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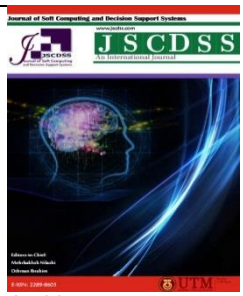

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Developing an Integrated Decision Making Framework for Evaluating Hotel Website under Fuzzy Environment

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Abstract

Assessing hotels' website based on several evaluative attributes is a critical issue for the managers in this industry. This study applies VlseKriterijumska Optimizacija I Kompromisno Resenje under fuzzy environment (FVIKOR) to assess hotels' website performance with respect to 12 attributes. First, the evaluative factors were chosen by the experts. Then, using triangular fuzzy number, the data set were gathered. The main objectives of this paper are to prepare the most effective attributes in evaluating hotels' websites. Moreover, developing a decision model for assessing the performance of hotels is another objective of this research.

Keywords: Performance evaluation, Hotel industry, Website, FVIKOR

1. Introduction

Internet has helped businesses reach customers who were previously not accessible (Samad, Nilashi, & Ibrahim, 2019). It has had great impact on customer purchasing behavior (Wang & Law, 2019). Nielsen and Norman (2018) specified that online shopping gives customers a wide view before buying a specific product (Nelson & Norman, 2018). Law and Bai (Law & Bai, 2008) indicated that the Internet has not only made many changes in the sale and purchase of products, but has also made significant changes in attracting customers in other areas such as tourism and hospitality. In the online hotel market, travelers can get a variety of facilities, including the food menu, food prices, discounts, number of empty rooms and other specific information on the hotels environments (Suo, Lu, & Lin, 2020). A hotel' website play an important role in customer' decision making. Therefore, the most important part in online hotel marketing is to design a very effective website design for hotels which increases the satisfaction of the customers (Ha & Im, 2012). The efficiency of hotel websites is thus very vital if hoteliers have aim to attract consumers and provide a pleasant and satisfying online experience.

As internet is very important in hotels' performance, the issue of website performance evaluation have received much attention from many scholars (Nilashi & Ibrahim, 2014). There are several investigations on website assessment to increase the level of performance in managing hotels websites (Stringam & Gerdes, 2019). But, there is a lack on website performance evaluation by applying Multi-Criteria Decision Making (MCDM) methods (Samad et al., 2019). In fact, MCDM is an approach in which decision makers (managers) can select the best website among several website based on multiple attributes (Erdoğan, Aydın, Balki, & Sayin, 2020; Fallahpour, Olugu, Moghassem, & Musa, 2014; Fallahpour, Olugu, Musa, Wong, & Noori, 2017; Nilashi, Ahmadi, Ahani, Ravangard, & bin Ibrahim, 2016; Nilashi et al., 2019). Ip et al. (Ip, Law, & Lee, 2012) utilized Analytic Hierarchy Process with fuzzy numbers (FAHP) for assessing performance of hotel website. They determined the most useful criteria for improving the website effectiveness in attracting tourists. As Woodside, Vicente, and Duque (Law, Bai, Woodside, Mir, & Duque, 2011) indicated, richness of content and ease of use are the most important factors to determine website performance. The literature shows that many studies have been conducted in this area; however, implementation of VIKOR, as a robust MCDM technique, under fuzzy environment is very rare in website performance evaluation. Accordingly, this study aims to develop a MCDM model for hotels' website functionality evaluation through VIKOR under fuzzy environment.

The structure of this article is as follows. In Section 2, the related work is presented. In Section 3, Fuzzy VIKOR (FVIKOR) is explained. In Section 4, case study and results are given. In Section 5, conclusion, limitation and future works are presented.

2. Related Work

There are numerous studies on hotels' website performance evaluation using decision making approaches. Ip et al. (2010) applied AHP to compute the importance degree of each criterion for hotels' websites performance assessment. Qi et al. (2015) utilized a fuzzy TOPSIS model for ranking the hotels' websites. In the first step, the evaluation criteria were determined. Then, each website performance was measured using a fuzzy scale. Finally, using fuzzy TOPSIS, the hotels were prioritized. Tsai et al. (2010) combined integrated Decision Making Trial and Evaluation Laboratory (DEMATEL) and Analytical Network Process (ANP) for determining the interrelationship between the criteria, calculating the weight of each criterion and ranking the hotels' website according to the evaluative criteria. Yin et al. (2020) developed a two-stage Data Envelopment Analysis (DEA) with respect to internal cooperation criteria. In the first stage, the most suitable criteria based on the internal cooperation perspective for hotels' website performance assessment were determined. Then, a DEA method under fuzzy environment was applied for calculating the efficiency of the hotels websites. Shang et al. (2010) assessed the hotels' website performance using DEA under stochastic environment. First, a list of evaluative criteria was specified based on the experts' opinions. Then, a questionnaire was developed and distributed between the experts to measure the websites' performance. Finally, the stochastic-DEA was run to calculate the efficiency and rank the hotels' websites.

3. FVIKOR

This is a MCDM model under fuzzy environment for selecting the best alternative using a compromise solution (Opricovic & Tzeng, 2002). The steps of FVIKOR are as follows:

i. Gather the linguistic data for each criterion of each website (see Table 1 regarding the linguistic variables).

Table 1
Linguistic variables

Linguistic variables	TFNs
Very Weak (VW)	(1, 2, 3)
Weak (W)	(2, 3, 4)
Average (A)	(3, 4, 5)
Strong (S)	(4, 5, 6)
Very Strong (VS)	(5, 6, 7)

ii. Convert the fuzzy values to crisp numbers by applying Eq. (1) (Chen & Hsieh, 1999). More comprehensive information is presented by (Fallahpour, Olugu, Musa, Khezrimotlagh, & Wong, 2016) regarding Eq. (1).

$$\vartheta(\tilde{A}) = \frac{(a+4b+c)}{6} \quad (1)$$

where $\tilde{A}$ is a TFN and $\vartheta(\tilde{A})$ shows the crisp value of$\tilde{A}$. a is the lower bound of the TFN, b is the middle value of TFN and c the upper bound of TFN.

iii. Describe the best f_j^* and the worst f_j^- numbers of all criteria ratings.

$$f_j^* = \max_i x_{ij} \quad (2)$$

$$f_j^- = \min_i x_{ij} \quad (3)$$

where j is an index for attributes or criteria and i is an index for alternatives.

iv. Compute the group utility S_i and individual regret R_i for each alternative.

$$S_i = \sum_{j=1}^{n} w_j \left(\left(f_j^* - f_{ij}\right) \Big/ \left(f_j^* - f_j^-\right) \right) \quad (4)$$

$$R_i = \max_j \; w_j \left(\left(f_j^* - f_{ij}\right) \Big/ \left(f_j^* - f_j^-\right) \right) \quad (5)$$

v. Compute the compromise value Q_i for each alternative.

$$Q_i = \left[v \left((S_i - S^*) \Big/ (S^- - S^*) \right) \right] + \left[(1-v) \left((R_i - R^*) \Big/ (R^- - R^*) \right) \right] \quad (6)$$

where $S^* = \min_i S_i$, $S^- = \max_i S_i$, $R^* = \min_i R_i$, $R^- = \max_i R_i$ and v is introduced as a weight for the strategy of "the majority of criteria" (or "the maximum group utility"), and $v = 0.5$ is used in this research.

vi. Rank the alternatives by sorting the S, R and Q values in ascending order.

4. Case Study and Results

In this research, four different hotels in Iran are studied to evaluate the developed model. In the data collection process from managers of the hotels, we name the hotels as A, B, C, and D. Hotel A is located in Mazandaran province, Ramsar city. This hotel has 126 workers with 150 rooms. Hotel B is located in Khorasan province, Mashhad city. This hotel has 121 workers and 117 rooms. Hotel C is in Tehran (Capital of Iran) with 199 rooms. There are 210 workers in this hotel. Hotel D is in Fars province, Shiraz with 88 rooms. This hotel has 103 workers. The current investigation is aimed at assess the websites of these hotels to help customers to use the hotels' services.

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4.1. Determining the evaluative criteria

For evaluating the websites of the hotels, the first step is to determine the most appropriate attributes. In this study, we have determined four main aspect known as 1) General Information; 2) Reservation Information; 3) Website Management and 4) Surrounding Information. After determining the main aspects, the most important criteria in each aspect were determined (see Table 2).

Table 2
The evaluative criteria for performance evaluation

Aspect	Corresponding Criteria
General Information	Hotel descriptions (hotel introduction)
	Hotel location
	Hotel facilities
	Promotion of products
	Availability of virtual tours/video files on the hotel
Reservation Information	Room rates
	Room availability
Website Management	Online forum
	Links to other related businesses
Surrounding Information	Transportation information
	Airport information
	Main local attractions

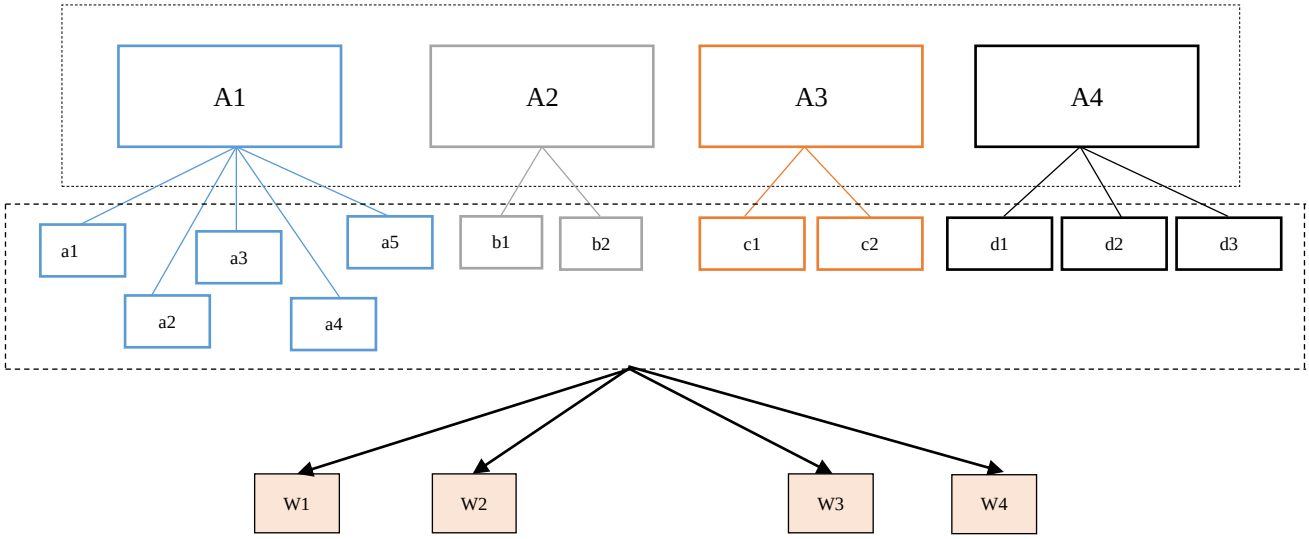

Fig. 1. The schematic of the decision making model

4.2. Collecting data set

After determining the suitable criteria and categorizing them, three experts (Purchasing manager, Accounting manager and IT manager) from the hotels were requested to give their opinions about the importance of the criteria for each hotel websites' in terms of fuzzy linguistic variables. As shown in Fig. 1, there are four main aspects (*A1*, *A2*, *A3* and *A4*). In *A1*, there are five criteria. *A2* has two attributes. *A3* includes two attributes and there are three criteria in *A4* (see Table 2).

4.3. Implementation of FVIKOR (Results)

After collecting data set, the average fuzzy value of each criterion for each alternative is changed to crisp value using Eq. (1). Then, the calculations of R, S and Q are conducted. The values of R, S and Q are given in Table 3. Note we used $\upsilon = 0.5$ for the FVIKOR in current study. The website with the minimum number of S, R and Q is the best website with the highest performance. As it is seen, website number 3 is the best website. It can be observed that this alternative has the lowest value of S, R and Q, respectively.

Table 3
Values of *S*, *R* and *Q*

S1	0.5657	R1	0.0647	Q1	0.2748
S2	0.7852	R2	0.0864	Q2	0.4879
S3	**0.2357**	**R3**	**0.0275**	**Q3**	**0.1547**
S4	0.6025	R4	0.0947	Q4	0.2578
-	$S^* = 0.2989$	-	$R^* = 0.0596$	-	-
-	$S^- = 0.7574$	-	$R^- = 0.0875$	-	-

5. Conclusions, Limitations and Future Work

Website performance evaluation is a very attractive and important issue in the context of hotel industry. The current study used FVIKOR to rank hotels' websites performance.

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To apply FVIKOR, 12 attributes were nominated for assessing the 4 hotels' websites in Iran. After achieving the fuzzy data set, the FVIKOR was implemented and the best website was determined according to the proposed criteria. The contributions of this research are: providing the most proper evaluative criteria for assessing hotels' websites performance, applying FVIKOR method in the context of hotel industry and proposing a fuzzy decision system for hotels' website performance assessment. This study includes some limitations which should be considered in the future study. First, as the number of criteria increases, the complexity of the calculations and the time to solve the problem increase. Second, the number of attributes in the model can be considered as another limitation of this work. In different countries (case studies), this number can be varied. Third, this study has applied FVIKOR. However, for future work, practitioners can perform other MCDM methods such as FAHP, FDEMATEL, and FANP.

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