IJID International Journal on Informatics for Development, *e-ISSN :2549-7448*
Vol. 6, No. 2, 2017, Pp. 34-39

Design of Decision Support System Selection of Beach Tourism Object in Gunungkidul using Fuzzy AHP Method

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***Abstract*-- The tourism industry is currently one of the important assessments for a certain region. Gunungkidul has a lot of of beach tourism potentials until visitors are confused to choose the right beach. The purpose of this research is to analyze and apply Fuzzy Analytical Hierarchy Process method in calculating the selection of beach tourism object in Gunungkidul with eight main criteria into a website.**

Multi Criteria Decision Making (MCDM) is a decision-making method to establish the best alternative of a number of alternatives based on several criteria that will be considered. One method of MCDM is the Fuzzy Analytical Hierarchy Process method. Fuzzy Analytical Hierarchy Process is a method of developing Analytical Hierarchy Process (AHP), which can describe unclear decisions and minimize uncertainty on AHP. Fuzzy approach, especially triangular fuzzy number to AHP scale, is expected to minimize uncertainty so that expected result was obtained more accurately.

The decision support system for choosing a beach resort in Gunungkidul has been successfully built by applying the Fuzzy Analytical Hierarchy Process method. The calculation of Fuzzy Analytical Hierarchy Process method with the same computer result with manual calculation. The testing system was done using Black Box method by testing Alpha and Betha. From the results of system testing, it was known that the average result of the overall function score was 104 which was on rating scale 97.51 - 120 (Very Good).

Keyword-Fuzzy Analytical Process; Multi Criteria Decision Making; Triangular Fuzzy Number

I. INTRODUCTION

The tourism industry is currently one of the important assessments for a certain region. Gunungkidul has a lot of beach tourism potentials. The beauty of the beaches that are still natural and not many of the changes made by the local people are the advantages of the beach base in Gunungkidul compared to the beaches in other regions.

Beach tourism in Gunungkidul is quite a lot so visitors are confused about choosing the right beach tour. Every beach in Gunungkidul has its own distinct advantages. In the selection of beaches, the data used is qualitative and quantitative. Therefore, the selection of beaches can be done by giving weighting to certain criteria that have been set.

Multi Criteria Decision Making (MCDM) is a method used to determine alternatives from several alternatives that will be taken into consideration. One of the MCDM methods is the method *Fuzzy Analytical Hierarchy Process*. *Fuzzy Analytical Hierarchy Process* method is a development from (*AHP*) method. *Fuzzy Analytical Hierarchy Process* method can handle method weaknesses (AHP), which when determining weights for difficult criteria can be overcome. *Fuzzy Analytical Hierarchy Process* method allows process descriptions making more accurate decisions and describing them uncertainty specifically mathematically. T*riangular fuzzy number* approach in AHP method is an approach used to minimize uncertainty on the AHP scale which is the value of 'crisp'. The approach taken is to do fuzzification on the AHP scale to obtain a new scale called the AHP fuzzy scale (Source: Anshori Yusuf, 2012).

The focus of this research is how to apply*Multi Criteria Decision Making* (MCDM) on Design of Decision Support System for Selection of Beach Tourism Object in Gunungkidul using Fuzzy Analytical Hierarchy Process method and how to implement it in the form of a website.

II. PURPOSE

The purpose of this research is as follows :

1. Analyze and determine *Fuzzy Analytical Hierarchy Process* method in the calculation of the selection of coastal attractions in Gunungkidul, The main criteria used are price, distance, security, crowds, cleanliness, cleanliness, terrain and facilities.
2. Building a Decision Support System for the Selection of Beach Tourism Objects in Gunungkidul based on websites.

III. METHODOLOGY

The system development methods used are as follows:

1. Preliminary studies

In this study the author uses the *Fuzzy Analytical Hierarchy Process* method of weighting criteria for possible descriptions of more accurate decision-making processes and describe it specifically mathematically and full of uncertainty.

2. Data Collection

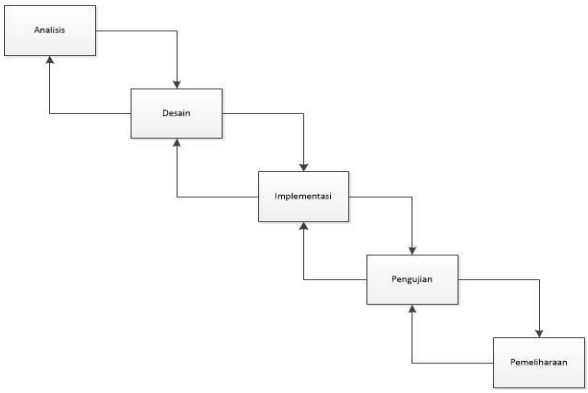
Data collection used in this research there are two stages:

a. Study of Literature
This stage is the stage of finding and learning references in the form of papers, journals, theses, and books related to the research conducted

b. Interview
This stage is the interview stage by asking the parties directly related to visitors to beach tourism and residents around the coastal tourism objects in Gunungkidul.

3. System Development Method

The system development method used for system development in this research is the System Development Life Cycle (SDLC) method using the Waterfall model.



Picture 3.1 Stages of the System Development Cycle Method

(Sumber : Pressman Roger . S, 1997)

IV. RESULT AND DISCUSSION

A. System Description

Decision support system for the selection of coastal tourism objects in Gunungkidul is a software built for helping website visitors (the community) to determine the right beach choice to be visited by website visitors in accordance with *Fuzzy Analytical Hierarchy Process* method. Calculation process with *Fuzzy Analytical Hierarchy* method can be conducted by providing beach data and the data of each subcriteria that has been input by admin.

B. Input System

Input data needed for getting a beach alternative to compare is the beach data entered by the admin. The data has been stored in the system database.

C. Output System

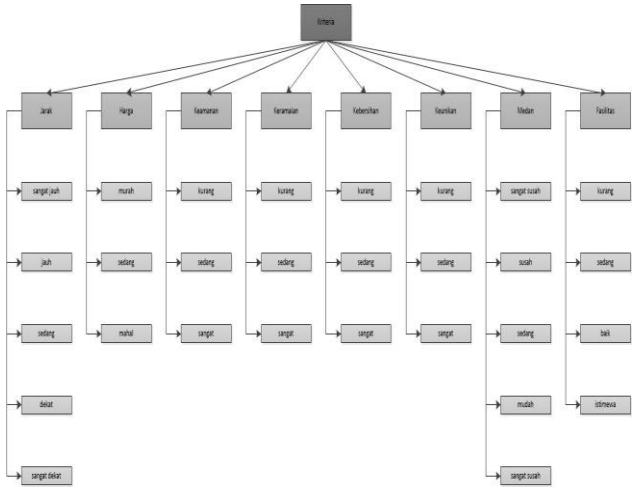
Output system is the beach ranking that has been sorted by the final result from the highest to the lowest. The beach recommended by the system is the beach has the highest final value after calculation with *Fuzzy Analytical Hierarchy Process* method that already done by system.

D. Discussion of calculation Fuzzy Analytical Hierarchy Process

The following steps can be done to calculate the final value of the beach with *Fuzzy Analytical Hierarchy Process* method.

1. Hierarchical Stucture

Determine comparison of paired matrix websites between criteria with *Tryangular Fuzzy Number* / TFN scale based on the level of importance inputted by visitors.



Picture 4.1 Hierarchical Stucture

2. Determine value *fuzzy* synthesis (S_i) priority with formula :

Kriteria Pantai	Pantai Kosakora	Pantai Baron	Pantai Ngeden	Pantai Gesing	Pantai Watu Lumbung
Jarak	0.0315	0.0315	0.0383	0.0383	0.0315
Harga	0.0006	0.0006	0.0047	0.0047	0.0047
Keamanan	0.0774	0.1182	0.0105	0.0105	0.0105
Keramaian	0.0990	0.0990	0.0088	0.0088	0.0088
Kebersihan	0.0503	0.0503	0.0329	0.0329	0.0329
Keunikan	0.1020	0.1020	0.1020	0.1020	0.1020
Medan	0.0378	0.0378	0.0310	0.0310	0.0213
Fasilitas	0.0133	0.0133	0.0119	0.0133	0.0079
TOTAL	0.4119	0.4527	0.2401	0.2415	0.2196

$$S_i = \sum_{j=1}^{m} M_i^j x = \frac{1}{\sum_{i=1}^{n}\sum_{j=1}^{m} M_1^j} \text{.....(1)}$$

Where :

$$\sum_{j=1}^{m} M_i^j = \sum_{j=1}^{m} lj, \sum_{j=1}^{m} mj, M_{j=1}^{m} uj \text{..... (2)}$$

while :

$$\frac{1}{\sum_{j=1}^{n}\sum_{j=1}^{m} M_i^j} = \frac{1}{\sum_{i=1}^{n} ui, \sum_{i=1}^{n} mi, \ \sum_{i=1}^{n} li} \text{..... (3)}$$

Tabel 4.1 Value Fuzzy Shyntetic Extenth

S	Nilai L	Nilai M	Nilai U
S1	0.041	0.168	0.465
S2	0.012	0.025	0.103
S3	0.090	0.225	0.542
S4	0.070	0.166	0.393
S5	0.028	0.058	0.213
S6	0.088	0.183	0.353
S7	0.056	0.120	0.264
S8	0.016	0.052	0.125

3. Determination of Vektor value (V) and Ordinate value Defuzzifikasi (d')

If the result are obtained on each fuzzy matrix, $M_2 \geq M_1$ $M_2 = (l_2, m_2, u_2)$ and $M_1 = (l_1, m_1, u_1)$ then *vector* value can be formulated as follows :

$$V\ (S_2 \geq S_1) = \begin{cases} 1 \ , if\ m_2 \geq m_1 \\ 0 \quad , if\ l_1 \geq u_2 \\ \frac{(l_1 - u_2)}{(m_2 - u_2) - (m_1 - u_1)} \ , others \end{cases} \text{.....(4)}$$

4. Normalization value *fuzzy* vektor *(W)*

After normalization, vector value can be formulated as follows.

W=$(d(A_1), d(A_2), \ldots, d(A_n))^T$ where W is number non *fuzzy*.

Tabel 4.4 Normalization Vektor Value

-	d(A1)	d(A2)	d(A3)	d(A4)	d(A5)	d(A6)	d(A7)	d(A8)
W	**0.179**	**0.012**	**0.206**	**0.172**	**0.087**	**0.177**	**0.128**	**0.034**

5. Calculate the total alternative

Calculate the total alternative done by multiplying between priority value with subcriteria value of alternative.

Tabel 4.5 Tabel total Alternatif value

6. Alternative Ranking

Alternative ranking is done in a way compare the average total weight of alternatives compared. Average number of total weights the biggest alternative is first rank. Calculation of the average total weight can be formulated as follows :

$$\textbf{Average weight} = \frac{\textbf{Amount of weight}}{\textbf{Amount of criteria}}$$

Tabel 4.6 Result of beach ranking :

		N	%
Cases	Valid	30	100,0
	Excluded[a]	0	,0
	Total	30	100,0

Cronbach's Alpha	N of Items
0.973	5

RANKING	BEACH	AVERAGE
1	Baron Beach	0,392969
2	Kosakora Beach	0.4119
3	Gesing Beach	0.2415
4	Ngeden Beach	0.2401
5	Watu Lumbung Beach	0.2196

E. Discussion of Testing Result

Testing conducted in this research includes testing validity, reliability, determining the rating scale ideal score. Technique sampling in Betha testing taken using techniques Purposive Sampling.

1) *Validity Testing of Research Instruments*

After collecting data obtained from answer to the respondent's questionnaire, then next the questionnaire was tested first whether it is valid or not by testing the validity. Validity testing is conducted by correlating item scores with a total score.

Tabel 4.7 Instrument Validity Test Results Research.

No	Fungsi	Item Uji	Nilai Korelasi	R Tabel	Ket
1	Interaktifitas Sistem	Soal 1	0.976	0.361	*valid*
2		Soal 2	0.970	0.361	*valid*
3		Soal 3	0.972	0.361	*valid*
4	Penanganan Session	Soal 4	0.976	0.361	*valid*
5		Soal 5	0.976	0.361	*valid*

2) Research Instrument Reliability Testing

After testing the instrument validity research and result is valid then do reliabilitas testing.

Setelah melakukan uji validitas instrument penelitian dan hasil yang diperoleh semua valid maka dilakukan pengujian reliabilitas.

Tabel 4.8 Result of Instrument Reliability Testing Research.

Based on the results of the reliability test in the table above proved that the value of Cronbach's Alpha instrument greater than 0.361, then the instrument this is stated as Reliable and all items questions used as instruments research can be trusted as a measuring tool research.

3) Determination of Idea Score

The ideal score is the score used for calculate the score to determine the rating scale and the total of answers. In the calculation the amount of the ideal score is used as the formula the following:

Ideal Score = **Scale Value x Number of Respondents**

In accordance with the score of the answers that have been used to rate each score using a scale Link, then the criteria score after calculation can be seen in the following table:

Tabel 4.9 Calculation of Ideal Scores

Skala Linkert	Rumus
Sangat Setuju	4 x 30 = 120
Setuju	3 x 30 = 90
Tidak Setuju	2 x 30 = 60
Sangat Tidak Setuju	1 x 30 = 30

4) Rating Scale

The rating scale is obtained by finding distance interval of total maximum score with total score the minimum is then divided by the number of scales used or in this study is 4 (Strongly Agree, Agree, Disagree, and Very Disagree). The following is the formula used to find interval intervals:

$$\textbf{Interval Distance} = \frac{\text{Maximum total score} - \text{Minimum total score}}{\text{number of scale.}}$$

Based on the formula above, the distance is obtained interval:

$$\textbf{Interval Distance} = \frac{120-30}{4} = 22.5$$

Tabel 4.10 Determination *Rating Scale*

Interval	Rating Scale
97.51-120	Very Good
75.01-97.5	Good
52.51-75	Enough
30-52.5	Nasty

5) Result of System Usability Testing

After system usability testing is find total value form total questions. Then add total value to each function, to find average score value from each function so it is obtained rating value on each function. The following is the formula fo finding the average value of the total score. (Nurgiyanto, 2004)

$$\overline{X} = \frac{\sum X}{N}$$

explanation :

$\overline{X}$ = average value

$\sum X$ = total skor

N = total subyek

a) Result Of Interactivity System Testing

Interactivity testing Results have 3 questions to measure the interactivity of the system usability. Then from score total of each question to interactivity system can calculate average value which is used to determine the rating scale of the function.

Tabel 4.11 Result Of Interactivity System Testing

Function	Test item	Score total	Average	Conclusion
Interaktifiti Sistem	question 1	106	102	Very good
	question 2	101		
	question 3	100		

b) Result of Session Handling Session

The Session Handling function has 2 question to measure usability function Session Handling. Next from the total score each statement can be calculated on average total score which is used to find out the rating scale the function.

Tabel 4.12 Result of testing session handling function

Function	Test item	Score total	Average	Conclusion
Penanganan Session	Soal 4	106	106	Sangat Baik
	Soal 5	106		

F. Conclusion of Betha Testing

Based on the results of testing each system usability, the average score of each function can be calculated, to find the average overall score of functionality, to look for value ratings of all functions that exist on the system. The following formula in finding the average score for all functions contained in the system (Nurgiyanto, 2004):

$$\overline{X} = \frac{\sum X}{N}$$

Explanation :

$\overline{X}$ = average value

$\sum X$ = total score

N = number of subject

Based on the formula above, the average total score of functions available on the system is obtained:

$$\textbf{Rata-rata Total Skor} = \frac{102+106}{2} = \textbf{104}$$

Based on the results of the average total score of all functions contained in the system, obtained the results of the average total function score of 104 which is on the rating scale between 97.51 - 120 (Very Good), then it can be concluded that the entire function contained in the system has a Very Good rating scale which means that the system that is late is feasible to be implemented.

CONCLUSION

Based on the results of research and testing of decision support systems for the selection of coastal tourism objects in Gunungkidul that have been carried out by the author, the following conclusions can be drawn

a) Decision support system for the selection of beaches in Gunungkidul using the Fuzzy Analytical Hierarchy Process method was successfully created.

b) The website has been successfully built and uploaded to hosting by applying the Fuzzy Anaytical Hierarchy Process method in weighting according to the beach data in Gunungkidul Regency.

ACKNOWLEDGMENT

Thank you for Ade Ratnasari, M.T, as a supervisor, so we can complete this paper. Do not forget also thanks to our parents who gave prayers and motivation to work on this paper.

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