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Determine The Best Travel Website Service Quality Using Fuzzy TOPSIS Approach

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Abstract: One of the crucial things to make a travel plan is to choose the best travel website quality. This is because there are many travel website that provides diverse services with different prices and many more. Therefore, it is important to make the right decision about choosing a travel website. This study implements Fuzzy TOPSIS to determine the best travel website quality. There are many factors that influence users' selection such as responsiveness, efficiency and privacy and the best travel websites choose were Traveloka, Skyscanner and Expedia. Decision-makers are asked to rank these factors from very high (VH) to very low (VL) for QA weight, while for alternatives assessment from very good (VG) to very poor (VP); very high and very good specifies the most influencing factors while very low and very poor indicates the least influencing factors. Next, each data ranking transforms into matrix form. Then, calculate a Normalized Decision Matrix (NDM). Furthermore, calculate the weighted (NDM) and distance of each alternative from the worse condition (A) and the best condition (A^+). Lastly, calculate the closeness of the coefficient of each alternative and rank them. The higher the value of relative closeness, the higher the ranking order has the best travel website service quality that can satisfy consumer's preferences.

Keywords: Decision making, Fuzzy TOPSIS ,travel website, service quality.

1 Introduction

This project is to determine the best travel website among a variety of travel websites. Three travel websites have been chosen for this project which are Traveloka, Skyscanner and Expedia. Travel websites are one of the ways for people to make a plan ahead of their journey. Also besides, a website provides a company not only a forum for product or service marketing but also another avenue for revenue generation by attracting more customers [1]. In this project, we have adopted four criteria for the best travel website quality. The ratings will be given by three respondents based on the criteria given to the alternatives.

Nowadays, thanks to the rapidly growing online market in recent years, the Internet has already had a huge impact on today's travel and tourism industry [2]. So, these users used the internet to surf the travel service website to find travel options, seek the best possible prices, and book reservations for airline tickets, hotel rooms, car rental and other associated travel services. However, there are numbers of travel website services in Malaysia and some of these websites do not provide users with satisfaction. Most users have issues where some websites have only provided the unreliable descriptions or unclear details that users need. This will only create confusion for the user. Besides, there are many non-user-friendly websites, which difficult for users to find what they are looking for. In addition, there are also some websites simply leaking out personal information without the customer's consent. Moreover, some websites are poor when it comes to notify or give a response to the customer. Generally, there are many users out there face some problem to choose which travel website offers the best travel website quality to make the most of their choices.

Multiple criteria decision making (MCDM) is amongst the best-known decision-making fields that choose the best alternative based on a variety of parameters and alternatives [3]. Hwang [4] has created one of the most popular MCDM methods known as the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) that now has been used to appraise performance in many different fields. TOPSIS has been suggested to define the nearest alternatives to the ideal solution [5]. The fundamental concept of TOPSIS is to choose the alternative that has the nearest distance from the positive ideal solution (PIS) and the longest distance from the negative ideal solution (NIS) [6]. Fuzzy TOPSIS is a tool that can help to test alternatives on multiple parameters in an unbiased and systematic way [7].

There are two types of problem in MCDM problems which is classical MCDM problems and fuzzy multi-criteria decision-making (FMCDM) problems. Classical MCDM measured weights and rankings of criteria in crisp numbers while FMCDM problems evaluated ratings and weights of criteria on imprecision, subjective and vagueness. In addition, it is usually articulated by linguistic terms and then set into fuzzy numbers [8]. To decide the best result, the chosen alternative should have the shortest distance to Positive Ideal Solution (PIS) and the farthest distance to Negative Ideal Solution (NIS) based on the concept that is used in Fuzzy TOPSIS. Further, TOPSIS is a utility-based technique that directly compares alternative data in matrices and weights of evaluation [9]. Fuzzy TOPSIS is one of the various models of multiple attributes decision making with fuzzy values that so far many models have been introduced for it [10]. In 2009, Chen and Tsao extended the TOPSIS method based on interval-value fuzzy set and in 2010, Chen and Lee presented a fuzzy TOPSIS technique based on interval type-2 fuzzy set [11]. Fuzzy TOPSIS methods have developed in a different applied fields.

In 2012, Kabir and Hasin performed a study on comparative analysis of TOPSIS and fuzzy TOPSIS for the website service assessment. The internet has become a leading network of companies [12]. The Internet has always played an important role in distributing information and services. E-commerce can be defined as a channel for buying and selling products and providing services as well through the internet. Generally, e-commerce is a business essential for organizations to reach their customers via the organization's website. The revolution of the internet really helps e-commerce to grow, achieve goals and become successful in this competitive market. Today, many travelers are preparing their vacations, reserving needed facilities and sharing their experience through the internet [13]. Therefore, many travel services or products suppliers know that they can benefit from developing their own websites to help their business grow faster [14].

However, establishing an e-commerce website is not as easy as it looks because not all websites able to change from a visitor into a customer. Even if the company has a well-established for an e-commerce website but as the number of online customers grows day after day, the provider of travel services should consider how to make consumer preferences. Therefore, the quality of e-commerce website is very important for both increased revenues and customer satisfaction [15].

According to Clemons [16], researches claimed that customer satisfaction would help to produce distinction approaches among competitors and could be one of the key elements of any internet business [17]. A formal service quality model was firstly introduced by Parasuraman [18]. In 2005, Parasuraman [19] developed E-SQUAL, which is a very effective scale for calculating the quality of online service. Service Quality is a key factor for customers as it is much easier to compare online product prices and technical specification than the traditional channels [20]. In order to measure service quality, the three-dimension that have always been stressed out the most in studies is trust, efficiency and responsiveness [21]. In earlier studies relating to the quality of services, most conventional methods of calculation to analyze it is by using a statistical approach. Nonetheless, multiple criteria decision making (MCDM) has been one of the main methods for assessing the quality of service in different fields in recent years.

The researcher use a triangular fuzzy number to solve the limitations by Liang and Wong. On top of that, in 2007, Kahraman and his research team proposed a hierarchical fuzzy TOPSIS method that has the ability to consider the hierarchy among the attributes and alternatives [22]. Following, Goli [9] have conducted research on computer security software selection by group fuzzy TOPSIS.

2 Premilinaries

Definition 1: Fuzzy Set

A fuzzy set $\tilde{A}$ in a universe of discourse X is described by a membership function $\mu\left(x\middle|\tilde{A}\right)$ that maps each element x in X to a actual number in the interval [0, 1]. The function value $\mu\left(x\middle|\tilde{A}\right)$ is termed the grade of membership of x in $\tilde{A}$. The closer the value of to unity, the higher the evaluation of the participation of x in $\tilde{A}$ [7].

Definition 2: Triangular Fuzzy Number

ATriangular fuzzy number are used in the studies and are described via tree real number (l, m, u). The membership function of the triangular fuzzy number is presented in Figure 1.

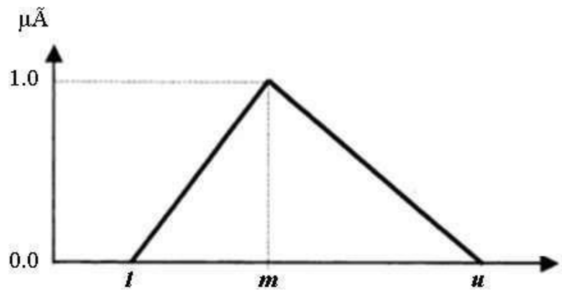

Figure 1 : The Membership Function

The real number value (l, m, u) are defined as "l", the smallest probable value, 'm', the most probable value, and "u", the largest probable value. The membership function of a triangular fuzzy number is defined as follows.

$$\mu\left(x\middle|\tilde{A}\right)=\begin{cases}0 & x<1, x>u \\ \dfrac{x-l}{m-i} & l\le x\le m \\ \dfrac{u-x}{u-m} & m\le l\le u\end{cases}$$

3 Methodology

In a view of the current situation, this paper aims to demonstrate the performance evaluation of the best travel website quality based on four criteria which are efficiency, reliability, privacy and responsiveness by comparing three alternatives which are Traveloka, Skyscanner and Expedia as shown in Figure 2. Efficiency can be defined as a measure on how well the website does what it needs to do such as provide sufficient information and easy navigation for users. Next, privacy is on how secured the website is with all its users' information. Users' need assurance that their information will not be a leak to others the third party. Furthermore, the responsiveness of the travel website can be measure on how well their team react to customers' complaints, resolve any problems occur while users directing the website and others. Lastly, reliability can be defined as how well the website will operate its designated operations and gain users' confidence that it is not a scam by providing true information.

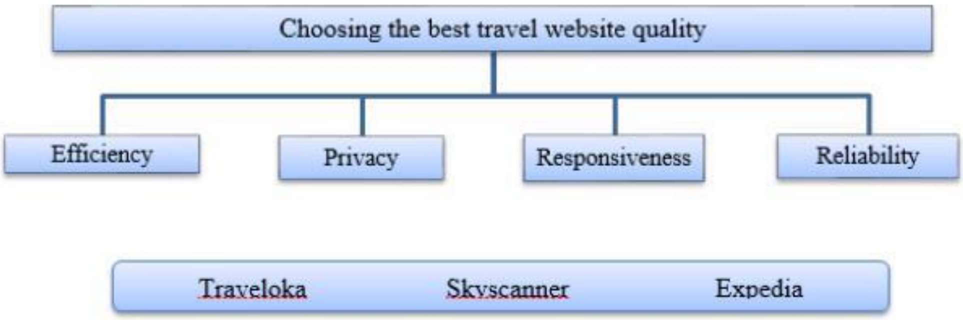

Figure 2: The Hierarchical Structure

There are 10 steps involved in this project as cited in Kore [23] as shown in Figure 3. The most important thing of the Fuzzy TOPSIS method is during the first step which is converting ratings by decision-makers into a set of fuzzy numbers. Fuzzy numbers are involved from 1 to 9. Besides, to decide which alternatives are the best, the last step of Fuzzy TOPSIS is to rank the alternatives in order of the highest value to the lowest value of the closeness coefficient. Therefore, the highest the rank, the better the alternative.

Step 1: Alternatives Ratings by Decision Makers
Step 2: Criteria Weightage by Decision Makers
Step 3: Apply Fuzzy Conversion Scales
Step 4: Aggregated Alternative and Criteria Weightage Fuzzy Decision Matrix
Step 5: Calculate Normalized Aggregated Fuzzy Decision Matrix for Alternative and Weighted Normalized Fuzzy Decision Matrix
Step 6: Find Fuzzy Positive Ideal Solution (FPIS) and Fuzzy Negative Ideal Solu-tion (FNIS)
Step 7: Calculate the Distance for each Alternative from FPIS and FNIS
Step 8: The Distance of each Weighted Alternative
Step 9: Closeness Coefficient of each Alternative
Step 10: Ranking of each Alternative

Figure 3: Fuzzy TOPSIS Steps for Supplier Selection Problems

Step 1: Alternatives Ratings by Decision Makers

In this step, the decision-makers are given with a set of questionnaire that asks them to rate the alternatives based on the criteria and explanation given.

Step 2: Criteria Weightage by Decision Makers

Same as step 1, the decision-makers are given with a set of questionnaire that asks them to rate the criteria weightage based on the criteria and explanation given.

Step 3: Apply Fuzzy Conversion Scales

Fuzzy conversion scales are applied to transform the linguistic terms into fuzzy numbers . In this project, we will apply a scale of 1 to 9 for rating the criteria and the alternatives. The intervals are chosen so as to have a uniform representation from 1 to 9 for the fuzzy triangular numbers used for the five linguistic ratings. The linguistic variables and fuzzy ratings for the alternatives are shown in Table 1.

Table 1: The Linguistic Variables and Fuzzy Ratings

Fuzzy Conversion Scales	**Alternative Assessment**	**QA Weights**
(1,1,3)	Very Poor (VP)	Very Low (VL)
(1,3,5)	Poor (P)	Low (L)
(3,5,7)	Fair (F)	Medium (M)
(5,7,9)	Good (G)	High (H)
(7,9,9)	Very Good (VG)	Very High (VH)

Step 4: Aggregated Alternative and Criteria Weightage Fuzzy Decision Matrix

$$\bar{x}_{ij}^{k} = \left(a_{ij}^{k}, b_{ij}^{k}, c_{ij}^{k}\right) \quad (1)$$

$$w_{ij}^{k} = \left(w_{j1}^{k}, w_{j2}^{k}, w_{j3}^{k}\right) \quad (2)$$

where

$a_{ij}^{k} = \min\ a_{ij}^{k}$, $\quad b_{ij}^{k} = \frac{1}{k}\sum_{k=1}^{k} b_{ij}^{k}$, $\quad c_{ij}^{k} = \min\ c_{ij}^{k}$

$i,j = 1, 2, 3, \dots, n$, $\quad k$ = number of decision group, $\quad i$ = alternatives

j = criterion

Equation (1) is for aggregated alternative while equation (2) is for criteria weightage. Criteria weightage can be obtain by using the same notations with aggregated alternative as stated above. A fuzzy multi criteria Group Decision Making (GDM) problem which can be concisely expressed in matrix format as:

$$\overline{D} = \begin{array}{c} \\ A_1 \\ A_2 \\ \vdots \\ A_m \end{array} \begin{array}{c} \begin{matrix} C_1 & C_2 & \cdots & C_n \end{matrix} \\ \begin{bmatrix} \bar{x}_{11} & \bar{x}_{12} & \cdots & \bar{x}_{1n} \\ \bar{x}_{21} & \bar{x}_{22} & \cdots & \bar{x}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \bar{x}_{m1} & \bar{x}_{m2} & \cdots & \bar{x}_{mn} \end{bmatrix} \end{array}$$

$$\overline{W} = \left[\bar{w}_1 \quad \bar{w}_2 \quad \cdots \quad \bar{w}_n\right]$$

Step 5: Calculate Normalized Aggregated Fuzzy Decision Matrix for Alternative and Weighted Normalized Fuzzy Decision Matrix

Some might be benefit criteria and some might be cost criteria. The aim is to maximize benefit and minimize the cost.

$$\overline{R} = \left[\bar{r}_{ij}\right],\ i,j = 1, 2, 3, \dots, n \quad (3)$$

$$\bar{r}_{ij} = \left(\frac{a_{ij}}{c_j^*}, \frac{b_{ij}}{c_j^*}, \frac{c_{ij}}{c_j^*} \right) \text{ and } c_j^* = \max c_j^* \text{ (benefit criteria)} \tag{4}$$

$$\bar{r}_{ij} = \left(\frac{\bar{a}_j}{c_{ij}}, \frac{\bar{a}_j}{c_{ij}}, \frac{\bar{a}_j}{c_{ij}} \right) \text{ and } \bar{a}_j = \min \bar{a}_{ij} \text{ (cost criteria)} \tag{5}$$

$\bar{R}$ is denoted as normalized aggregated fuzzy decision matrix for alternative. In this project, we use benefit criteria. Therefore, the weighted normalized fuzzy decision matrix is formed where

$$\bar{P} = \left[\bar{p}_{ij} \right] \text{ where } \bar{p}_{ij} = \bar{r}_{ij} \times \bar{w}_j \tag{6}$$

Step 6: Find Fuzzy Positive Ideal Solution (FPIS) and Fuzzy Negative Ideal Solution (FNIS)

Select the maximum value from each column as p^+ and select the minimum value from each column as p^- .

$$A^+ = \left(p_1^+, p_2^+, \ldots, p_n^+ \right) \tag{7}$$

where

$$p_j^+ = \max p_{ij3}, \qquad i = 1, 2, 3, \ldots, m, \qquad ,j = 1, 2, 3, \ldots, n$$

$$A^- = \left(p_1^-, p_2^-, \ldots, p_n^- \right) \tag{8}$$

where

$$p_j^- = \min p_{ij1}, \qquad i,= 1, 2, 3, \ldots, m, \qquad ,j = 1, 2, 3, \ldots, n$$

Step 7: Calculate the Distance for each Alternative from FPIS and FNIS

Formula for calculate distance is as shown below

$$d(a,b) = \sqrt{\frac{1}{3}\left[(a_1 - b_1)^2 + (a_2 - b_2)^2 + (a_3 - b_3)^2 \right]} \tag{9}$$

Step 8: The Distance of each Weighted Alternative

$$d_i^+ = \sum_{j=1}^{n} d\left(\bar{p}_{ij}, p_j^+ \right) \tag{10}$$

$$d_i^- = \sum_{j=1}^{n} d\left(\bar{p}_{ij}, p_j^- \right) \tag{11}$$

Step 9: Closeness Coefficient of each Alternative

$$CC_i = \frac{d_i^-}{d_i^- + d_i^+} \text{ where } i = 1, 2, 3, \ldots, m \tag{12}$$

Step 10: Ranking of each Alternative

According to the CC_i, the higher the value of the relative closness, the higher the ranking order and have better performance of the alternative.

4 Implementation

In this paper, there are three alternatives which are A_1 = Traveloka, A_2 = Skyscanner and A_3 = Expedia for comparison with four criteria such as C_1, C_2, C_3 and C_4. There are three decision makers namely DM_1, DM_2, and DM_3. Table 2 below shows the rate of the alternatives according to each decision makers.

Table 2: Alternatives Rating by Decision Makers

		DM_1	DM_2	DM_3
C_1	A_1	VG	VG	G
	A_2	G	VG	G
	A_3	F	F	G
C_2	A_1	G	G	VG
	A_2	G	F	VP
	A_3	G	G	VG
C_3	A_1	F	VG	VG
	A_2	F	G	VP
	A_3	F	G	F
C_4	A_1	G	G	G
	A_2	G	F	VP
	A_3	G	P	VP

These are the weighted performance parameters that have been merged on the basis of the questionnaire.

Table 3: Criterion Rating

Criteria	DM_1	DM_2	DM_3
C_1	M	H	H
C_2	M	VH	M
C_3	M	H	M
C_4	VH	M	L

Convert the rating scale to transform the linguistic term into fuzzy numbers. This step applied a scale of 1 to 9 for rating the criteria and alternatives.

Table 4: Fuzzy Number for Alternative Rating

		DM_1	DM_2	DM_3
C_1	A_1	VG(7,9,9)	VG(7,9,9)	G(5,7,9)
	A_2	G(5,7,9)	VG(7,9,9)	G(5,7,9)
	A_3	F(3,5,7)	F(3,5,7)	G(5,7,9)
C_2	A_1	G(5,7,9)	G(5,7,9)	VG(7,9,9)
	A_2	G(5,7,9)	F(3,5,7)	VP(1,1,3)
	A_3	G(5,7,9)	G(5,7,9)	VG(7,9,9)
C_3	A_1	F(3,5,7)	VG(7,9,9)	VG(7,9,9)
	A_2	F(3,5,7)	G(5,7,9)	VP(1,1,3)
	A_3	F(3,5,7)	G(5,7,9)	F(3,5,7)
C_4	A_1	G(5,7,9)	G(5,7,9)	G(5,7,9)
	A_2	G(5,7,9)	F(3,5,7)	VP(1,1,3)
	A_3	G(5,7,9)	P(1,3,5)	VP(1,1,3)

Table 5: Fuzzy Number for Criterion Rating

Criteria	DM_1	DM_2	DM_3
C_1	M(3,5,7)	H(5,7,9)	H(5,7,9)
C_2	M(3,5,7)	VH(7,9,9)	M(3,5,7)
C_3	M(3,5,7)	H(5,7,9)	M(3,5,7)
C_4	VH(7,9,9)	M(3,5,7)	L(1,3,5)

Based on equation (1) and (2), the aggregated alternative and criteria weightage can be written in matrix form as shown below.

$$\overline{D} = \begin{bmatrix} (5,8.333,9) & (5,7.667,9) & (3,7.667,9) & (5,7,9) \\ (5,7.667,9) & (1,4.333,9) & (1,4.333,9) & (1,4.333,9) \\ (3,5.667,9) & (5,8.333,9) & (3,5.667,9) & (1,3.667,9) \end{bmatrix}$$

Matrix 1: Aggregated fuzzy decision matrix for alternative

$$\overline{W} = \begin{bmatrix} (3,6.333,9) & (3,6.333,9) & (3,5.667,9) & (1,5.667,9) \end{bmatrix}$$

Matrix 2: Aggregated fuzzy decision matrix for weightage

As for this study, we use benefit criteria. Therefore, from equation (4) we obtained the normalized aggregated fuzzy decision matrix for alternative and weighted normalized fuzzy decision matrix as shown in table 6.

Table 6: Normalized Fuzzy Decision Matrix for Alternative

Criteria	C_1	C_2	C_3	C_4
A_1	$\left(\frac{5}{9},\frac{8.333}{9},\frac{9}{9}\right)$	$\left(\frac{5}{9},\frac{7.667}{9},\frac{9}{9}\right)$	$\left(\frac{3}{9},\frac{7.667}{9},\frac{9}{9}\right)$	$\left(\frac{5}{9},\frac{7}{9},\frac{9}{9}\right)$
A_2	$\left(\frac{5}{9},\frac{7.667}{9},\frac{9}{9}\right)$	$\left(\frac{1}{9},\frac{4.333}{9},\frac{9}{9}\right)$	$\left(\frac{1}{9},\frac{4.333}{9},\frac{9}{9}\right)$	$\left(\frac{1}{9},\frac{4.333}{9},\frac{9}{9}\right)$

A_3	$\left(\frac{3}{9},\frac{5.667}{9},\frac{9}{9}\right)$	$\left(\frac{5}{9},\frac{8.333}{9},\frac{9}{9}\right)$	$\left(\frac{3}{9},\frac{5.667}{9},\frac{9}{9}\right)$	$\left(\frac{1}{9},\frac{3.667}{9},\frac{9}{9}\right)$

Therefore, the normalized aggregated fuzzy decision matrix for alternative is given by

$$\overline{D}=\begin{bmatrix}(0.556,0.926,1) & (0.556,0.852,1) & (0.333,0.852,1) & (0.556,0.778,1)\\ (0.556,0.852,1) & (0.111,0.481,1) & (0.111,0.481,1) & (0.111,0.481,1)\\ (0.333,0.630,1) & (0.556,0.926,1) & (0.333,0.630,1) & (0.111,0.407,1)\end{bmatrix}$$

From equation (6), the weighted normalized fuzzy decision matrix is formed as

$$\overline{D}=\begin{bmatrix}(1.668,5.864,9) & (1.668,5.396,9) & (0.999,4.828,9) & (0.556,4.409,9)\\ (1.668,5.396,9) & (0.333,2.726,9) & (0.333,2.726,9) & (0.111,2.726,9)\\ (0.999,3.990,9) & (1.668,5.864,9) & (0.999,3.570,9) & (0.111,2.306,9)\end{bmatrix}$$

Next, from equation (7) and (8), select the maximum value from each column as A^+ and the minimum value as A^-.

Table 7: Maximum Value and Minimum Value for Each Column

	C_1	C_2	C_3	C_4
A_1	$(1.668,5.864,9)$	$(1.668,5.396,9)$	$(0.999,4.828,9)$	$(0.556,4.409,9)$
A_2	$(1.668,5.396,9)$	$(0.333,2.726,9)$	$(0.333,2.726,9)$	$(0.111,2.306,9)$
A_3	$(0.999,3.990,9)$	$(1.668,5.864,9)$	$(0.999,3.570,9)$	$(0.111,2.306,9)$
A^+	$(9,9,9)$	$(9,9,9)$	$(9,9,9)$	$(9,9,9)$
A^-	$(0.999,0.999,0.999)$	$(0.333,0.333,0.333)$	$(0.333,0.333,0.333)$	$(0.111,0.111,0.111)$

Therefore from equation (9), the distance from FPIS and FNIS for Alternative 1, A_1

$$C_1A_1^+=\sqrt{\frac{1}{3}\left[(1.668-9)^2+(5.864-9)^2+(9-9)^2\right]}=4.604$$

$$C_2A_1^+=\sqrt{\frac{1}{3}\left[(1.668-9)^2+(5.396-9)^2+(9-9)^2\right]}=4.717$$

$$C_3A_1^+=\sqrt{\frac{1}{3}\left[(0.999-9)^2+(4.828-9)^2+(9-9)^2\right]}=5.210$$

$$C_4A_1^+=\sqrt{\frac{1}{3}\left[(0.556-9)^2+(4.409-9)^2+(9-9)^2\right]}=5.549$$

$$C_1A_1^-=\sqrt{\frac{1}{3}\left[(1.668-0.999)^2+(5.864-0.999)^2+(9-0.999)^2\right]}=5.420$$

$$C_2A_1^-=\sqrt{\frac{1}{3}\left[(1.668-0.333)^2+(5.864-0.333)^2+(9-0.333)^2\right]}=5.846$$

$$C_3A_1^-=\sqrt{\frac{1}{3}\left[(0.999-0.333)^2+(4.828-0.333)^2+(9-0.333)^2\right]}=5.650$$

$$C_4A_1^- = \sqrt{\frac{1}{3}\left[(0.556-0.111)^2+(4.409-0.111)^2+(9-0.111)^2\right]} = 5.706$$

The same method is used for the rest of the alternatives.

The value of the distance for each criteria and alternatives from Fuzzy Positive Ideal Solution (FPIS) and Fuzzy Negative Ideal Solution (FNIS) given as in Table 8 and Table 9

Table 8: The Distance from Fuzzy Positive Ideal Solution (FPIS)

	C_1	C_2	C_3	C_4
A_1	4.604	4.717	5.210	5.549
A_2	4.717	6.177	6.177	6.282
A_3	5.450	4.604	5.583	6.425

Table 9: The Distance from Fuzzy Negative Ideal Solution (FNIS)

	C_1	C_2	C_3	C_4
A_1	5.420	5.846	5.650	5.706
A_2	5.285	5.191	5.191	5.350
A_3	4.932	5.986	5.355	5.286

From equation (10) and (11), the distance of each weighted alternative was obtained.Then, by using equation (12), the closeness coefficient, CC_i of each alternative

Table 10: The Distance and Closeness Coefficient of Each Weighted Alternative

	d_i^+	d_i^-	CC_i
A_1	20.080	22.622	0.530
A_2	23.353	21.017	0.474
A_3	22.062	21.559	0.494

From the above result, it is shown that the greater closeness coefficient value will higher the ranking order and have better performance of the alternative. Hence, from the closeness coefficient value $A_1 > A_3 > A_2$, therefore A_1 is the best choice according to the given criteria.

5 Result and Discussion

Referring to the implementation above, we have described the application of fuzzy TOPSIS for a scenario where there are three decision-maker and evaluation criteria: C_1 (efficiency), C_2 (privacy), C_3 (responsiveness) and C_4 (reliability) based on three alternatives: A_1 (Traveloka), A_2 (SkyScanner) and A_3 (Expedia).

Our findings showed that CC_i's closeness of the A_1, A_2 and A_3 values were respectively 0.530, 0.474 and 0.494. The application of the fuzzy TOPSIS was concluded by order of ranking $A_1 > A_3 > A_2$. Therefore, it is clearly demonstrated that travel website A_1, Traveloka has the highest level of service by using the Fuzzy TOPSIS system. Compared to Skyscanner and Expedia, Traveloka met performance, confidentiality, responsibility and reliability standards.

This approach is aimed at finding the most successful website for travelling. Furthermore, this approachable to assist the users to make the right choice of alternative based on the ranking of travel websites that have been evaluated. This means that they do not have to look for other website options because we have already proven which alternative has the best criteria based on our evaluation criteria.

Fuzzy TOPSIS is the preferred solution in order to solve the proposed service quality problem if it provides imprecise or unclear performance ratings. This technique offers an approach that consistently eliminates the number of options and improves decision-making. The constraint on this system approach is, in order to measure the importance and trending of all the criteria, the decision-maker must have experience with all these alternatives. If the decision-maker does not have experience with one of the alternatives, the overall evaluation of this framework approach would be inaccurate.

6 Conclusion

As technology advancement continues to grow quickly, website reservations for travellers have rapidly increased. By means, the quality of the website must be maintained in order to have good customer relationships securely on the internet. By establishing an efficient and effective model for evaluating the quality of the travel website, the criteria can be recognized and the relative quality of the criteria can be found. This is why our proposed model was used to analyse these criteria. The use of this model approach will provide travel management with guidance to ensure that the service standard is adequate to meet customer expectations.

In this paper, we are using fuzzy TOPSIS approach to evaluate the travel website quality. Our proposed model consists of four main criteria and three alternatives. Fuzzy TOPSIS is a straightforward, effective and proven approach for decision-making with multiple criteria. Decision-makers evaluated the questionnaire on travel website quality according to the criteria. In the next step, the questionnaire answers were combined to produce an overall performance rating of quality with fuzzy TOPSIS. The highest score alternative is chosen to be the best travel website option.

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