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Decision support system in choosing tour packages and travel reservations using simple additive weight (SAW) method on Berkat Hemat Wisata

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ABSTRACT
Travel activities' growth as an effort to seek balance, harmony, and happiness with the environment has intensified competition in the tourism industry. Therefore, this study employs the Simple Additive Weighting (SAW) method to aid in selecting travel packages and reservations. This method enables the assessment of alternative performances based on specified criteria such as hotel class, package price, number of tours, and tour duration. The SAW process involves normalizing decision matrices and summing matrix multiplications with a weight vector, resulting in alternative rankings from the largest to the smallest. The case study demonstrates that the selection of travel packages is conducted by assigning weights to each criterion, such as hotel class, package price, number of tours, and tour duration. The final results reveal alternative rankings, facilitating decision-makers in choosing travel packages that align with their preferences. By utilizing the SAW method, this decision support system streamlines the assessment and selection of travel packages, enhancing service quality and consumer satisfaction in the tourism industry.

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INTRODUCTION

Traveling is often done by people to places that have never been visited or also those that have been visited before. Traveling from one place to another is done to relieve fatigue or relieve stress obtained at work or in the environment. There are also people traveling to other places for fun. To travel to other places can be done individually or in groups. Tourism activities are activities that involve people who travel. Travel from one place to another, is temporary, carried out by individuals or groups, as an effort to find balance or harmony and happiness with the environment in social, cultural, natural and scientific dimensions. In doing a tourist trip, you need a travel agency that helps provide information about various tourist attractions, plan and organize tourist trips, and serve the sale of various other tour package products. Competition between travel agencies is already a matter of course. One way to attract the

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attention of consumers is to improve service through the delivery of information quickly and accurately. As well as travel agencies Berkat Hemat Wisata that offer and convey information about tour package products to consumers. The diverse desires of consumers with limited budget availability often make it difficult for companies to provide information about alternative tour package products that suit their wishes.

METHOD

The method used in making decisions on the selection of tour packages and travel reservations is using the Simple Additive Weight (SAW) method. This method was chosen because it was able to choose the best alternative from a number of alternatives, in this case the alternative in question was the selection of tour packages and reservations based on predetermined criteria. The results of the process of implementing the SAW method can sort alternatives from the largest value to the smallest value.

The Simple Additive Weighting (SAW) method is often also known as the weighted addition method. The basic concept of the SAW method is to find the weighted sum of performance ratings on each alternative on all attributes (Fishburn, 1967) (MacCrimmon, 1968). The SAW method requires normalizing the decision matrix (X) to a scale comparable to all available alternative ratings. This method is the most famous and most widely used method in dealing with Multiple Attribute Decision Making (MADM) situations. MADM itself is a method used to find optimal alternatives from a number of alternatives with certain criteria. This SAW method requires decision makers to determine the weight for each attribute. The total score for an alternative is obtained by summing all the multiplication results between the rating (which can be compared across attributes) and the weight of each attribute. The rating of each attribute must be dimension-free in the sense that it has passed the previous matrix normalization process. SAW Completion Steps as follows:

1. Determine the criteria that will be used as a reference in decision making, namely Ci.
2. Determine the match rating of each alternative on each criterion.
3. Make a decision matrix based on criteria (Ci), then normalize the matrix based on equations that are adjusted to the type of attribute (profit attribute or cost attribute) so that a normalized matrix is obtained.
4. The final result is obtained from the ranking process, namely the sum of the multiplication of the normalized matrix R with a weight vector so that the largest value is obtained which is chosen as the best alternative (Ai) as a solution.

The formula for normalization is:

$$rij \begin{cases} \frac{x_{ij}}{maxXij} jika\ j\ adalah\ atribut\ keuntungan\ (benefit) \\ \frac{mijXij}{xij} \quad jika\ j\ adalah\ benefit\ biaya\ (cost) \end{cases} \text{.....(1.1)}$$

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Where :
rij = normalized performance rating
Maxij = maximum value of each row and column
Minij = minimum value of each row and column
Xij = row and column of the matrix Where rij is the normalized performance rating of the alternative Ai on the Cj attribute; i = 1.2,... m and j = 1.2,...,n.

The preference value for each alternative (Vi) is given as:

$$vi = \sum_{j=1}^{n} Wj\ rij \quad \text{.....(1.2)}$$

Where :
Vi = Final value of alternative
wj = Predetermined weight
rij = Matrix normalization A larger Vi value indicates that the alternative

Ai is preferred The Assessment Criteria used in this study are:
1. Hotel Class
2. Package Price
3. Number of Tours
4. Tour Duration

RESULTS AND DISCUSSION

Simple Additive Weighting (SAW)

Method In Choosing Tour Packages and Travel Reservations using the Simple Additive Weighting method, criteria and weights are needed to do the calculation so that the best alternative will be obtained.

Criteria and Weights

In the Simple Additive Weighting method, there are criteria needed to determine Tour Packages and Travel Reservations. The criteria are as follows:

Table 1 Criteria

Criterion	Information
C1	Hotel Class
C2	Package Price
C3	Number of Tours
C4	Tour Duration

From each of these criteria, weights will be determined. The weight consists of four Simple Additive Weighting numbers, Namely Less (NL), Sufficient (S), Good (G), Very Good

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(VG) From the information mentioned the Simple Additive Weighting numbers can be converted into certain weights which will later be used to calculate each criterion. For clarity the weight data is formed in the table:

Table 2 : Decision matrix

Fuzzy Simple Numbers Additive Weighting System	Value
Namely Less (K)	0.25
Sufficient (C)	0.5
Good (B)	0.75
Very Good (SB)	1

Case Examples For Three Tour Packages And Travel Reservations Of the many Tour Packages and Travel Reservations that were assessed, three Tour Packages and Travel Reservations were taken as examples for the application of the Simple Additive Weighting method in determining Tour Packages and Travel Reservations. The data from each Tour Package and Travel Reservation are entered into Table

Table 3 Tour Package Data assessed

No Sort	Participant Name	Value			
		C1	C2	C3	C4
10001	Package-1	3	1650000	5	7
10002	Package-2	3	3200000	2	5
10003	Package-3	2	2700000	4	3

Calculation of Tour Package Assessment and Travel Reservation

Based on the assessment steps to determine the results of the assessment using the Simple Additive Weighting method, what must be done is: Provide the value of each alternative (Ai) on each criterion (Cj) that has been determined. Hotel Class The Hotel Class variable consists of four Simple Additive Weighting numbers, Namely Less (K), Sufficient (C), Good (B), Very Good (SB) as shown in Figure 4.1.

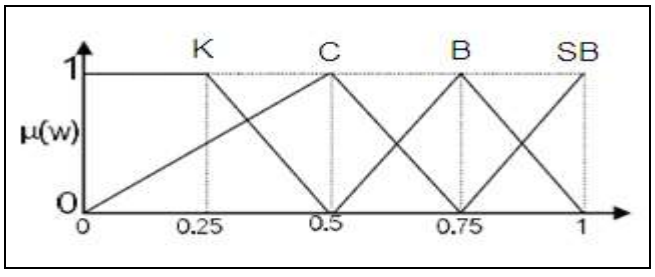

Figure 1 Simple Additive Weighting Number for C1

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Description K : Less, C : Sufficient, B : Good, SB : Very good From the picture above, Simple Additive Weighting numbers can be converted to crisp numbers. For clarity, Hotel Class data is formed in table 4.4.

Hotel Class (C1)	Fuzzy Simple Additive Weighting Number	Value
C1 <= 1	Namely Less(K)	0.25
C1= 2	Sufficient (C)	0.5
C1= 3	Good (B)	0.75
C1>= 4	Very Good (SB)	1

Package Price The variable C2 consists of four Simple Additive Weighting numbers, namely Less (K), Sufficient (C), Good (B), Very Good (SB) as shown in Figure 2.

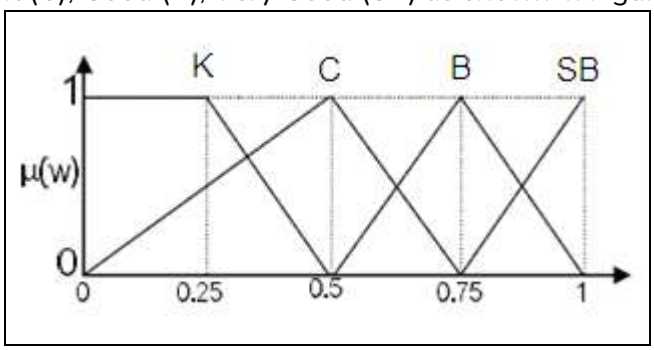

Figure 2 Simple Additive Weighting Number for C2

Description

K : Less C : Sufficient B : Good SB : Excellent

From the picture above, Simple Additive Weighting numbers can be converted to crisp numbers. For clarity TT data is formed in table 4.5.

Table 5 Package Prices

Package Price (C2)	Simple Additive Weighting Number	Nilai
C2 .>= 4000000	Namely Less (K)	0.25
C2 = 3000000	Sufficient (C)	0.5
C2 = 2000000	Good (B)	0.75
C2 < 2000000	Very Good (SB)	1

The Number of Tours

Variable consists of four Simple Additive Weighting numbers, namely Less (K), Sufficient (C), Good (B), Very Good (SB) as shown in Figure 4.3.

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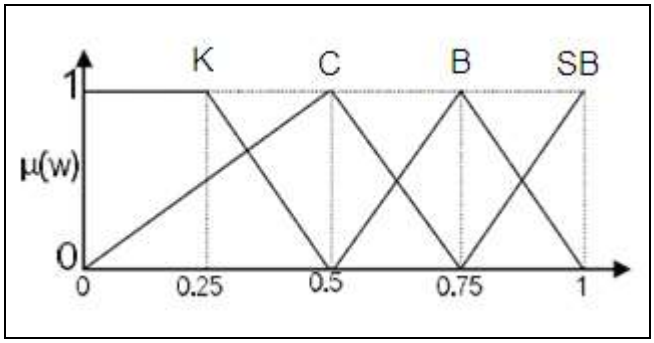

Figure 3 Simple Additive Weighting Number for C3.

Description

K : Less, C : Enough, B : Good, SB : Very good

From the picture above, Simple Additive Weighting numbers can be converted to crisp numbers. For more clarity the value data is formed in table 4.6.

Table 6 Number of Tours

Number of Tours (C3)	Simple Additive Weighting Number	Value
C2 <= 3	Namely Less (K)	0.25
C2 = 4	Enough (C)	0.5
C2 = 5	Good (B)	0.75
C2 >= 6	Very Good (SB)	1

Travel Duration

The Tour Duration variable consists of four Simple Additive Weighting numbers, namely Less (K), Sufficient (C), Good (B), Very Good (SB) as shown in the Figure.

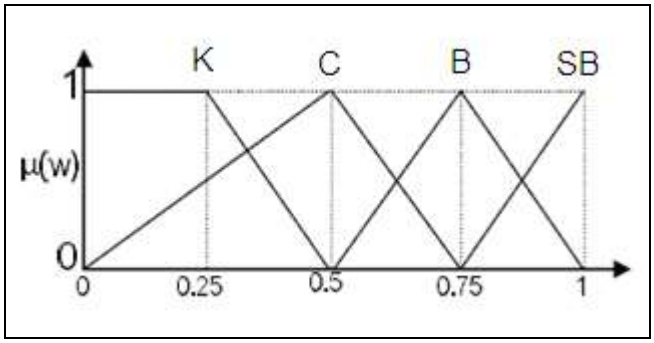

Figure 4: Simple Additive Weighting for Travel Duration

Description

K : Less C : Enough B : Good SB : Very good

From the picture Simple Additive Weighting numbers can be converted to crisp numbers. For more clarity, Travel Time data is formed in the table.

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Table 7 Duration of Tourism

Duration of Tourism (C4)	Simple Additive Weighting Number	Value
C2 <= 3	Less (K)	0.25
C2 = 4	Enough (C)	0.5
C2 = 5	Good (B)	0.75
C2 > 5	Very Good (SB)	1

To be clearer, for example, the first package from the table above is the 1st Package = A1, the 2nd Package = A2 and the 3rd Package = A3. The table below shows the match rating of each alternative on each criterion.

Table 8. The match rating of each alternative on each criterion.

Alternative	Criterion			
	C1	C2	C3	C4
A1	0.25	0.25	0.25	0.25
A2	0.75	0.5	1	1
A3	1	0.25	0.5	0.5

From Table 8 converted into decision matrix X with data:

$$X = \begin{bmatrix} 0{,}25 & 0{,}25 & 0{,}25 & 0{,}25 \\ 0{,}75 & 0{,}5 & 1 & 1 \\ 1 & 0{,}25 & 0{,}5 & 0{,}5 \end{bmatrix}$$

Normalizes matrix X to matrix R based on the following equation.
Rij = (Xij / max{Xij}) If j is the benefit attribute Rij = (min{Xij} / Xij) If j is the cost attribute
Remarks :
rij = normalized performance rating value
xij = attribute value owned from each criterion
Max xij = largest value of each criterion i
Min xij = smallest value of each criterion i
benefit = if the largest value is best
cost = if the smallest value is best

For Hotel Class. So:

$$r11 = \frac{0.25}{Max\{0.25 : 0{,}5 : 0.75 : 1\}} = \frac{0.25}{1} = 0.25$$

$$r21 = \frac{0.75}{Max\{0.25 : 0.5 : 0.75 : 1\}} = \frac{0.75}{1} = 0.75$$

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$$r31 = \frac{1}{Max\{0.25 : 0.5 : 0.75 : 1\}} = \frac{1}{1} = 1$$

For the amount of Package Price. So:

$$r12 = \frac{0.25}{Max\{0.25 : 0.5 : 0.75 : 1\}} = \frac{0.25}{1} = 0.25$$

$$r22 = \frac{0.5}{Max\{0.25 : 0.5 : 0.75 : 1\}} = \frac{0.5}{1} = 0.5$$

$$r32 = \frac{0.25}{Max\{0.25 : 0.5 : 0.75 : 1\}} = \frac{0.25}{1} = 0.25$$

For the number of finished tours:

$$r13 = \frac{0.25}{Max\{0.25 : 0.5 : 0.75 : 1\}} = \frac{0.25}{1} = 0.25$$

$$r23 = \frac{1}{Max\{0.25 : 0.5 : 0.75 : 1\}} = \frac{1}{1} = 1$$

$$r33 = \frac{0.5}{Max\{0.25 : 0.5 : 0.75 : 1\}} = \frac{0.5}{1} = 0.5$$

For the duration of the tour so:

$$r14 = \frac{0.25}{Max\{0.25 : 0.5 : 0.75 : 1\}} = \frac{0.25}{1} = 0.25$$

$$r24 = \frac{1}{Max\{0.25 : 0.5 : 0.75 : 1\}} = \frac{1}{1} = 1$$

$$r34 = \frac{0.5}{Max\{0.25 : 0.5 : 0.75 : 1\}} = \frac{0.5}{1} = 0.5$$

Matriks R :

$$\boldsymbol{R} = \begin{bmatrix} 0.25 & 0.25 & 0.25 & 0.25 \\ 0.75 & 0.5 & 1 & 1 \\ 1 & 0.25 & 0.5 & 0.5 \end{bmatrix}$$

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Perform the ranking process using the Fuzzy Simple Additive Weighting System method.

$$Vi = \sum_{j=1}^{n} Wj\ rij$$

Remarks :
Vi = rank for each alternative
wj = weighted value of each criterion
rij = normalized performance rating value A larger Vi value indicates that alternative A i is preferred. Gives the weight value (W).
To determine the weight of the Package Assessment is formed in table 9 below.

Table 9 Weights for Package Assessment

Code	Criterion	Weight
C1	Hotel Class	0.30
C2	Package Price	0.40
C3	Number of Tours	0.10
C4	Tour Duration	0.20

The greatest value is in V2 so alternative A2 (Package 2) is the alternative chosen as the best alternative. For more details see Table 4.10:

Table 10 Process Results

No	Name	Value				Final Results
		C1	C2	C3	C4	
1	A1	0,25	1	0,125	0,075	0,650
2	A2	0,75	0,40	0,5	0,3	1,950
3	A3	1	0,20	0,25	0,15	1,60

To get the best value, it starts from the largest value, so that the ranking results look like table 11 below:

Table 11 Selection Results

No	Nama	Nilai				Hasil Akhir	Keterangan
		C1	C2	C3	C4		
1.	Paket 2	0,30	0,40	0,08	0,17	0,95	Rangking-1
2.	Paket 3	0.25	0,30	0,07	0,18	0,80	Rangking-2
3.	Paket 1	0,25	0,30	0,125	0,075	0,65	Rangking-3

CONCLUSION

The decision support system for choosing tour packages using the Simple Additive Weight method allows voters to choose the best tour package. Simple Additive Weighting is able to display weighting results and calculations based on criteria easily and efficiently.

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