the judgment of tourism experts. Based on the literature, eight of the most important factors influencing this decision-making were selected, and three hotels will serve as alternatives. The results showed that 'cost per person' was the most influential factor with a weight of 0.335, followed by 'room facilities' with a weight of 0.248. The factor with the lowest impact on the choice of accommodation was 'children's policies' with a weight of 0.035, which was the least influential factor. Meanwhile, 'meals' and 'reservations policy' had approximately the same importance in decision-making. Considering the factors with the greatest impact, reducing costs, improving accommodation, and increasing the quality of service would bring tourism structures closer to tourists.

Keywords: Fuzzy AHP, hotel selection, factor, decision-making

1. INTRODUCTION

The tourism industry is one of the main factors in Albania's economy. The numerous natural and cultural attractions of the country, from year to year increase the interest of tourists to visit it. According to the official data of the Ministry of Tourism, only in 2023, the country's economy from tourism income increased by 4.173 million euros, approximately 1.37 million euros more than the income this sector brought in 2022. Albania is a favorite destination throughout the year, only in the first two months of this year there were 970 thousand foreign visitors, from 686 thousand in the same period of the previous year.

The development of tourism is associated with the development of the country's infrastructure, the improvement of tourist structures, and the increase in the quality of service. When choosing suitable accommodations, tourists face specific challenges. According to Mahdi et al. (2021), choosing the right accommodation is about comfort and ensuring a pleasant and memorable travel experience. Factors such as the variety of hotels, personal preferences, budget constraints, etc., complicate this decision-making. Moreover, subjective factors such as service quality, location, price, cleanliness, and access to cultural or natural attractions often make it difficult for tourists to identify with certainty the best accommodation option. An optimal choice can only be made by analyzing and evaluating the most important factors that affect holiday satisfaction.

The use of MCDM methods is the optimal choice when we have to choose between many alternatives and when the selection is influenced by several factors (Ali et al., 2012). Vatankhah et al. (2023) showed that 11% of the MCDM literature (374 publications) pertains to travel and tourism. These methods are mostly used in the selection of hotels and tourist destinations.

In this study, based on the judgments of tourism experts, who analyzed the factors identified in the literature, one of the decision-making methods with multiple criteria, Fuzzy AHP, was used to calculate their weights. Also, three hotels in different areas of the coastal city of Vlore were chosen as alternatives for this study. The results of this work help both tourists and accommodation structures.

The article is organized as follows: in continuation of this introduction, several papers are presented that have applied the Fuzzy Analytic Hierarchy Process method in choosing a suitable accommodation during a trip, the factors that the authors have taken into consideration, and the results achieved. The following is a brief presentation of the methodology used, presenting the method used in more detail. The paper ends with the results and conclusions sections.

2. LITERATURE REVIEW

Chen et al. (2012) calculated the weights of the factors that influence the choice of five-star hotels. According to the authors, location was the most important factor for that category of tourists who frequent five-star hotels, followed by security, price, room and reception desk,

service quality, and hotel facilities. In their study, Zaman et al. (2016) showed how the weight of the six criteria that influenced the choice of a hotel could be calculated. AHP was the method that the authors used in this study, taking into consideration the responses of 250 surveyed tourists. The results showed that cleanliness, location, and value for money were the criteria that most influenced the choice of a hotel. Sezgin et al. (2016) analyzed the choice of a suitable hotel in the Mersin region by local tourists. The authors use the AHP method for determining the weights of the criteria and the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) method for ranking the five hotels taken into consideration. AHP results showed that 'cleanliness' was the most valued criterion followed by 'comfort' and 'cost/benefit', while 'location' and 'staff' had the same influence. The factor with the least impact on the election was 'free Wi-Fi'. Gülsün et al. (2017) in their study focused on the ranking of five hotels through five criteria taken into consideration such as room price, cleaning service, food diversity, security level, and proximity to the destination. In their study, the analysis was done through three of the most used MCDM methods to achieve a solid result. The authors showed that the AHP and TOPSIS methods gave the same result, while VIKOR (Vise Kriterijumska Optimizacija I Kompromisno Rešenje) was not suitable for this decision-making.

An extended model of the Complex Proportional Assessment (COPRAS) method was applied by Roy et al. (2019) for web-based hotel evaluation and selection. Hotels were ranked and rated according to performance and several criteria from the tourists' point of view. 'Value for money', 'food', and 'facilities' were the three most important factors according to experts who analyzed customers' preferences and feedback. They turned out to be less important in decision-making 'price', and 'location'. Mahdi et al. (2021) in their study used Fuzzy-AHP and GIS (Geographic Information Systems) methods to model preferences in the selection of accommodation by tourists. They analyzed 364 accommodation places in the city of Budapest and showed that half of them were recommendable for tourists. In their work, the factor with the greatest impact on choosing accommodation was the 'price per room' followed by the 'security level'. 'The free cancellation service' turned out to be the factor with the least influence on the choice of tourists, while 'breakfast included in the price' and 'distance from the center' had the same influence.

According to Karamasa (2021), the criteria that most affect the perception of the quality of service offered by hotels are 'availability of prices' followed by 'politeness and level of respect'. Other important factors in this study were 'reliability', 'flexibility of service and process', 'quality of restaurant service', and 'cleanliness'. The study refers to three-star hotels in the province of Erzurum in Turkey, and analysis was done through the Complex Proportional Assessment (SWARA) method which also showed that the least influential factors were 'housekeeping quality', and 'front office service quality'. Meanwhile, in his study, Akpınar (2022) analyzed the choice of a hotel in the conditions of the pandemic. SWARA and COPRAS were the methods used to evaluate the safe tourism certification criteria to solve the problem of choosing the most suitable hotel. As expected, the most important factors in this period were 'safety measures' and 'staff measures'.

Based on the literature, the factors considered in this study are presented in Table 1 below.

Table 1. Criteria for Selection an Accommodation

Factors	Descriptions
C1. Cost per person	Cost of accommodation per night for one person
C2. Review score	Impressions of previous tourists
C3. Room facilities	Private bathroom, air conditioning, sea view, balcony, kitchen
C4. Facilities	Free Wi-Fi, parking, family rooms, 24-hour front desk
C5. Child policies	Children of all ages are welcome and under 3 stay free
C6. Reservation policy	Free cancellation, no prepayment, book without credit card
C7. Meals	Breakfast included self-catering, breakfast & dinner included
C8. Location	Distance from destination or city center

In choosing a hotel, depending on the number and nature of the criteria and the number of alternatives, different decision-making methods with multiple criteria can be used. Let's compare TOPSIS, VIKOR, and Fuzzy AHP (Analytic Hierarchy Process with Fuzzy Logic) as three of the most used methods in this type of decision-making, presenting their strengths and weaknesses.

TOPSIS is a simple method to understand and implement. Using this method, we can rank the alternatives based on their distance from the ideal solution. The choice of an accommodation is based on many criteria, also the alternatives can be numerous and this is not an obstacle for this method. TOPSIS has several limitations. First, it uses subjective weighting of criteria, and decision-makers often lack sufficient information to assign accurate weights. Second, it does not take into account inaccuracies in the decision-maker's judgments.

If we had conflicting criteria in decision-making, VIKOR would be one of the methods we could use. VIKOR does not enable direct comparisons between criteria but evaluates alternatives based on their proximity to the ideal and non-ideal solution. Through the sensitivity analysis, the method provides a clear overview of how changing the weights of the criteria affects the ranking of the alternatives. Like TOPSIS, VIKOR does not manage ambiguities in the data, reducing its effectiveness.

Fuzzy AHP is an efficient method, especially when making decisions when human judgment is involved and preferences are not very clear. The method allows direct pairwise comparisons of criteria, which helps in decision-making. It also structures the problem into three or more levels, simplifying complex decision-making. This method is also suitable for group decision-making and the use of fuzzy numbers allows decision-makers to fine-tune the relative importance of criteria. Fuzzy AHP is more complex to calculate than TOPSIS or VIKOR. Pairwise comparisons for each criterion and alternative can be time-consuming, especially when the number of criteria and alternatives is considerable. In the selection of hotels, considering many hotels and criteria significantly lengthens the decision-making time.

In this paper, including eight criteria and only three hotels that serve as alternatives, and based on the judgments of three experts, we will use the FAHP method. In the future, further

development of this study is planned, where a larger number of alternatives will be included, and the analysis will include the above three methods to make a comparison of the achieved results.

3. METHODOLOGY

Among the decision-making methods with multiple criteria, the FAHP method is widely used in the tourism industry, especially when it comes to choosing accommodation during travel. First, subjective criteria such as service quality, convenience, or location must be taken into account in this decision-making and this method through fuzzy logic is more flexible in human judgments and preferences.

Second, during pairwise comparisons of criteria, decision makers can express themselves in linguistic terms, (e.g., 'equally important', 'much more important'). Then these judgments are converted into fuzzy numbers, to get more accurate estimates in this way. Also, this method is more flexible in weighing the criteria through fuzzy groups. In addition, FAHP enables the control of the consistency of the judgments of the decision-makers, assuring us that the decision is based on stable judgments.

In this study, the FAHP method with triangular fuzzy numbers (TFN) was used, which was first introduced in 1983 by Van Laarhoven and Pedrycz.

The method is applied in three stages:

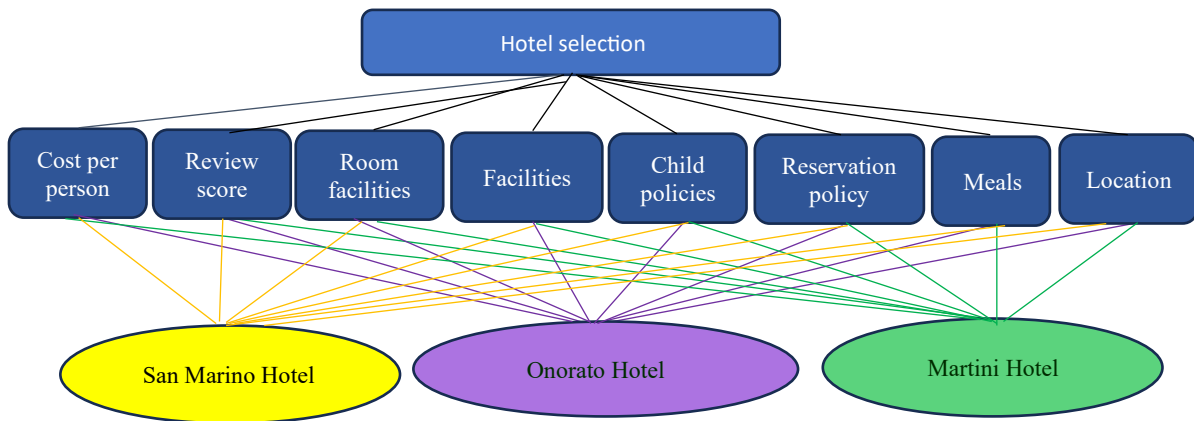
- The problem was first structured in three levels, Figure 1.

Goal: choosing a suitable hotel during a trip.

Criteria: The selection of criteria for the selection of the tourist destination was carried out through the literature review and consultation with tourism experts. Studies related to destination selection, tourism management, and multi-criteria decision analysis (MCDA) in tourism were consulted. In this way, the common and influential criteria were identified in these studies on the selection of the tourist destination. Through interviews, tourism experts were consulted and eight suitable and adaptable criteria were selected for the specific touristic context of Albania.

Alternatives: three of the best three-star hotels in the city of Vlore were chosen.

Figure 1. FAHP Hierarchical Structure



- Based on the judgments of experts, a comparison matrix was built based on the membership function of linguistic scale and Fuzzy triangular number (Table 2).

Table 2. Proposed Membership Function of Linguistic Scale

Saaty's scale	Value Description	TFN	Reciprocal TFN
9	Extreme importance	(8, 9, 9)	(1/9, 1/9, 1/8)
8	Absolute importance	(7, 8, 9)	(1/9, 1/8, 1/7)
7	Very Good	(6, 7, 8)	(1/8, 1/7, 1/6)
6	Fairly Good	(5, 6, 7)	(1/7, 1/6, 1/5)
5	Strong importance	(4, 5, 6)	(1/6, 1/5, 1/4)
4	Preferable	(3, 4, 5)	(1/5, 1/4, 1/3)
3	Moderate advantage	(2, 3, 4)	(1/4, 1/3, 1/2)
2	Weak advantage	(1, 2, 3)	(1/3, 1/2, 1)
1	Equal importance	(1, 1, 1)	(1, 1, 1)

The relative importance of each criterion was calculated as in the matrix below:

$$A = \begin{bmatrix} (1, 1, 1) & l_{21}m_{21}u_{21} & \dots & l_{1n}m_{1n}u_{1n} \\ l_{21}m_{21}u_{21} & (1, 1, 1) & \dots & l_{2n}m_{2n}u_{2n} \\ \vdots & \vdots & \dots & \vdots \\ l_{n1}m_{n1}u_{n1} & l_{n2}m_{n2}u_{n2} & \dots & (1, 1, 1) \end{bmatrix}$$

- The judgment matrices of the three experts were analyzed through the Fuzzy AHP web application developed by Holecck and Talasova (2016), and since the number of experts was small, the geometric mean was used to obtain the final results. According to Wu et. al, (2008), if we had used a large number of experts, the use of the arithmetic mean would have been more suitable.

4. RESULT OF ANALYSIS

In the first phase of the study, the opinions of three tourism experts were obtained, two of whom were hotel managers and the other a professor of the faculty of tourism with work experience of no less than 10 years. Their judgments were obtained through interviews that lasted about 25 minutes each after a brief description of the purpose of the study and the factors that were taken

into consideration. Next, each of them made the double comparisons of the factors related to the goal of "choosing an accommodation during a trip" and then the double comparisons of the hotels considered in relation to each factor. The Saaty's 1-9 scale was used for these comparisons. With these data, Saaty's judgment matrices were built with the equivalent fuzzy numbers as in Table 1. The data analysis was done through the Fuzzy AHP web application, which showed that the experts' judgments were consistent with $CR = 0.076$ less than 0.1.

The results achieved above were organized in Excel, and their fuzzy geometric mean value \tilde{r}_i was calculated. For the calculation of fuzzy weights of the criteria, was used,

$$\tilde{w}_i = \tilde{r}_i \otimes (\tilde{r}_1 \oplus \tilde{r}_2 \oplus \dots \oplus \tilde{r}_8)^{-1}$$

where in this case,

$$\begin{aligned} \tilde{r}_1 \oplus \tilde{r}_2 \oplus \dots \oplus \tilde{r}_8 &= (0.86, 0.938, 1.03) \\ (\tilde{r}_1 \oplus \tilde{r}_2 \oplus \dots \oplus \tilde{r}_8)^{-1} &= \left(\frac{1}{1.03}, \frac{1}{0.938}, \frac{1}{0.86} \right) \end{aligned}$$

Table 3 below presents the results of this analysis regarding the criteria.

Table 3. The Relative Weights of Selected Criteria

Criteria	Fuzzy geometric mean value \tilde{r}_i	Fuzzy weights \tilde{w}_i	Rank
C1. Cost per person	(0.305, 0.314, 0.320)	(0.296, 0.335 , 0.372)	1
C2. Review score	(0.118, 0.139, 0.159)	(0.115, 0.148 , 0.185)	3
C3. Room facilities	(0.210, 0.233, 0.250)	(0.204, 0.248 , 0.291)	2
C4. Facilities	(0.050, 0.057, 0.065)	(0.049, 0.060 , 0.076)	5
C5. Child policies	(0.031, 0.033, 0.037)	(0.030, 0.035 , 0.043)	8
C6. Reservation policy	(0.039, 0.041, 0.049)	(0.038, 0.044 , 0.057)	7
C7. Meals	(0.040, 0.045, 0.056)	(0.039, 0.048 , 0.065)	6
C8. Location	(0.067, 0.076, 0.094)	(0.065, 0.082 , 0.109)	4

Source: Authors' Calculations Using the Fuzzy AHP Application Web

As seen in Table 3, the factor with the greatest impact on choosing accommodation is C1(cost per room) with a weight of 0.335, followed by C3 (room facilities) with a weight of 0.248. In third place in terms of importance in decision-making is C2 (review score) with a weight of 0.148. In fourth and fifth place are the factors C8 (location) and C4 (facilities) with weights of 0.082 and 0.06 respectively. Factors C6 (reservation policies) and C7 (meals) have approximately equal weights; the least important factor was C5 (child policies) with a weight of 0.035.

These results are in accordance with the results of Karamasa (2021), and in contrast with the results of Zaman et al., (2016), and Sezgin et al., (2016), which had 'cleanliness' as the most important factor in the selection.

Considering the results of this paper, hotel managers should work on optimizing price strategies, improving room facilities, continuously monitoring comments left on online

platforms by customers, and improving the quality of service. Since the price per person turned out to be the most important factor in choosing an accommodation, the price policies applied by accommodation structures should be more flexible to attract more visitors. Here we mean seasonal discounts, loyalty packages, and special rates for extended or group bookings. Also, this paper showed that tourists value room amenities, so managers should provide rooms with comfortable beds, air conditioning, high-speed internet, and various entertainment options. Tourists' comments on platforms such as Booking.com, and others, influence future bookings, so hotel managers must make improvements based on these comments to improve the services offered. In this way, they will be able to increase their reputation and trust. Maintaining a presence and reputation on the internet is essential for an accommodation structure. Listing on multiple booking platforms is not enough, but quality presentation, detailed descriptions, and accurate information about the structure and services are needed.

For the calculation of fuzzy weights of the alternatives, was used,

$$\tilde{w}_i = \tilde{r}_i \otimes (\tilde{r}_1 \oplus \tilde{r}_2 \oplus \tilde{r}_3)^{-1}$$

where in this case,

$$\tilde{r}_1 \oplus \tilde{r}_2 \oplus \tilde{r}_3 = (0.88, 0.99, 1.056)$$

$$(\tilde{r}_1 \oplus \tilde{r}_2 \oplus \tilde{r}_3)^{-1} = \left(\frac{1}{1.056}, \frac{1}{0.99}, \frac{1}{0.88} \right)$$

Table 4 below presents the results of this analysis regarding the alternatives.

Table 4. Summarized Results for the Alternatives

Alternatives	Fuzzy geometric mean value \tilde{r}_i	Fuzzy weights \tilde{w}_i	Rank
San Marino Hotel	(0.445, 0.511, 0.524)	(0.421, 0.516 , 0.596)	1
Onorato Hotel	(0.210, 0.225, 0.247)	(0.199, 0.227 , 0.281)	3
Martini Hotel	(0.225, 0.254, 0.285)	(0.213, 0.257 , 0.324)	2

Source: Authors' Calculations Using the Fuzzy AHP Application Web

Table 4 clearly shows that the hotel with the best performance about the reviewed factors was San Marino Hotel with a weight of 0.516 and the other two hotels were almost equally preferred in the selection during a trip.

5. CONCLUSION

Various platforms such as Booking.com, Tripadvisor.com, and others enable hotels to get closer to their customers. However, they also help the latter to make a better choice and have the opportunity to leave their impressions of the service offered. This is how a better relationship with customers in the tourism sector is achieved. This study analyzes the factors that most influence the choice of a hotel through the FAHP method. These factors have been selected based on the literature and expert opinions together with three of the three-star hotels in the city

of Vlore, located in different areas of the city. The results showed that for tourists choosing three-star hotels, price per person, room facilities and other tourists' impressions of the service received in hotels are the most important factors. So, hotels can attract tourists by making improvements to accommodation units, improving the quality of services, and moderating prices.

Some limitations of this study: First, this study may include the judgments of more experts and a significant number of tourists. Second, only three of the three-star hotels in the coastal city of Vlore were considered. Hotels in different areas of Albania can attract different types of tourists. Expanding the search to more destinations can help hotels identify emerging trends and preferences.

Some recommendations for further studies: The continuous development of tourism in Albania requires studies, the results of which would help both businesses operating in the field of tourism, as well as tourists themselves to have unforgettable experiences in their travels. A study can also be done to rank the factors that influence the choice of hotel and to rank hotels based only on the ratings made by tourists on online platforms. Future research could focus on different hotel categories, such as budget or luxury hotels, to understand how preferences differ between income groups or travel motivations. Hotel managers must be careful when adapting their offers to different types of tourists. Thus, family-oriented hotels may offer child-friendly facilities, while business hotels may offer various conference or event spaces. Future studies could use two or more multi-criteria decision-making methods to rank hotels or factors influencing their choice. In this way, it can be seen which method is more efficient in specific contexts or regions. The study of luxury hotels would provide an overview of the luxury tourism sector in a growing country like Albania. Understanding what factors influence the preferences of luxury tourists can help these hotels refine their strategies.

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