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The Determination of A Place of Popular Tourism on The Island of Madura Using Weighted Product (WP)

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ABSTRACT

This research explored the diverse aspects of Madura Island, including its cultural, societal, and touristic facets. The primary focus was on developing a recommendation system to identify Madura's most popular tourist destinations. Utilizing the Weighted Product (WP) method, a decision support system model, this study assessed the popularity of various tourist attractions in Madura, aiding tourists in selecting destinations through a multi-criteria weighting process. Key parameters included the number of both foreign and local visitors, proximity to the city center, and visitor ratings. The study encompassed 62 tourist sites across four districts in Madura, evaluating the most popular attractions in each. Findings revealed the top destinations in each district: Bangkalan featured Makam Syeichona Cholil (preference value: 0.113), Sampang showcased Hutan Kera Nepa (0.127), Pamekasan highlighted Batu Ampar (0.171), and Sumenep was known for Makam Asta Tinggi (0.076). This research offered valuable insights for both tourists and stakeholders in the tourism industry of Madura Island.

Keywords*:* recommendation, system, tourist destinations, weight product

INTRODUCTION

Madura Island, located east of Java, is a topic of growing interest, especially in tourism. This island has a lot to offer, from its unique culture and natural beauty to its rich food and historical sites, including places of religious importance. Recently, there has been more talk about the potential of Madura as a tourist spot. Despite this, promoting tourism here is challenging due to long-standing stereotypes about the local community. These issues make it hard to showcase what Madura has to offer properly.

Additionally, choosing the right places to visit is crucial for tourists, which highlights the need for a system that makes finding information and selecting destinations on Madura Island easier and more efficient [1]. To enhance tourists' experiences by providing them with detailed knowledge and recommendations for tourist destinations tailored to their preferences, a computer system has been developed. This system houses comprehensive information on various tourist areas, assisting visitors in making informed decisions based on their selected criteria.

In the 1970s, the term 'Decision Support System' (DSS) emerged as an alternative to 'Management Information System'. It was crafted to facilitate interaction with users [2]. The primary aim of a DSS is to assist decision-makers in choosing the best possible options by processing various alternatives based on the information available. This system handles both structured and unstructured problems, providing an interactive platform for accessing information, creating models, and manipulating data [3].

One method regarding multi-criteria is Simple Additive Weighting (SAW). Joni Purnama conducted research and tested the decision support system for selecting new admissions using the Simple Additive Weighting (SAW) method based on the results obtained by processing the data that was carried out to produce sufficient prospective student data information to be analyzed further [4][5].

The advantages and disadvantages of this method are that the decision-maker must make a

decision matrix. The decision maker must determine the weight of each attribute. Decision makers must input data correctly and correctly so that there are no errors in the weighting and ranking criteria.

In 2017 [6], a study was conducted on the decision support system for selecting favorite tourist destinations in Yogyakarta Province using the Android-based weighted product method. The results of this system are useful in making it easier for tourists to get information about tourist locations and making it easier for tourists to make decisions when traveling. The results of the questionnaire on the overhead GUI, ease of data, the accuracy of the information, and user satisfaction showed an average value of 70,95 %, which means testing applications based on the questionnaire is a good category according to a scale rank Likert made.

In 2020 [7], research on information systems for selecting tourist objects was carried out using the weighted product method. Mobile device applications are designed to make it easy for administrators and users to choose a tourist attraction with a process that includes several criteria that the user requires. Then, this application is added to Google Maps so users can immediately find tourist attractions. Information systems and the selection of a tourist attraction based on the weighting products can go well. In testing the black box, the system can work as expected. In beta testing, the innate system was found to work as requested by the user, with a score of 78.29 %.

Madura has a variety of tourist destinations that are no less beautiful than other regions. The tourist attractions offered are also increasingly diverse, such as beach tourism, modern and traditional entertainment, culinary, nature tourism, cultural tourism, etc. Each tourist location offers its advantages. Not all tourists know interesting tourist locations, especially for new locations. The contribution of this research can help prospective tourists find out the most popular tourist destinations in each District in Madura based on the distance from the tourist destination to the city center, visitor ratings, and the number of foreign visitors and local visitors.

METHODS

In Figure 1, there is a Weighted Product (WP) flowchart starting with inputting criteria data and then inputting the criteria values for each alternative. The data that has been inputted will be processed using a decision matrix calculation. Then, the weighting normalization process is done by dividing the weight of each criterion by the total number. After that, the process of calculating the alternative preference value as a vector S will be positive for benefits and negative for costs. In the process of determining relative preferences, it can be calculated using a vector V to rank each alternative. This decision support system then presents a rating of preference values.

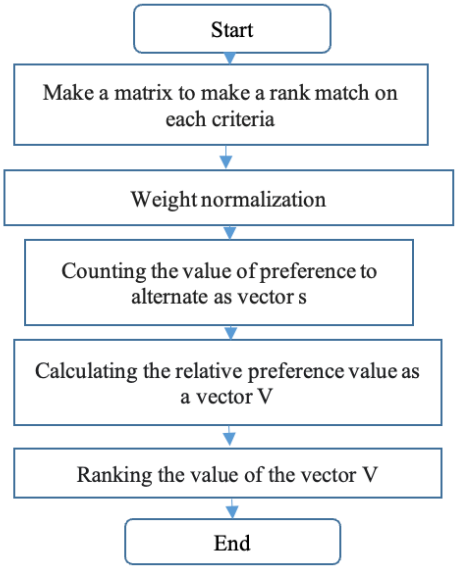

Figure 1. Flowchart Weighted Product

A. Recommendation system

A recommendation system is an application that is used to provide item recommendations in making a decision that the user wants. It is also known as a recommendation engine that assists in making suggestions to customers based on available data. Several factors can influence the system's decision in providing recommendations to users, such as user behavior, item descriptions, and the

preferences and habits of a group of users who have similarities in assessing an item. The recommendation system is an effective tool for filtering information. So, it can be said that the recommendation system emphasizes the characteristics of information filtering.

B. Weighted Product (WP)

Weighted product is one of the methodologies that was used to address the issues of Multi-Attribute Decision Making (MADM). A method of weighted product using multiply to combine values attributes (criteria), where the value of any attribute (criteria) should be raised to the power of first having a specific gravity of those attributes [9]. The Weighted Product (WP) method is part of the decision-making model with multiplication in connecting an attribute rating [12]. Measures to settle a matter with a method of weighted product to choose an alternative:

a. The criteria used as the basis in the determination of the most popular destinations (Ci)
b. Make a matrix to make a rank match on each criterion.
c. Weight normalization: for total normalization, the weights must meet all the criteria:

$$\sum_{j=1}^{n} w_j = 1 \quad (1)$$

d. Counting the value of preference to alternate as vector s
Value preference to alternate is calculated by applying the following:

$$S_i = \prod_{j=1}^{n} X_{ij}^{wj} \text{Where} \quad (2)$$

where:
s : alternate preference
w : weighted criteria
x : value criteria
i : alternative i until the n
j : criteria
w_j is a positive rank for the benefit attribute and a negative value for the cost attribute.

e. Calculating the relative preference value as a vector V
Vector V is the relative preference value that will be used to find the ranking of the calculation results of each alternative:

$$V_i = \frac{S_i}{\sum_{i=1}^{n} S_i} \quad (3)$$

f. Ranking the value of the vector V
At this stage, it will be the alternative that has the highest Vi value, which is the result of the decision.

RESULT AND DISCUSSION

A. Determining The Criteria and Weight

Determining the criteria and weight of the sample criteria used in this method using 62 alternatives and four criteria.

Table 1. Criteria WP

Criteria	Description	Category	Weight
C1	foreign visitors	Benefit	4
C2	local visitors	Benefit	4
C3	Distance	Cost	2
C4	Rating	Benefit	5

There are four criteria used in this study: tourist, local tourist, distance of the destination from the city center (Distance), and rating. In comparison, the weights of each criterion are listed in Table 1.

B. Determine The Value of Each Criterion

Table 2. Scale Local Tourism Criteria

Qualification	Scale
> 50000 Persons	5
30001 - 50000 Persons	4
15001 - 30000 Persons	3
5001 - 15000 Persons	2
0 - 5000 Persons	1

Table 3. Scale Tourism Criteria

Qualification	Scale
> 200 Persons	5
101 - 200 Persons	4
51 - 100 Persons	3
26 - 50 Persons	2
0 - 25 Persons	1

Table 4. Scale Distance Criteria

Qualification	Scale
> 30 KM	1
21 - 30 KM	2
13 - 20 KM	3
6 - 12 KM	4
0 - 5 KM	5

Table 5. Scale Distance Criteria

Qualification	Scale
> 4 Stars	5
3.1 - 4 Stars	4
2.1 - 3 Stars	3
1.2 - 2 Stars	2
0 - 1 Stars	1

Each criterion is converted using a scale of 1-5 using the regulations listed in Table 2 – 5. Because distance is a cost criterion, the farther away the tourist attractions are from the city center, the smaller the value.

C. Entering The Most Popular Tourist Alternative Data On The Island Of Madura

The alternatives used in this study were 62 tourist destinations in all districts on Madura Island. The details can be seen in Table 6. Pamekasan Regency has eight tourist destinations. The following is an example of calculating the most popular tourist destinations in Pamekasan District.

Table 6. Alternative Data WP District Pamekasan

Alternative	Tourist Destinations
A1	Bukit Cinta
A2	Pantai Batu Kerbuy
A3	Api Tak Kunjung Padam
A4	Batu Ampar
A5	Makam Ronggo Sukowati
A6	Museum Umum Mandilaras
A7	Pantai Jumiang
A8	Pantai Talang Siring

D. Change the value of alternative criteria according to the predetermined scale value

Examples of tourism data used are listed in Table 7. The table shows tourism data in Pamekasan Regency.

Table 7. Tourist Destination Pamekasan

Alternative	Location	C1	C2	C3	C4
A1	Bukit Cinta	0	9604	33	4
A2	Pantai Batu Kerbuy	0	14217	41	04.01
A3	Api Tak Kunjung Padam	6	14570	6.03	4
A4	Batu Ampar	0	62411	16	4.01
A5	Makam Ronggo Sukowati	0	1705	1.02	0
A6	Museum Umum Mandilaras	0	1995	0.01	3.08
A7	Pantai Jumiang	0	14012	14	4.01
A8	Pantai Talang Siring	0	14316	14	3.08

The data is then converted, as shown in Table 7. C1 is data on tourist visits, C2 is local tourists, C3 is the distance from the city center, and C4 is the rating of tourist destinations.

Table 8. Criteria Value Scale WP

Alternative	Location	C1	C2	C3	C4
A1	Bukit Cinta	1	2	1	4
A2	Pantai Batu Kerbuy	1	2	1	5
A3	Api Tak Kunjung Padam	1	2	4	4
A4	Batu Ampar	1	5	3	5
A5	Makam Ronggo Sukowati	1	1	5	1
A6	Museum Umum Mandilaras	1	1	5	4
A7	Pantai Jumiang	1	2	3	5

Alternative	Location	C1	C2	C3	C4
A8	Pantai Talang Siring	1	2	3	4

E. In calculating the normalization of the criteria weights, the number of normalized weights must meet Equation 1.

Table 9. Weight Normalization

w=(4,4,2,5)	W	Criteria	w_j	w_i normalization
Value	4	W1	0.267	0.267
	4	W2	0.267	0.267
	2	W3	0.133	-0.133
	5	W4	0.333	0.333
Count	15	wj=1	1.0000	

W=(4,4,2,5)
W1= 4/(4+4+2+5)= 0,267
W2= 4/(4+4+2+5)= 0,267
W3= 2/(4+4+2+5)= 0,133
W4= 5/(4+4+2+5)= 0,333
W1+W2+W3+W4=1
0,267+0,267+0,133+0,333=1,000

F. Calculating the vector S, in the calculation of the power vector S for the benefit category, is positive, while for the cost category, it is negative.

Table 10. Value Vector S WP

Alternative	C1^W1	C2^W2	C3^W3	C4^W4	Si
A1	1	1.203	1	1.587	1.909
A2	1	1.203	1	1.709	2.057
A3	1	1.203	0.831	1.587	1.587
A4	1	1.536	0.863	1.709	2.268
A5	1	1	0.806	1	0.806
A6	1	1	0.806	1.587	1.280
A7	1	1.203	0.863	1.709	1.776
A8	1	1.203	0.863	1.587	1.649

G. Calculate vector V

Vector V is calculated by dividing the value of vector S from each alternative, then divided by the total number of vectors S

$\sum_{i=1}^{n} S_i$ =16.17894

$\boldsymbol{V_1} = \frac{2.63703}{16.17894}$=0.143

$\boldsymbol{V_2} = \frac{1.99684}{16.17894}$=0.154

$\boldsymbol{V_3} = \frac{2.807573}{16.17894}$=0.119

$\boldsymbol{V_4} = \frac{2.183269}{16.17894}$=0.171

$\boldsymbol{V_5} = \frac{1}{16.17894}$=0.061

$\boldsymbol{V_6} = \frac{1.587401}{16.17894}$=0.096

$\boldsymbol{V_7} = \frac{2.057144}{16.17894}$=0.133

$\boldsymbol{V_8} = \frac{1.909683}{16.17894}$=0.123

H. Rankings vector V

Table 11. shows the order of the results of the vector, which is also called the order of preference values. The table shows that popular tourist destinations in Pamekasan are alternative 4, namely the Batu Ampar. In addition, Table 12, Table 13, and Table 14 show the preference values of tourist destinations in Bangkalan, Sampang, and Sumenep regencies.

Table 11. Rankings Vector V Pamekasan

A	Vi	Rank
A4	0.171	1
A2	0.154	2
A1	0.143	3
A7	0.133	4
A8	0.123	5
A3	0.119	6
A6	0.096	7
A5	0.061	8

Table 12. Rangkings Vector V Bangkalan

A	Vi	Rank
A7	0.113	1
A5	0.094	2
A6	0.068	3
A13	0.064	4
A14	0.048	5
A12	0.048	6
A2	0.048	7
A9	0.048	7
A3	0.044	9
A4	0.043	10
A8	0.040	11
A15	0.039	12
A17	0.039	12
A16	0.038	14
A11	0.037	15
A19	0.037	15
A20	0.037	15
A1	0.035	18
A10	0.035	19
A18	0.035	20

Table 13. Rangkings Vector V Sampang

A	Vi	Rank
A5	0.127	1
A6	0.127	1
A1	0.110	3
A7	0.095	4
A3	0.088	5
A12	0.087	6
A10	0.085	7
A8	0.070	8
A4	0.068	9
A11	0.063	10
A9	0.040	11
A2	0.034	12

Table 14. Rangkings Vector V Sumenep

A	Vi	Rank
A9	0.076	1
A11	0.076	2
A10	0.072	3
A14	0.063	4
A12	0.061	5
A22	0.059	6
A15	0.059	7
A8	0.058	8
A20	0.043	9
A1	0.042	10
A19	0.042	11
A5	0.041	12
A7	0.039	13
A13	0.032	14
A16	0.032	15
A21	0.032	16
A18	0.030	17
A2	0.030	18
A17	0.029	19
A6	0.029	20
A3	0.022	21
A4	0.022	22

Based on the trial results above, it is known that tourist sites can be recommended to visitors. This is known based on the existing ranking value and the high preference value of 0.171, namely Batu Ampar. Tests were carried out on the island of Madura to determine the level of accuracy or precision of the travel recommendation website using the weighted product (WP) method. Accuracy is stated based on the magnitude of the error or discrepancy. System calculations using the weighted product method show an accuracy rate of 94% when compared with expert data.

CONCLUSION

The results of research from this recommendation system are:

1. Based on the results of trials using alternative tourism data in Madura, the Weighted Product method was successfully implemented for calculating alternative

criteria to determine the most popular tourist attractions on the island of Madura by using four criteria, namely foreign visitor, local visitor, distance and rating

2. The results of this study show that popular tourist attractions in each district on Madura Island, namely, Bangkalan has the Makam Syeichona Cholil, the preference value is 0.113, Sampang has the Hutan Kera Nepa, the preference value is 0.127, Pamekasan has Batu Ampar, the preference value is 0.171, Sumenep has the Makam Asta Tinggi, the preference value is 0.076.
3. This system can recommend which tourist sites to visit to users.

Research on tourism recommendations is still very wide open, both in adding to the criteria for existing facilities within tourist objects and outside. Then, research on the route that must be taken by tourists so that it can facilitate access to tourist sites.

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