



# Modeling the Ranking of Tourist Destinations in West Kalimantan Using the Fuzzy Analytical Hierarchy Process (FAHP) Approach

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**Abstract:** The selection of tourist destinations in West Kalimantan that meet tourist's needs is a challenge for tourists, due to lack of information and involves various criteria that are subjective and uncertain. An analytical method is needed to evaluate and rank tourist destinations in West Kalimantan. This research aims to rank tourist destinations in West Kalimantan so that it can become an information tool for tourists. The Fuzzy Analytical Hierarchy Process (FAHP) is a multi-criteria decision-making method that combines the Analytical Hierarchy Process (AHP) with fuzzy logic concepts to overcome uncertainty and improve assessment accuracy. The FAHP is used in ranking cascade tourist destinations by determine the criteria (C) used in choosing tourist destinations, namely natural beauty, uniqueness of natural resources, accessibility, supporting facilities, safety and comfort, potential activities, popularity and reputation, and affordability. Furthermore, the research questionnaire was prepared based on the criteria. From the results of distributing research questionnaires, it can be determined that cascade tourism destinations are used as alternatives (A), namely Riam Jugan, Pangar, Ampakng, Mangoi, Batu Susun, Marum, Berawat'n, Parangek, Merasap, and Eria. Next, the calculation of the weight for each criterion (W) is carried out. After that, the weight matrix of each cascade tour is calculated against each criterion (X) and the preference value (Y) for each cascade tourist destination. The result of applying the FAHP method is the ranking of cascade tourist destinations based on the order of preference value (Y) from higher to lower.

**Keywords:** Cascade tourism, Decision making, Fuzzy logic, Multi criteria

## Introduction

West Kalimantan is one of Indonesia's provinces rich in natural beauty and cultural uniqueness, with great potential for developing the tourism industry. With its vast area consisting of tropical rainforests, mountains, rivers, and the cultural diversity of the Dayak tribes, West Kalimantan offers a variety of attractive tourist destinations.

However, choosing tourist destinations that suit the needs of tourists remain a challenge due to the lack of exploration and limited information about tourist destinations in West Kalimantan. Criteria such as the diversity of tourist preferences, accessibility, cost, and other criteria can influence the selection of tourist destinations. Therefore, a systematic and structured approach is needed in evaluating and ranking tourist destinations in West Kalimantan. Thus, the results of the evaluation and ranking of tourist destinations in West Kalimantan can serve as a source of information for tourists in selecting tourist destinations based on these criteria.

In this context, the use of the Fuzzy Analytical Hierarchy Process (FAHP) approach offers a potential solution. FAHP is a ranking method developed from the Analytical Hierarchy Process (AHP) method with a fuzzy set concept approach (Firouz & Ghadimi, 2016; Harahap et al., 2022; Santoso et al., 2016). FAHP can be used in multi-criteria

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decision making (MCDM) using weight calculations with pairwise comparisons (Ashtiani & Azgomi, 2016; Lee & Seo, 2016; Mahasastrawan et al., 2022; Nagpal et al., 2015). FAHP is designed to address the weaknesses of AHP, namely in problems where there are subjective criteria that are compared more than once and have the same value, thus requiring a fuzzy set approach (Abdullah & Zulkifli, 2015; (Akkaya et al., 2015; Harahap et al., 2022; Lubis & Husein, 2023). In FAHP, the fuzzification process involves the use of triangular fuzzy number (TFN) membership functions, which are a form of fuzzy calculation with three points forming a triangle in the criteria weighting process (Aflahin et al., 2023; Ariyati et al., 2024; Ayca & Karal, 2017; Azarnivand et al., 2015; Pamungkas et al., 2020). The advantage of FAHP lies in its higher weighting accuracy and final result precision, which exceeds the results obtained from calculations without using the fuzzy approach (Aflahin et al., 2023; Akkaya et al., 2015; Ayca & Karal, 2017; Fedrizzi & Krejčí, 2015).

In previous research, such as those conducted by Aflahin, Fathoni, and Cindrabumi in 2023, the FAHP method was successfully applied to determine the priority of students receiving PIP (Program Indonesia Pintar) scholarships at Madrasah Ibtidaiyah (MI) Salafiyah Prambontergayang. The results of the study show that FAHP can be used in decision-making processes involving many subjective criteria, such as family economic conditions, average family income, and number of family dependents. In addition, the results of the study show that FAHP can be used to determine the priority of the three criteria by determine the weight of each criterion. Furthermore, the weighting of the three criteria resulted in a final alternative, namely MI Salafiyah Prambontergayang students who applied for the PIP scholarship and were declared eligible as PIP scholarship recipients based on the final weighting of each alternative using the three criteria after ranking. The use of FAHP aims to change the decision-making process, which was initially subjective for each student, to be more objective and accurate, as well as to give weight to each of the criteria set. Based on the results of using FAHP, it can also be seen which alternatives are eligible to receive PIP scholarships and which are not. The students selected through FAHP are the same as those determined by the teachers or operators at MI Salafiyah Prambontergayang. The test results prove that the FAHP method has a level of criterion importance so that the weight values of the alternatives produced are more detailed, and the accuracy of the final results exceeds the results obtained without FAHP. Thus, the FAHP method can be applied by teachers or operators to facilitate the selection process for PIP scholarships at MI Salafiyah Prambontergayang.

This research aims to apply the FAHP method in evaluating and ranking tourist destinations in West Kalimantan. West Kalimantan was chosen as the location for this study because it is rich in natural and cultural tourism potential that has not been fully optimized. By integrating criteria such as natural beauty, cultural uniqueness, accessibility, and affordability. It is hoped that this research can contribute to tourists in choosing tourist destinations that suit the needs of tourists in West Kalimantan.

## Method

The methodology used in writing this research began with a literature study, which involved studying literature sourced from scientific books, journal articles, and internet searches related to the issue of evaluating and ranking tourist destinations using the Fuzzy Analytical Hierarchy Process (FAHP). The supporting theories for this research include Fuzzy Logic, Fuzzy Multi Criteria Decision Making (FMCDM), and the Fuzzy Analytical Hierarchy Process (FAHP) method.

The data used in this study is secondary data, namely the assessment of the level of importance of criteria for the objectives provided by Direktorat Wisata Alam dan Pemanfaatan Jasa Lingkungan in 2003, which is contained in Pedoman Analisis Daerah Operasi Obyek Wisata dan Daya Tarik Wisata Alam (ADO-ADTWA) and primary data, namely the results of questionnaires compiled based on the criteria used in the selection of riam tourist destinations in West Kalimantan by visitors to riam tourist destinations and residents around riam tourist destinations in West Kalimantan.

In general, the following are the steps in determine the ranking of tourist destinations in West Kalimantan using FAHP (Akkaya et al., 2015; Hadi et al., 2016; Harahap et al., 2022; Prasanta et al., 2023) :

Data requirements analysis

Determine the criteria  $C_j(j = 1,2, \dots, n)$  to be used.

Determine the alternatives  $A_i(i = 1,2, \dots, m)$  to be used.

Criteria ranking with FAHP

Determine the level of importance of criteria for research objectives.

Determine pairwise comparison matrix between criteria.

Conversion of the pairwise comparison matrix (tabel 1) between criteria into a FAHP pairwise comparison matrix using TFN conversion values is denoted as  $c_{jk} = (l[c_{jk}]; m[c_{jk}]; u[c_{jk}])$  for  $k = 1,2, \dots, n$  where  $l[c_{jk}]$  is the lower bound of the fuzzy number  $c_{jk}$ ,  $m[c_{jk}]$  is the middle of the fuzzy number  $c_{jk}$ , dan  $u[c_{jk}]$  is the upper bound of the fuzzy number  $c_{jk}$ .

Table 1. Triangular Fuzzy Number conversion value

Pairwise Comparison of Matrix Between Criteria	FAHP Pairwise Comparison Matrix
1	(1; 1; 1)
2	(1/2; 1; 3/2)
3	(1; 3/2; 2)
4	(3/2; 2; 5/2)
5	(2; 5/2; 3)
6	(5/2; 3; 7/2)
7	(3; 7/2; 4)
8	(7/2; 4; 9/2)
9	(4; 9/2; 9/2)
1/1	(1; 1; 1)
1/2	(2/3; 1; 2)
1/3	(1/2; 2/3; 1)
1/4	(2/5; 1/2; 2/3)
1/5	(1/3; 2/5; 1/2)
1/6	(2/7; 1/3; 2/5)
1/7	(1/4; 2/7; 1/3)
1/8	(2/9; 1/4; 2/7)
1/9	(2/9; 2/9; 1/4)

Source: Chang, (1996), as cited in Hadi et al. (2016)

Determine the fuzzy synthetic extent value for  $j$ -th criterion,  $S_j$ , is given as (Ashtiani & Azgomi, 2016; Chang, 1996; Akkaya et al., 2015; Firouz & Ghadimi, 2016):

$$S_j = M_j \odot (M)^{-1} \approx \left( \frac{l[M_j]}{u[M]}, \frac{m[M_j]}{m[M]}, \frac{t[M_j]}{t[M]} \right) = (l[S_j]; m[S_j]; u[S_j]), \quad \text{where } j = 1,2, \dots, n \quad \dots(1)$$

where  $l[S_j]$  is the lower bound of fuzzy number  $S$ ,  $m[S_j]$  is the middle bound of fuzzy number  $S$ , and  $u[S_j]$  is the upper bound of fuzzy number  $S$ .  $M_j$  is the sum of TFN from the FAHP pairwise comparison matrix, given as (Akkaya et al., 2015):

$$M_j = (l[M_j]; m[M_j]; u[M_j]) = \left( \sum_{k=1}^n l[c_{jk}]; \sum_{k=1}^n m[c_{jk}]; \sum_{k=1}^n u[c_{jk}] \right) \dots\dots\dots(2)$$

and  $M$  is the sum of TFN from  $M_j$ , given as (Akkaya et al., 2015):

$$M = (l[M]; m[M]; u[M]) = \left( \sum_{j=1}^n l[M_j]; \sum_{j=1}^n m[M_j]; \sum_{j=1}^n u[M_j] \right) \dots\dots\dots(3)$$

Determine the degree of probability of  $S_j$  to  $S_k$ ,  $V(S_j \geq S_k)$ , for  $k = 1, 2, \dots, n$  is given as (Abdullah & Zulkifli, 2015; Chang, 1996; Akkaya et al., 2015) :

$$V(S_j \geq S_k) = \begin{cases} 1 & ; \text{ iff } m[S_j] \geq m[S_k] \\ \frac{l[S_k] - u[S_j]}{(m[S_j] - u[S_j]) - (m[S_k] - l[S_k])} & ; \text{ iff } m[S_j] < m[S_k] \end{cases} \dots\dots\dots(4)$$

where  $j = 1, 2, \dots, n$ .

Determine the minimum value of  $V(S_j \geq S_k)$  for  $j$ -th criterion,  $d_j$ , where  $j = 1, 2, \dots, n$  is given as (Chang, 1996; Akkaya et al., 2015) :

$$d_j = \min(V(S_j \geq S_k)) \text{ for } k = 1, 2, \dots, n \dots\dots\dots(5)$$

Determine the weight matrix for each criterion  $W'$ , given as (Chang, 1996; Akkaya et al., 2015) :

$$W' = \begin{bmatrix} d_1 \\ d_2 \\ \vdots \\ d_n \end{bmatrix} \dots\dots\dots(6)$$

Normalization of the weight matrix for each criterion is given as (Chang, 1996; Akkaya et al., 2015) :

$$W = \begin{bmatrix} \frac{d_1}{\sum_{j=1}^n d_j} \\ \frac{d_2}{\sum_{j=1}^n d_j} \\ \vdots \\ \frac{d_n}{\sum_{j=1}^n d_j} \end{bmatrix} = \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{bmatrix} \dots\dots\dots(7)$$

Alternative ranking with FAHP

Determine the compatibility rating matrix for each alternative  $A_i (i = 1, 2, \dots, m)$  for each criterion  $C_j (j = 1, 2, \dots, n)$ .

Determine the decision matrix  $X$  for each alternative  $A_i (i = 1, 2, \dots, m)$  for each criterion  $C_j (j = 1, 2, \dots, n)$ , the element  $x_{ij}$  can be obtained as:

$$x_{ij} = \frac{z_{ij} - z_j^{min}}{z_j^{max} - z_j^{min}} \dots\dots\dots(8)$$

where  $z_{ij}$  is the compatibility rating value for  $i$ -th alternative for each  $j$ -th criterion.  $z_j^{max}$  is the highest value of the compatibility rating for  $j$ -th criterion, given as:

$$z_j^{max} = \max(z_{1j}; z_{2j}; \dots; z_{mj}), \text{ for } j = 1, 2, \dots, n \dots\dots\dots(9)$$

$z_j^{min}$  is the lowest value of the compatibility rating for  $j$ -th criterion, given as:

$$z_j^{min} = \min(z_{1j}; z_{2j}; \dots; z_{mj}), \text{ for } j = 1, 2, \dots, n \dots\dots\dots(10)$$

Determine the preference matrix  $E$  for each alternative  $A_i (i = 1, 2, \dots, m)$  based on the ranking results for criteria  $C_j (j = 1, 2, \dots, n)$ . Suppose that the criteria  $C_j (j = 1, 2, \dots, n)$  that are ranked first are  $C_1, C_2,$  and  $C_3$ . Thus,  $E_1$ , as:

$$E_1 = \begin{bmatrix} x_{11} & x_{12} & x_{13} \\ x_{21} & x_{22} & x_{23} \\ \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & x_{m3} \end{bmatrix} \begin{bmatrix} w_1 \\ w_2 \\ w_3 \end{bmatrix} = \begin{bmatrix} e_{11} \\ e_{21} \\ \vdots \\ e_{m1} \end{bmatrix}$$

Determine the preference matrix  $Y$  for each alternative  $A_i (i = 1, 2, \dots, m)$  using all criteria  $C_j (j = 1, 2, \dots, n)$ , given as:

$$Y = WX \dots\dots\dots(11)$$

**Results and Discussion**

**Data Requirements Analysis**

In this research, the criteria used in selection cascade tourism destinations were determined by the researchers through literature studies, observation via social media, and interviews with local residents in West Kalimantan.

Table 2. Criteria for selecting cascade tourist destinations in West Kalimantan

Symbol	Criteria
$C_1$	Natural beauty
$C_2$	Uniqueness of natural resources
$C_3$	Accessibility
$C_4$	Supporting facilities
$C_5$	Safety and comfort
$C_6$	Potensi aktivitas
$C_7$	Popularity and reputation
$C_8$	Affordability

Based on table 2, it can be seen that there are eight criteria commonly used in selecting cascade tourism destinations in West Kalimantan. Furthermore, a research questionnaire can be compiled based on these criteria. From the results of the research questionnaire completed by visitors to cascade tourism destinations and residents around cascades in West Kalimantan, alternatives can be determined for use in ranking tourism destinations with FAHP.

Table 3. Alternatives in choosing tourist destinations in West Kalimantan

Symbol	Alternative
$A_1$	Riam Jugan
$A_2$	Riam Pangar
$A_3$	Riam Ampakng
$A_4$	Riam Mangoi
$A_5$	Riam Batu Susun
$A_6$	Riam Marum
$A_7$	Riam Berawat'n
$A_8$	Riam Parangek
$A_9$	Riam Merasap
$A_{10}$	Riam Eria

Based on table 3, it can be seen that there are only 10 cascade tourism destinations in West Kalimantan that are used as alternatives in this study. The next process is to determine the ranking of criteria and alternatives using FAHP weighting.

**Criteria Ranking With FAHP**

Based on table 2, the level of importance of the criteria for the objectives obtained from the assessment of Direktorat Wisata Alam dan Pemanfaatan Jasa Lingkungan contained in

Pedoman Analisis Daerah Operasi Obyek Wisata dan Daya Tarik Wisata Alam (ADO-ADTWA) can be determined

Table 4. Level of importance of criteria to research objectives

Criteria	Level of importance of criteria to objectives
$C_1$	6
$C_2$	6
$C_3$	5
$C_4$	3
$C_5$	5
$C_6$	6
$C_7$	4
$C_8$	4

Source: Direktorat Wisata Alam dan Pemanfaatan Jasa Lingkungan, (2003)

Based on table 4, it can be seen that in selection cascade tourism destinations in West Kalimantan, the criteria of natural beauty, uniqueness of natural resources, and potential activities have the highest level of importance. The next process is to determine the pairwise comparison between criteria. Based on table 4, a pairwise comparison matrix between criteria can be determined.

Table 5. Pairwise comparison matrix between criteria

Criteria	$C_1$	$C_2$	$C_3$	$C_4$	$C_5$	$C_6$	$C_7$	$C_8$
$C_1$	1	1	1	3	1	1	2	2
$C_2$	1	1	1	3	1	1	2	2
$C_3$	1/1	1/1	1	2	1	1/1	1	1
$C_4$	1/3	1/3	1/2	1	1/2	1/3	1/1	1/1
$C_5$	1/1	1/1	1	2	1	1/1	1	1
$C_6$	1	1	1	3	1	1	2	2
$C_7$	1/2	1/2	1/1	1	1/1	1/2	1	1
$C_8$	1/2	1/2	1/1	1	1/1	1/2	1	1

Based on table 5, the values of the pairwise comparison matrix between criteria can be seen, which are determined based on the level of importance of each criterion. Based on table 5, the pairwise comparison between criteria using TFN will be converted into a FAHP pairwise comparison matrix using Table 1.

Table 6. FAHP pairwise comparison matrix

Criteria	$C_1$	$C_2$	$C_3$	$C_4$	$C_5$	$C_6$	$C_7$	$C_8$
$C_1$	(1;1;1)	(1;1;1)	(1;1;1)	(1;3/2;2)	(1;1;1)	(1;1;1)	(1/2;1;3/2)	(1/2;1;3/2)
$C_2$	(1;1;1)	(1;1;1)	(1;1;1)	(1;3/2;2)	(1;1;1)	(1;1;1)	(1/2;1;3/2)	(1/2;1;3/2)
$C_3$	(1;1;1)	(1;1;1)	(1;1;1)	(1/2;1;3/2)	(1;1;1)	(1;1;1)	(1;1;1)	(1;1;1)
$C_4$	(1/2;2/3;1)	(1/2;2/3;1)	(2/3;1;2)	(1;1;1)	(2/3;1;2)	(1/2;2/3;1)	(1;1;1)	(1;1;1)
$C_5$	(1;1;1)	(1;1;1)	(1;1;1)	(1/2;1;3/2)	(1;1;1)	(1;1;1)	(1;1;1)	(1;1;1)
$C_6$	(1;1;1)	(1;1;1)	(1;1;1)	(1;3/2;2)	(1;1;1)	(1;1;1)	(1/2;1;3/2)	(1/2;1;3/2)
$C_7$	(2/3;1;2)	(2/3;1;2)	(1;1;1)	(1;1;1)	(1;1;1)	(2/3;1;2)	(1;1;1)	(1;1;1)
$C_8$	(2/3;1;2)	(2/3;1;2)	(1;1;1)	(1;1;1)	(1;1;1)	(2/3;1;2)	(1;1;1)	(1;1;1)

Based on table 6, the TFN values from the comparison matrix between criteria can be seen. Based on Table 6. the  $M_j$  and  $M$  values for  $j$ -th criterion where  $j = 1, 2, \dots, 8$  will be calculated using Equations (2) dan (3).

Table 7. Calculation of  $M_j$  and  $M$  values

Criteria	$\sum_{k=1}^8 l[c_{jk}]$	$\sum_{k=1}^8 m[c_{jk}]$	$\sum_{k=1}^8 u[c_{jk}]$
	$l[M_j]$	$m[M_j]$	$u[M_j]$
$C_1$	7,00	8,50	10,00

Criteria	$\sum_{k=1}^8 l[c_{jk}]$	$\sum_{k=1}^8 m[c_{jk}]$	$\sum_{k=1}^8 u[c_{jk}]$
	$l[M_j]$	$m[M_j]$	$u[M_j]$
$C_2$	7,00	8,50	10,00
$C_3$	7,50	8,00	8,50
$C_4$	5,83	7,00	10,00
$C_5$	7,50	8,00	8,50
$C_6$	7,00	8,50	10,00
$C_7$	7,00	8,00	11,00
$C_8$	7,00	8,00	11,00
Total ( $M$ )	55,83	64,50	79,00

Based on table 7, the fuzzy synthesis degree value for  $j$ -th criterion,  $S_j$ , where  $j = 1, 2, \dots, 8$  will be calculated using Equation (1), as:

$$S_1 \approx \left( \frac{7}{79}; \frac{8,5}{64,5}; \frac{10}{55,83} \right) \approx (0,089; 0,132; 0,179)$$

$$S_2 \approx \left( \frac{7}{79}; \frac{8,5}{64,5}; \frac{10}{55,83} \right) \approx (0,089; 0,132; 0,179)$$

$$\vdots$$

$$S_8 \approx \left( \frac{7}{79}; \frac{8}{64,5}; \frac{11}{55,83} \right) \approx (0,089; 0,124; 0,197)$$

The complete calculation results can be seen in Table 8.

Table 8. The  $S_j$  value of the criteria for selecting cascade tourism destinations in West Kalimantan

Fuzzy synthesis degree for $j$ -th criterion ( $S_j$ )	Lower of $S_j (l[S_j])$	Middle of $S_j (m[S_j])$	Upper of $S_j (u[S_j])$
$S_1$	0,089	0,132	0,179
$S_2$	0,089	0,132	0,179
$S_3$	0,095	0,124	0,152
$S_4$	0,074	0,109	0,179
$S_5$	0,095	0,124	0,152
$S_6$	0,089	0,132	0,179
$S_7$	0,089	0,124	0,197
$S_8$	0,089	0,124	0,197

Based on table 8, the probability degree  $V(S_j \geq S_k)$  for  $k = 1, 2, \dots, 8$  will be determined using Equation (4), as:

$$V(S_1 \geq S_1) = 1 \text{ because } m[S_1] = m[S_1] = 0,132$$

$$V(S_1 \geq S_2) = 1 \text{ because } m[S_1] = m[S_2] = 0,132$$

$$V(S_1 \geq S_3) = 1 \text{ because } m[S_1] = 0,132 > m[S_3] = 0,124$$

$$V(S_1 \geq S_4) = 1 \text{ because } m[S_1] = 0,132 > m[S_4] = 0,109$$

$$V(S_1 \geq S_5) = 1 \text{ because } m[S_1] = 0,132 > m[S_5] = 0,124$$

$$V(S_1 \geq S_6) = 1 \text{ because } m[S_1] = m[S_6] = 0,132$$

$$V(S_1 \geq S_7) = 1 \text{ because } m[S_1] = 0,132 > m[S_7] = 0,124$$

$$V(S_1 \geq S_8) = 1 \text{ because } m[S_1] = 0,132 > m[S_8] = 0,124$$

The complete calculation results can be seen in Table 9.

Table 9. Degree of probability of  $S_j$  to  $S_k (k = 1, 2, \dots, 8)$

	$S_1$	$S_2$	$S_3$	$S_4$	$S_5$	$S_6$	$S_7$	$S_8$
$S_1$	1	1	1	1	1	1	1	1
$S_2$	1	1	1	1	1	1	1	1
$S_3$	0,891	0,891	1	1	1	0,891	1	1

	$S_1$	$S_2$	$S_3$	$S_4$	$S_5$	$S_6$	$S_7$	$S_8$
$S_4$	0,796	0,796	0,844	1	0,844	0,796	0,854	0,854
$S_5$	0,891	0,891	1	1	1	0,891	1	1
$S_6$	1	1	1	1	1	1	1	1
$S_7$	0,933	0,933	1	1	1	0,933	1	1
$S_8$	0,933	0,933	1	1	1	0,933	1	1

Based on table 9, the minimum value of  $V(S_j \geq S_k)$  will be determined using Equation (5), as:

$$d_1 = \min(1; 1; 1; 1; 1; 1; 1; 1) = 1$$

$$d_2 = \min(1; 1; 1; 1; 1; 1; 1; 1) = 1$$

$$\vdots$$

$$d_8 = \min(0,933; 0,933; 1; 1; 1; 0,933; 1; 1) = 0,933$$

The complete calculation results can be seen in Table 10.

Table 10. Minimum value of the probability degree

$d_1$	$d_2$	$d_3$	$d_4$	$d_5$	$d_6$	$d_7$	$d_8$
1	1	0,891	0,796	0,891	1	0,933	0,933

Based on table 10, a weight matrix for each criterion can be formed using Equation (6), and then normalized using Equation (7) to obtain the results as:

$$W = \begin{bmatrix} \frac{1}{1+1+0,891+0,796+0,891+1+0,933+0,933} \\ \frac{1}{1+1+0,891+0,796+0,891+1+0,933+0,933} \\ \frac{0,891}{1+1+0,891+0,796+0,891+1+0,933+0,933} \\ \frac{0,796}{1+1+0,891+0,796+0,891+1+0,933+0,933} \\ \frac{0,891}{1+1+0,891+0,796+0,891+1+0,933+0,933} \\ \frac{1}{1+1+0,891+0,796+0,891+1+0,933+0,933} \\ \frac{0,933}{1+1+0,891+0,796+0,891+1+0,933+0,933} \\ \frac{0,933}{1+1+0,891+0,796+0,891+1+0,933+0,933} \\ \frac{1}{1+1+0,891+0,796+0,891+1+0,933+0,933} \end{bmatrix} = \begin{bmatrix} 7,445 \\ 1 \\ 0,891 \\ 0,796 \\ 0,891 \\ 7,445 \\ 0,933 \\ 0,933 \\ 7,445 \end{bmatrix} = \begin{bmatrix} 0,134 \\ 0,134 \\ 0,120 \\ 0,107 \\ 0,120 \\ 0,134 \\ 0,125 \\ 0,125 \end{bmatrix} \dots\dots\dots(12)$$

Based on the results of the weight matrix  $W$  in (12) ranking is obtained by sorting from the largest to the smallest value.

Table 11. Ranking of criteria for selection of cascade tourism destination in West Kalimantan

Rangking	Criteria	Preference Value
1	Natural beauty Uniqueness of natural resources Potential activities	0,134
2	Popularity and reputation Affordability	0,125
3	Accessibility Safety and comfort	0,120
4	Supporting facilities	0,107

Based on table 11. an be seen that together natural beauty, uniqueness of natural resources and potential activities are ranked 1 with a value of 0,134 meaning that in the selection of a cascade tourism destination in West Kalimantan, the criteria of natural beauty, uniqueness of natural resources and potential activities are more of a priority for tourists. Meanwhile, supporting facilities rank last with a value of 0,107 meaning that in the selection of cascade tourism destination in West Kalimantan, the criteria of supporting facilities are less of a priority for tourists.

Alternative Ranking With FAHP

The next step is to rank the cascade tourism destination alternatives in West Kalimantan. Based on the questionnaire results compiled based on the criteria  $C_j (j = 1, 2, \dots, 8)$  a compatibility rating matrix can be determined. Using Equations (9) and (10), the  $z_j^{max}$  and  $z_j^{min}$  values will be determined.

Table 12. Compatibility rating matrix for each alternative to the criteria

	$C_1$	$C_2$	$C_3$	$C_4$	$C_5$	$C_6$	$C_7$	$C_8$
$A_1$	68,89	54,76	84,76	67,62	73,81	54,60	73,81	78,29
$A_2$	81,48	68,33	66,67	66,67	84,44	69,63	75,56	73,56
$A_3$	81,27	59,05	70,95	47,14	73,33	64,76	72,38	65,90
$A_4$	88,33	80,00	48,75	34,17	61,25	46,67	67,50	68,00
$A_5$	76,67	81,67	55,00	30,56	56,67	43,33	68,33	66,00
$A_6$	91,85	77,78	54,44	34,07	55,56	44,44	70,00	66,67
$A_7$	87,62	82,86	54,29	44,76	68,57	61,90	72,86	71,43
$A_8$	93,33	82,00	52,00	36,67	60,00	56,00	68,00	68,00
$A_9$	79,52	72,14	62,14	50,24	67,86	53,81	63,57	69,43
$A_{10}$	86,67	75,00	75,00	48,33	75,00	56,67	80,00	76,00
$z_j^{max}$	93,33	82,86	84,76	67,62	84,44	69,63	80,00	78,29
$z_j^{min}$	68,89	54,76	48,75	30,56	55,56	43,33	63,57	65,90

Based on table 12. it can be seen that according to the results of the questionnaire filled out in West Kalimantan, the highest natural beauty ( $C_1$ ) value was Riam Parangek ( $A_8$ ) with a value of 93,33 and the lowest was Riam Jugan ( $A_1$ ) with a value of 68,89, The highest natural resource uniqueness ( $C_2$ ) value was Riam Berawat'n ( $A_7$ ) with a value of 82,86 and the lowest was Riam Jugan ( $A_1$ ) with a value of 54,76, etc. Based on Table 12. the decision matrix  $X$  for each alternative  $A_i (i = 1, 2, \dots, 10)$  for each criterion  $C_j (j = 1, 2, \dots, 8)$  can be determined using Equation (8), as:

$$\begin{aligned}
 x_{1,1} &= \frac{z_{1,1} - z_1^{min}}{z_1^{max} - z_1^{min}} = \frac{68,89 - 68,89}{93,33 - 68,89} = 0 \\
 x_{2,1} &= \frac{z_{2,1} - z_1^{min}}{z_1^{max} - z_1^{min}} = \frac{81,48 - 68,89}{93,33 - 68,89} = 0,52 \\
 x_{3,1} &= \frac{z_{3,1} - z_1^{min}}{z_1^{max} - z_1^{min}} = \frac{81,27 - 68,89}{93,33 - 68,89} = 0,51 \\
 x_{4,1} &= \frac{z_{4,1} - z_1^{min}}{z_1^{max} - z_1^{min}} = \frac{88,33 - 68,89}{93,33 - 68,89} = 0,8 \\
 x_{5,1} &= \frac{z_{5,1} - z_1^{min}}{z_1^{max} - z_1^{min}} = \frac{76,67 - 68,89}{93,33 - 68,89} = 0,32 \\
 x_{6,1} &= \frac{z_{6,1} - z_1^{min}}{z_1^{max} - z_1^{min}} = \frac{91,85 - 68,89}{93,33 - 68,89} = 0,94 \\
 x_{7,1} &= \frac{z_{7,1} - z_1^{min}}{z_1^{max} - z_1^{min}} = \frac{87,62 - 68,89}{93,33 - 68,89} = 0,77 \\
 x_{8,1} &= \frac{z_{8,1} - z_1^{min}}{z_1^{max} - z_1^{min}} = \frac{93,33 - 68,89}{93,33 - 68,89} = 1 \\
 x_{9,1} &= \frac{z_{9,1} - z_1^{min}}{z_1^{max} - z_1^{min}} = \frac{79,52 - 68,89}{93,33 - 68,89} = 0,04 \\
 x_{10,1} &= \frac{z_{10,1} - z_1^{min}}{z_1^{max} - z_1^{min}} = \frac{86,67 - 68,89}{93,33 - 68,89} = 0,73
 \end{aligned}$$

The complete calculation results can be seen in table 13.

Table 13. Decision matrix  $X$  for each alternative for each criteria

	$C_1$	$C_2$	$C_3$	$C_4$	$C_5$	$C_6$	$C_7$	$C_8$
$A_1$	0,00	0,00	1,00	1,00	0,63	0,43	0,62	1,00
$A_2$	0,52	0,48	0,50	0,97	1,00	1,00	0,73	0,62

	$C_1$	$C_2$	$C_3$	$C_4$	$C_5$	$C_6$	$C_7$	$C_8$
$A_3$	0,51	0,15	0,62	0,45	0,62	0,81	0,54	0,00
$A_4$	0,80	0,90	0,00	0,10	0,20	0,13	0,24	0,17
$A_5$	0,32	0,96	0,17	0,00	0,04	0,00	0,29	0,01
$A_6$	0,94	0,82	0,16	0,09	0,00	0,04	0,39	0,06
$A_7$	0,77	1,00	0,15	0,38	0,45	0,71	0,57	0,45
$A_8$	1,00	0,97	0,09	0,16	0,15	0,48	0,27	0,17
$A_9$	0,44	0,62	0,37	0,53	0,43	0,40	0,00	0,28
$A_{10}$	0,73	0,72	0,73	0,48	0,67	0,51	1,00	0,82

Based on table 13. the preference matrix  $E$  will be calculated for each alternative  $A_i (i = 1,2, \dots, 10)$  based on the ranking results of criteria  $C_j (j = 1,2, \dots, 8)$  in Table 11. The criteria  $C_j (j = 1,2, \dots, 8)$  that are ranked 1 are natural beauty ( $C_1$ ), uniqueness of natural resources ( $C_2$ ), and activity potential ( $C_6$ ), resulting in  $E_1$ , as:

$$E_1 = \begin{bmatrix} 0 & 0 & 0,43 \\ 0,52 & 0,48 & 1 \\ 0,51 & 0,15 & 0,81 \\ 0,8 & 0,9 & 0,13 \\ 0,32 & 0,96 & 0 \\ 0,94 & 0,82 & 0,04 \\ 0,77 & 1 & 0,71 \\ 1 & 0,97 & 0,48 \\ 0,04 & 0,62 & 0,4 \\ 0,73 & 0,72 & 0,51 \end{bmatrix} \begin{bmatrix} 0,134 \\ 0,134 \\ 0,134 \end{bmatrix} = \begin{bmatrix} 0,058 \\ 0,268 \\ 0,198 \\ 0,245 \\ 0,171 \\ 0,242 \\ 0,332 \\ 0,329 \\ 0,195 \\ 0,263 \end{bmatrix} \dots\dots\dots(13)$$

Based on the results of the matrix  $E_1$  in (13) ranking is obtained by sorting from the largest to the smallest value.

Table 14. Ranking of cascade tourism destinations in West Kalimantan based on natural beauty, uniqueness of natural resources, and potential activities

Alternative	Preference Value	Rangking
Riam Berawat'n	0,332	1
Riam Parangek	0,329	2
Riam Pangar	0,268	3
Riam Eria	0,263	4
Riam Mangoi	0,245	5
Riam Marum	0,242	6
Riam Ampakng	0,198	7
Riam Merasap	0,195	8
Riam Batu Susun	0,171	9
Riam Jugan	0,058	10

Based on table 14 t can be seen that based on natural beauty, uniqueness of natural resources, and activity potential, Riam Berawat'n ranks first with a value of 0,332 meaning that if the selection of cascade tourism destinations in West Kalimantan is based on natural beauty, uniqueness of natural resources, and activity potential, then Riam Berawat'n is a higher priority for tourists. Meanwhile, Riam Jugan ranks last with a value of 0,058 meaning that if the selection of cascade tourism destinations in West Kalimantan is based on natural beauty, uniqueness of natural resources, and activity potential, Riam Jugan is less of a priority for tourists.

The same calculation was applied to the selection criteria for cascade tourism destination in West Kalimantan with rankings of 2, 3, and 4. The details are as follows:

Table 15. Ranking of cascade tourism destinations in West Kalimantan based on popularity and reputation, and affordability

Alternative	Preference Value	Rangking
Riam Eria	0,228	1
Riam Jugan	0,203	2

Alternative	Preference Value	Rangking
Riam Pangar	0,169	3
Riam Berawat'n	0,127	4
Riam Ampakng	0,067	5
Riam Marum	0,057	6
Riam Parangek	0,055	7
Riam Mangoi	0,051	8
Riam Batu Susun	0,037	9
Riam Merasap	0,036	10

Based on [table 15](#) it can be seen that based on popularity and reputation, and affordability, Riam Eria ranks first with a value of 0,228 meaning that if the selection of cascade tourism destination in West Kalimantan is based on popularity and reputation, and affordability, then Riam Eria is a higher priority for tourists. Meanwhile, Riam Merasap ranks last with a value of 0,036 meaning that if the selection of cascade tourism destinations in West Kalimantan is based on popularity and reputation, and affordability, Riam Merasap is less of a priority for tourists.

Table 16. Ranking of cascade tourism destinations in West Kalimantan based on accessibility, safety and comfort

Alternative	Preference Value	Rangking
Riam Jugan	0,195	1
Riam Pangar	0,179	2
Riam Eria	0,168	3
Riam Ampakng	0,148	4
Riam Merasap	0,096	5
Riam Berawat'n	0,072	6
Riam Parangek	0,029	7
Riam Batu Susun	0,025	8
Riam Mangoi	0,024	9
Riam Marum	0,019	10

Based on [table 16](#) it can be seen that in terms of accessibility, safety, and comfort, Riam Jugan ranks first with a value of 0,195 meaning that if the selection of cascade tourism destinations in West Kalimantan is based on accessibility, safety and comfort, then Riam Jugan is a higher priority for tourists. Meanwhile, Riam Marum ranks last with a value of 0,019 meaning that if the selection of cascade tourism destinations in West Kalimantan is based on accessibility, safety and comfort, Riam Marum is less of a priority for tourists..

Table 17. Ranking of cascade tourism destinations in West Kalimantan based on supporting facilities

Alternative	Preference Value	Rangking
Riam Jugan	0,107	1
Riam Pangar	0,104	2
Riam Merasap	0,057	3
Riam Eria	0,051	4
Riam Ampakng	0,048	5
Riam Berawat'n	0,041	6
Riam Parangek	0,018	7
Riam Mangoi	0,0104	8
Riam Marum	0,0101	9
Riam Batu Susun	0	10

Based on [table 17](#) it can be seen that based on supporting facilities, Riam Jugan ranks first with a value of 0,107 meaning that if the selection of cascade tourism destinations in West Kalimantan is based on supporting facilities, then Riam Jugan is a higher priority for

tourists. Meanwhile, Riam Batu Susun ranks last with a score of 0 meaning that if the selection of cascade tourism destinations in West Kalimantan is based on supporting facilities, Riam Batu Susun is less of a priority for tourists.

Based on [table 11](#) and [table 13](#) the preference matrix  $Y$  for each alternative  $A_i (i = 1, 2, \dots, 10)$  will be calculated using Equation (11), as:

$$Y = \begin{bmatrix} 0 & 0 & 1 & 1 & 0,63 & 0,43 & 0,62 & 1 \\ 0,52 & 0,48 & 0,5 & 0,97 & 1 & 1 & 0,73 & 0,62 \\ 0,51 & 0,15 & 0,62 & 0,45 & 0,62 & 0,81 & 0,54 & 0 \\ 0,8 & 0,9 & 0 & 0,1 & 0,2 & 0,13 & 0,24 & 0,17 \\ 0,32 & 0,96 & 0,17 & 0 & 0,04 & 0 & 0,29 & 0,01 \\ 0,94 & 0,82 & 0,16 & 0,09 & 0 & 0,04 & 0,39 & 0,06 \\ 0,77 & 1 & 0,15 & 0,38 & 0,45 & 0,71 & 0,57 & 0,45 \\ 1 & 0,97 & 0,09 & 0,16 & 0,15 & 0,48 & 0,27 & 0,17 \\ 0,04 & 0,62 & 0,37 & 0,53 & 0,43 & 0,4 & 0 & 0,28 \\ 0,73 & 0,72 & 0,73 & 0,48 & 0,67 & 0,51 & 1 & 0,82 \end{bmatrix} \begin{bmatrix} 0,134 \\ 0,134 \\ 0,120 \\ 0,107 \\ 0,120 \\ 0,134 \\ 0,125 \\ 0,125 \end{bmatrix} = \begin{bmatrix} 0,563 \\ 0,721 \\ 0,461 \\ 0,330 \\ 0,234 \\ 0,328 \\ 0,572 \\ 0,431 \\ 0,383 \\ 0,709 \end{bmatrix} \dots\dots\dots(14)$$

Based on the results of matrix  $Y$  in (14) ranking is obtained to determine the priority of cascade tourism destinations by sorting from the largest to the smallest value.

Table 18. Ranking of cascade tourism destinations in West Kalimantan based on the weight of each criterion  $W$

Alternative	Preference Value	Rangking
Riam Pangar	0,721	1
Riam Eria	0,709	2
Riam Berawat'n	0,572	3
Riam Jugan	0,563	4
Riam Ampakng	0,461	5
Riam Parangek	0,431	6
Riam Merasap	0,383	7
Riam Mangoi	0,330	8
Riam Marum	0,328	9
Riam Batu Susun	0,234	10

Based on [table 18](#) it can be seen that Riam Pangar has the highest value of 0,721 making it rank 1st. This means that if the selection of cascade tourism destinations in West Kalimantan is based on the eight criteria for destination selection in West Kalimantan in this research, Riam Pangar will be the highest priority for tourists. Meanwhile, the lowest value is for Riam Batu Susun, with a value of 0,234 making it the last in the ranking. This means that if the selection of cascade tourism destinations in West Kalimantan is based on the eight criteria for destination selection criteria in West Kalimantan in this research, Riam Batu Susun is less of a priority for tourists.

Based on the weighting results that have been carried out, the FAHP method is also appropriate for use in decision-making systems because it can determine the weight of each criterion ([Aflahin et al., 2023](#); [Ariyati et al., 2024](#); [Harahap et al., 2022](#); ([Santoso et al., 2016](#))). The assessment of each cascade tourist destination was carried out by determining the weight matrix for each cascade tourist destination against each criterion.

In addition, the application of the FAHP method provides final results in the form of rankings based on preference values ( $Y$ ) for each cascade tourist destination, with cascade tourist destinations that have higher  $Y$  values or rankings being prioritized in the selection of cascade tourist destinations in West Kalimantan. This is in line with research by [Ariyati et al. \(2024\)](#) and [Aflahin et al. \(2023\)](#), where the FAHP method was used in ranking each alternative, with alternatives with higher preference values or rankings becoming the top priority.

Thus, tourists can not only choose cascade tourism destinations as their top priority, but they can also choose cascade tourism based on the criteria used.

## Conclusion

Based on the research conducted, it can be concluded that the Fuzzy Analytic Hierarchy Process (FAHP) method can be applied to rank 10 cascade tourist destinations in West Kalimantan, namely Riam Jugan, Pangar, Ampakng, Mangoi, Batu Susun, Marum, Berawat'n, Parangek, Merasap, and Eria. The FAHP method is effective in evaluating cascade tourist destinations based on predetermined criteria, namely natural beauty, uniqueness of natural resources, accessibility, supporting facilities, safety and comfort, activity potential, popularity and reputation, and affordability. The application of the FAHP method provides final results in the form of rankings based on preference values ( $Y$ ) for each waterfall tourist attraction, with the cascade with the highest  $Y$  value, namely Riam Pangar, being prioritized in the selection of waterfall tourist destinations in West Kalimantan. However, the ranking results obtained in this study may differ depending on tourist preferences by applying appropriate weightings. This is because the data used in the weighting process in this study is data on the preferences of visitors and residents around cascade tourism destinations in West Kalimantan. Therefore, it is necessary to add data on preferences related to existing tourism destinations in West Kalimantan so that the ranking results can be more accurate.

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## Author Contribution

RV contributed to data collection and the writing of this article. Meanwhile, NK, Y, and BP contributed by providing guidance on data processing and revisions to this article.

## References

- Abdullah, L., & Zulkifli, N. (2015). Integration Of Fuzzy AHP And Interval Type-2 Fuzzy DEMATEL: An Application To Human Resource Management. *Expert Systems with Applications*, 42(9), 4397–4409. <https://doi.org/10.1016/j.eswa.2015.01.021>
- Aflahin, A. A. A. D., Fathoni, M. I. A., & Cindarbumi, F. (2023). Penerapan Sistem Pendukung Keputusan Dengan Menggunakan Metode Fuzzy AHP (Analytical Hierarchy Process) Sebagai Penentuan Penerima Beasiswa PIP. *Jurnal Lebesgue: Jurnal Ilmiah Pendidikan Matematika, Matematika Dan Statistika*, 4(3), 1452–1467. <https://doi.org/10.46306/lb.v4i3.411>
- Akkaya, G., Turanoğlu, B., & Öztaş, S. (2015). An Integrated Fuzzy AHP And Fuzzy MOORA Approach To The Problem Of Industrial Engineering Sector Choosing. *Expert Systems with Applications*, 42(24), 9565–9573. <https://doi.org/10.1016/j.eswa.2015.07.061>
- Ariyati, F. P., Rakhmawati, F., & Batubara, A. U. (2024). Penerapan Fuzzy Analytical Hierarchy Process Untuk Menentukan Prioritas Pembangunan Irigasi Di Provinsi Sumatera Utara. *Jurnal Lebesgue: Jurnal Ilmiah Pendidikan Matematika, Matematika Dan Statistika*, 5(1), 329–335. <https://doi.org/10.46306/lb.v5i1.563>
- Ashtiani, M., & Azgomi, M. A. (2016). Trust Modeling Based On A Combination Of Fuzzy Analytic Hierarchy Process And Fuzzy VIKOR. *Soft Computing*, 20(1), 399–421. <https://doi.org/10.1007/s00500-014-1516-1>

- Ayca, C., & Karal, H. (2017). An Application Of Fuzzy Analytic Hierarchy Process (FAHP) For Evaluating Students Project. *Educational Research and Reviews*, 12(3), 120–132. <https://doi.org/10.5897/ERR2016.3065>
- Azarnivand, A., Hashemi-Madani, F. S., & Banihabib, M. E. (2015). Extended Fuzzy Analytic Hierarchy Process Approach In Water And Environmental Management (Case Study: Lake Urmia Basin, Iran. *Environmental Earth Sciences*, 73(1), 13–26. <https://doi.org/10.1007/s12665-014-3391-6>
- Chang, D. Y. (1996). Applications Of The Extent Analysis Method On Fuzzy AHP. *European Journal of Operational Research*, 95(3), 649–655.
- Fedrizzi, M., & Krejčí, J. (2015). A Note On The Paper "Fuzzy Analytic Hierarchy Process: Fallacy Of The Popular Methods. *International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems*, 23(06), 965–970. <https://doi.org/10.1142/S0218488515500440>
- Firouz, M. H., & Ghadimi, N. (2016). Optimal Preventive Maintenance Policy For Electric Power Distribution Systems Based On The Fuzzy AHP Methods. *Complexity*, 21(6), 70–88. <https://doi.org/10.1002/cplx.21668>
- Hadi, F., Farmadi, A., & Kartini, D. (2016). Fuzzy Analytical Hierarchy Process (FAHP) Pada Penerima Bantuan Stimulan Perumahan Swadaya. *KLIK: Kumpulan Jurnal Ilmu Komputer*, 04(01), 21–34.
- Harahap, A. R., Simbolon, N. H. M., Agata, R. A., & Sunarsih, S. (2022). Metode Fuzzy AHP (Analytical Hierarchy Process) Untuk Pemilihan Metode Pembelajaran Demi Menunjang Pembelajaran Matematika. *Jurnal Sains dan Edukasi Sains*, 5(1), 9–17. <https://doi.org/10.24246/juses.v5i1p9-17>
- Lee, S., & Seo, K. K. (2016). A Hybrid Multi-Criteria Decision-Making Model For A Cloud Service Selection Problem Using BSC, Fuzzy Delphi Method And Fuzzy AHP. *Wireless Personal Communications*, 86(1), 57–75. <https://doi.org/10.1007/s11277-015-2976-z>
- Lubis, R. M., & Husein, I. (2023). Determination Of Factors Influencing Drug Use Using The Fuzzy AHP Method At The North Sumatra Provincial National Narcotics Agency (BNNP. *Jurnal Lebesgue: Jurnal Ilmiah Pendidikan Matematika, Matematika Dan Statistika*, 4(2), 1067–1074. <https://doi.org/10.46306/lb.v4i2.385>
- Mahasastrawan, I. G. A., Wijaya, I. N. Y. A., & Sudiarmika, I. B. K. (2022). Sistem Pendukung Keputusan Penentuan Pemeliharaan Pada Mesin Pembangkit Listrik Tenaga Diesel Dan Gas (PLTDG) Menggunakan Metode Fuzzy-AHP (Studi Kasus PT. *Indonesia Power Unit Pembangkit Bali*). *Jurnal Teknologi Informasi dan Komputer*, 8(1), 52–68. <https://doi.org/10.36002/jutik.v8i1.1584>
- Nagpal, R., Mehrotra, D., Bhatia, P. K., & Sharma, A. (2015). FAHP Approach To Rank Educational Websites On Usability. *International Journal of Computing and Digital Systems*, 4(4), 251–260. <https://doi.org/10.12785/ijcds/040404>
- Pamungkas, T. S., Kusriani, & Kurniawan, M. P. (2020). Penerapan Metode Fuzzy Analytical Hierarchy Process Pada Penilaian Kinerja Dosen Dalam Aspek Kedisiplinan. *IJAI: Indonesian Journal of Applied Informatics*, 4(2), 76–84.
- Pemanfaatan Jasa Lingkungan, D. W. A. (2003). Pedoman Analisis Daerah Operasi Obyek Dan Daya Tarik Wisata Alam (ADO-ODTWA. *Departemen Kehutanan, Direktorat Jenderal Perlindungan Hutan dan Konservasi Alam*.
- Prasanta, P. P. S. Y., Via, Y. V., & Mumpuni, R. (2023). Pengembangan Sistem Informasi Pariwisata Berbasis Web Dengan Pendekatan Fuzzy AHP Sebagai Fitur Utama Dalam Rekomendasi Paket Wisata Di Kabupaten Badung. *Jurnal Teknik Mesin*,

*Elektro dan Ilmu Komputer*, 3(2), 59–68.

<https://doi.org/10.55606/teknik.v3i2.2008>

Santoso, A., Rahmawati, R., & Sudarno. (2016). Aplikasi Fuzzy Analytical Hierarchy Process Untuk Menentukan Prioritas Pelanggan Berkunjung Ke Galeri (Studi Kasus Di Secondhand Semarang). *Jurnal GAUSSIAN*, 5(2), 239–248.