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Recommendation of Yogyakarta tourism based on simple additive weighting under fuzziness

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ABSTRACT

Tourists who do not understand the situation or the desired tourist attraction can choose tour and travel services. Tour and travel provide a choice of tour packages with various variations. Determining the right tour and travel package and agency can benefit tourists, both in terms of financial and vacation quality. The data used in this study were obtained from several Tour and Travel agents. There are several variables used, namely the price of the package, the number of participants, and the number of facilities obtained. The method used in this study combines the Triangular Fuzzy Number (TFN) and the Simple Additive Weighting (SAW) method. The purpose of this study is to help tourists determine the most profitable or best packages. The results of this study obtained the best 2 packages recommended for tourists to choose. In the SAW calculation, it can be seen that packages that have a preference value above 0.7 are highly recommended to be selected. Meanwhile, preference values above 0.6 to 0.7 are still considered to be selected, because they have an advantage in one of the criteria. For preference values below 0.6, it is not recommended to choose because the package is too expensive and not worth what you get.

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1. INTRODUCTION

Tourism is an important economic sector to support the progress of a country [1]. Both local and foreign tourists are business opportunities for several companies engaged in the tourism sector. So that a tour and travel agency emerged whose function was to assist tourists in accommodation, transportation, and famous tourist objects in certain areas [1]–[3]. It also [4] helps tourists identify popular tourist objects, especially in the Province of Yogyakarta Special Region.

The method used is Simple Additive Weighting (SAW) with fuzzy additions to help solve uncertain problems. The basic concept of the SAW method is to find the weighted sum of the performance ratings for each alternative in all attributes [5]–[7]. The advantage of the SAW method is to make a more precise assessment because it is based on predetermined criteria and weight values [8]–[11].

In [12], [13] use AHP and SAW methods. In [14]–[17], use the TOPSIS and SAW methods. In [18], [19] uses the SAW method to build a decision support system for selecting Banjar restaurants in Banjarmasin city. Based on several previous studies, it can be seen that the SAW method can be used to assist in decision-making. So that the Fuzzy SAW method can also be used to help make decisions on Tour and Travel problems.

2. METHOD

The method used to solve the problem of determining tourism is SAW using the TFN. The selected input variables are price, the number of participants, and the number of facilities available. The data is obtained from several tour and travel websites in Yogyakarta Special Region Province.

2.1 Triangular Fuzzy Number (TFN)

TFN denotes the relative strength of each feature pair in the same hierarchy and can be indicated as $M = (l, m, u)$, where $l \leq m \leq u$. The membership function of the TFN can be defined as follows.

$$\mu_M(x) = \begin{cases} 0. \;\; x < l \; atau \; x > u \\ \dfrac{x-l}{m-l}, \;\; l \leq x \leq m \\ \dfrac{u-x}{u-m}, \;\; m \leq x \leq u \end{cases}$$

2.2 Fuzzy Simple Additive Weighting (FSAW)

FSAW is a method that is often used to solve problems in spatial decision analysis [20], [21]. This method requires the process of normalizing the decision matrix (X) to a scale that can be compared with all existing alternative ratings [22]. The Fuzzy SAW method is divided into 2 criteria, namely benefit (profitable) and cost (disadvantage) [23]. The steps of the Fuzzy SAW method are as follows.

First, changing all alternatives into a TFN form or called fuzzification. Second, classifying the benefit and cost criteria to determine the normalization formula. Third, normalize using the following formula.

$$r_{ij} = \begin{cases} \dfrac{X_{ij}}{\max X_{ij}}, \;\; if \; j \; is \; benefit \; criteria \\ \dfrac{\min X_{ij}}{X_{ij}}, \;\; if \; j \; is \; cost \; criteria \end{cases}$$

where r_{ij} is the normalized performance rating of the alternatives A_i on criteria C_j with $i = 1,2, \dots, m$ and $j = 1,2, \dots, n$. Preference value for each alternative (V_i) as follows.

$$V_i = \sum_{j=1}^{n} w_j r_{ij}$$

where V_i is the preference value and w_j is the ranking weight.The value of V_i the larger one indicates that the alternative is preferred.

3. RESULT AND DISCUSSION

In making decisions about determining tour and travel, researchers use 3 criteria, namely price, number of participants (NoP), and number of facilities. In Table 1, we can see the data that will be used in this study. The tour and travel data below is obtained from several tours and travel agencies and the data below has been grouped according to the existing variables

The step that needs to be done is to change the crisp numbers into fuzzy numbers (fuzzification), with the following groupings Low (1,1,3), Medium (1,3,5), and High (3,5,5). Fuzzification results can be seen in Table 2.

The next step is to determine the benefit and cost criteria for this research. The criteria included in the benefits are the number of participants and the number of facilities, while the cost criteria are the package price. Furthermore, normalization is carried out for each alternative, according to the formula for the benefit and cost criteria. After getting a normalized performance rating, we continue to look for the preferential value. The prevalence value is obtained by multiplying the normalized performance rating of each alternative with each criterion weight. The weights for each criterion are as follows, Price (0.2072; 0.4145; 0.5181), number of participants (0.1036; 0.2072; 0.4145), and number of facilities (0.2072; 0.4145 ; 0.5181). The preference value of each alternative can be seen in Table 3.

Table 1. Data on tour and travel vacation packages.

No.	Package Name	Price	NoP	Facilities
1.	Gua Pindul1	290.000	4	7
2.	Kalibiru1	220.000	4	7
3.	Merapi Lava Tour	310.000	4	7
4.	Rafting Sungai Elo	390.000	5	6
5.	Snorkeling	240.000	4	6
6.	Sunrise	220.000	3	7
7.	Mangunan	310.000	4	6
8.	Gua Pindul2	320.000	3	8
9.	Merapi	350.000	4	8
10.	Kalibiru2	320.000	3	8
11.	Indrayanti	300.000	4	7
12.	Candi Borobudur	270.000	3	6
13.	Gua Pindul3	290.000	3	6
14.	Hutan Pinus	240.000	4	6
15.	Kalibiru3	360.000	3	6
16.	Air Terjun Sri Gethuk	220.000	5	7
17.	Umbul Ponggok	320.000	4	6
18.	Candi Prambanan	230.000	4	6
19.	Indrayanti	270.000	3	6
20.	Rafting Sungai Elo	425.000	5	6
21.	Keraton Jogja	225.000	3	5
22.	Dieng Wonosobo	350.000	3	6
23	Keraton Solo	215.000	3	5

Table 2. Triangular Fuzzy Number from Data

No.	Package Name	Price	NoP	Facilities
1.	Gua Pindul1	(3,5,5)	(1,3,5)	(3,5,5)
2.	Kalibiru1	(1,3,5)	(1,3,5)	(3,5,5)
3.	Merapi Lava Tour	(3,5,5)	(1,3,5)	(3,5,5)
4.	Rafting Sungai Elo	(3,5,5)	(3,5,5)	(1,3,5)
5.	Snorkeling	(1,3,5)	(1,3,5)	(1,3,5)
6.	Sunrise	(1,3,5)	(1,1,3)	(3,5,5)
7.	Mangunan	(3,5,5)	(1,3,5)	(1,3,5)
8.	Gua Pindul2	(3,5,5)	(1,1,3)	(3,5,5)
9.	Merapi	(3,5,5)	(1,3,5)	(3,5,5)
10.	Kalibiru2	(3,5,5)	(1,1,3)	(3,5,5)
11.	Indrayanti	(3,5,5)	(1,3,5)	(3,5,5)
12.	Candi Borobudur	(1,3,5)	(1,1,3)	(1,3,5)
13.	Gua Pindul3	(3,5,5)	(1,1,3)	(1,3,5)
14.	Hutan Pinus	(1,3,5)	(1,3,5)	(1,3,5)
15.	Kalibiru3	(3,5,5)	(1,1,3)	(1,3,5)
16.	Air Terjun Sri Gethuk	(1,3,5)	(3,5,5)	(3,5,5)
17.	Umbul Ponggok	(3,5,5)	(1,3,5)	(1,3,5)
18.	Candi Prambanan	(1,3,5)	(1,3,5)	(1,3,5)
19.	Indrayanti	(1,3,5)	(1,1,3)	(1,3,5)
20.	Rafting Sungai Elo	(3,5,5)	(3,5,5)	(1,3,5)
21.	Keraton Jogja	(1,3,5)	(1,1,3)	(1,3,5)
22.	Dieng Wonosobo	(3,5,5)	(1,1,3)	(1,3,5)
23	Keraton Solo	(1,3,5)	(1,1,3)	(1,3,5)

Table 3. Preference value of fuzzy SAW

No.	Package Name	Preference Value
1.	Gua Pindul1	0,6372
2.	Kalibiru1	0,7708
3.	Merapi Lava Tour	0,6372
4.	Rafting Sungai Elo	0,5957
5.	Snorkeling	0,6879
6.	Sunrise	0,6879
7.	Mangunan	0,5543
8.	Gua Pindul2	0,5543
9.	Merapi	0,6372
10.	Kalibiru2	0,5543
11.	Indrayanti	0,6372
12.	Candi Borobudur	0,605
13.	Gua Pindul3	0,4714
14.	Hutan Pinus	0,6879
15.	Kalibiru3	0,4714
16.	Air Terjun Sri Gethuk	0,8123
17.	Umbul Ponggok	0,5543
18.	Candi Prambanan	0,6879
19.	Indrayanti	0,605
20.	Rafting Sungai Elo	0,5957
21.	Keraton Jogja	0,605
22.	Dieng Wonosobo	0,4714
23	Keraton Solo	0,605

From Table 3, it can be seen that the package with the highest preference value shows the best package for tourists to choose from. The Sri Gethuk Waterfall Package has the highest value because, with a cheap package price, it gets quite a lot of facilities and the largest number of participants, namely 5. Furthermore, several packages have low preference values, namely the Kalibiru3 Package, the Pindul3 Cave Package, and the Dieng Wonosobo Package. The three packages have relatively expensive prices for the number of participants as many as 3 people and fewer facilities too.

4. CONCLUSION

The Fuzzy SAW method can help tourists choose the best Tour and Travel package based on the three available criteria. From the SAW calculation, it can be seen that packages that have a preference value above 0.7 are highly recommended to be selected. Meanwhile, preference values above 0.6 to 0.7 are still considered to be selected, because they have an advantage in one of the criteria. For preference values below 0.6 it is not recommended to choose because the package is too expensive and not worth what you get.

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