Comparison Topsis And Saw Method In The Selection Of Tourism Destination In Indonesia

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***Abstract*- Based on data from the Central Bureau of Statistics of Indonesia there are 6 million more attractions there are in Indonesia, resulting in both local and foreign visitors to the difficulty in determining the options for visiting tourist attractions. To help travelers in facilitates are looking for sights required a decision support system in the selection of the right attractions, safe, cheap and convenient. Decision Support Systems is required to function as a tool for travelers in the decision-making process on the selection of tourist attractions. In this study, the authors compare Topsis and Saw method, in determining where that method showed results of the ranking order is not always the same, because there is a different algorithm on both of these methods and the difference in the scale of values of the weighting. The purpose of this method helps determine and increase local and foreign tourist visits to various attractions are there in Indonesia with the determination of the criteria for decision making give judgment on any alternative and weighting each criterion. Research results, based on the method of Saw, the code (A3) with a value of 0.98 with Toba Lake tourism object is set as the primary choice insights in Indonesia and based on Topsis method is addressed by alternative A11 on behalf of Raja Ampat Papua established as the first option with a value of 0.62.**

Keywords-Saw, Topsis, Tourism Destination

1. INTRODUCTION

Tourism has now become one of the biggest sectors of the economy that have most growth rate rapidly and became one of the main sources of income for many countries in the world. Through the acceptance of foreign exchange, creation of employment opportunities and infrastructure development as well as trying to make tourism as one of the drivers of socio-economic progress of a country [1].

Based on data from the Central Bureau of statistics of Indonesia there are 6 million more attractions there are in Indonesia, with it resulted in both local and foreign visitors of the difficulty in determining the options for visiting tourist attractions. The abundance of attractions can be a major attraction for prospective travelers. Saturation will be routine daily living, demands for a limited time, as well as economic efficiency considerations, make the prospective tourists trying to find alternative tourist products are able to meet the satisfaction, comfort, recreation, multiply the new cheap and practical experience [2].

The difficulty of finding the option to specify points of interest then it takes the appropriate decisions of a variety of variable that supports the reference to visiting tourist attractions [3]. Decision Support System is interactive computer-based systems that help decision-makers utilize data to solve a problem. There are a few methods in the Decision Support System include Saw (Simple Additive Weighting) and the Topsis (Technique for Order Preference by Similarity to Ideal Solution) [4]. Madm Saw and Topsis method can be used to complete the selection of a number of alternatives based on some criteria that have been set. The determination of the criteria, decision makers or pass judgment on any alternatives, as well as the weighting of each criterion are important factors that may affect the calculation method of the Saw and Topsis [5]. The basic concept of the method is to find a weighted summation of the Saw of the performance rating on each alternative in all attributes. Whereas the principle that using Topsis alternative selected should have the closest distance from the ideal solution is positive and farthest from the ideal solution negative based on geometric point of view by using Euclidean distance to determine the relative proximity of an alternative with an optimal solution [6]. The use of the Saw and Topsis method have in common in the process of solving the problem by performing the turn weight [7]. Topsis method considers the subjective preferences as the decision maker to determine attribute weights of interest [8]. Method the method by using the Saw where each criterion is given more weight to get the rating of each alternative [9]. Decision making with this Saw methods become more efficient [10]. the faster the Saw method is used to determine the place of interest because this method is simple and specific, as well as in the weighted directly fixed on the value weights and do rank [11].

In this study the author makes a comparison of methods to determine the Saw and Topsis and help in the selection of attractions in Indonesia with the five criteria i.e., the location,

costs, transportation, distance and time visiting with attractions Bunaken, Komodo island, Toba Lake, Kalimutu Lake, Lombok, Bromo, Monas, Borobudur Temple, Lot Land, Wakatobi, and Papua Raja Ampat. The reason using the method and Topsis Saw in this research because both of these methods incorporated in the Madm model (Multi-Attribute Decision Making) as well as decision matrix and requires the value weights for calculating [12]. The purpose of this Saw and Topsis method helps determine and increase local and foreign tourist visits to various attractions are there in Indonesia with the determination of the criteria for decision making give judgment on any alternative and weighting of each criterion.

In recent years, tourism has emerged as an opportunity by leveraging the potential of nature. Comparative advantage Fahp and Topsis is that Fahp can collect qualitative data, quantitative effectively, analyze the values with fuzzy logic and give alternative ratings while rating Topsis method by comparing each alternative to the ideal solution [5].

Decision support system of delivering results in the form of a priority of tourist attractions to suit every traveler and also refers to a scale of weights that is owned by every tourist attraction in choosing [14]. This research uses the Matlab GUI that can assist the user in performing data processing using Topsis to select attractions in Central Java [4].

Based on previous research associated with this research method is to use the Saw and Topsis method in decision making, to explain the problem, gather data into information and determine the issue of alternative solutions in choosing tourist sites to be visited.

The purpose of this research can help determine and increase local and foreign tourist visits to various attractions are there in Indonesia with the determination of the criteria for decision making give judgment on any alternative and weighting of each criterion.

II. LITERATURE REVIEW

A. Decision Support System

Decision support system are usually built to provide solutions to a problem. Characteristics of a decision support system is to support the decision-making process of an organization or company, the human/machine interface where humans remain in control of the decision-making process, supporting decision makers to discuss the problem of systematic, systematic and spring supports several interrelated decisions, has a capacity of dialogue to get information as needed, have integrated subsystems such that can function as a unitary system, and had the first two parts namely data and models [15].

B. *Simple Additive Weighting* (SAW)

A method of Simple Additive Weighting (Saw) is called by the method of weighted sum. The concept is essentially looking for a weighted summation of rating performance on any alternative on all attributes. For the steps is [15]: (a) Specify the criteria that will be used as reference in decision-making, i.e. Cj. (b) Provides the value of each alternative Ai on any criteria that are already determined, where that value is obtained based on the value of the crips. (c) Determine the value of rating the suitability of each alternative on each criterion are then mapped into fuzzy numbers after that convert to integer crips. (d) Define weighting of preference or importance (W) on each criterion. (e) Make a decision matrix (X) formed from a table rating the suitability of any of the alternatives on each criterion. (f) Do the decision matrix with normalization steps do calculation value nomalisation performance rating (rij) from alternative Ai on the criteria of Cj.

$$Rij = \begin{cases} \dfrac{X_{ij}}{Max\ Xij} & If\ j\ a\ benefit\ attribute\ (benefit) \\ \dfrac{MinX_{ij}}{Xij} & If\ j\ is\ an\ attribute\ of\ gain\ (cost)Xij \end{cases} \quad (1)$$

Where:

Rij= nomalisation performance rating Maxij = the maximum value of each row and column

Minij = The minimum value of each row and column Xij = rows and columns of a matrix

Description:

The criteria of profit when the value of the benefit the decision maker, rather the criteria conditions raises the cost for the decision maker and in the form of criteria of profit then value divided by the value of any columns, while for the criteria of cost, the value of each column is divided by grades. (g) The result of the value of the ternomalisasi performance rating (rij) forming the matrix ternormalisasi (R) and the final outcome (Vi) preference value is obtained from the sum of the work element nomalisation matrix multiplication with a weighted preference (W) a corresponding element of column matrix (W).

$$VI = \sum_{j=1}^{n} Wjrij \quad (2)$$

Description:

Vi = Rank for each alternative

WJ = value weighted rank (of each alternative) rij = value nomalisation performance rating

the values Vi larger indicates that alternative Ai more elected [15].

C. *Technique for Order Preference by Similarity of Ideal Solution (Topsis)*

Methods of Technique for Order Preference by Similarity of Ideal Solution (Topsis) capable of measuring the relative performance in the form of simple mathematical form and determine the value of the preference for the a alternative. Topsis method of working steps [15]:

1. Describe alternatives (m) and (n) criteria in a matrix, where the Xij is the measurement of choice of alternatives to a-i and ke-j criteria.

$$D = \begin{matrix} X_{11} & X_{12} & \dots & X_{1n} \\ X_{21} & X_{22} & \dots & X_{2n} \\ X_{m1} & X_{m1} & \dots & X_{mn} \end{matrix} \quad (3)$$

2. Create a matrix R IE normalisation decision matrix. Where the value of each element of the matrix obtained from equation 2

$$rij = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \quad (4)$$

3. Create a weighting on a matrix that has been normalized.

$$D = \begin{matrix} W_1 n_{11} & W_1 n_{12} & W_n n_n \\ W_2 n_{21} & \dots\dots & \dots\dots \\ W_j n_{m1} & W_j n_{m2} & W_1 n_{mn} \end{matrix} \quad (5)$$

4. Determine the value of the ideal solution for the positive and the negative solution is ideal. The ideal solution dinotasikan A +, while the ideal solution A-negative.

$A^+ = [Y_1^+ \quad Y_2^+ \dots Y_n^+]$ (6)

$A^- = [Y_1^- \quad Y_2^- \dots Y_n^-]$ (7)

5. Calculate the distance of a positive alternative to the ideal solution
   A. Calculation of the positive ideal solution can be seen in equation 6:

$$Si^+ = \sqrt{\sum_{i=1}^{n}(Y_i^+ - Y_{ij}+)^2} \quad (8)$$

   With I = 1, 2, 3, …, n
   B. Calculation of ideal solution negative can be seen in the equation 7:

$$Si^+ = \sqrt{\sum_{i=1}^{n}(Y_{ij} - Y_i -)^2} \quad (9)$$

   With I = 1, 2, 3, …, n
6. Calculate the value of preferences for each alternative. To determine the rank of each of the alternatives then need to be calculated in advance the value of the prefensi of each alternative.

$$V_i^+ = \frac{S_i^-}{S_i^+ + S_i^-} \quad (10)$$

Where $0 < C_i^+ < 1$ and i=1,2,3,…, m

After obtained the value of Ci +, then alternatives can be ranked based on sequence Ci +. From the results of this ranking can be seen the best alternatives i.e. alternative that has the shortest distance from the ideal solution and is furthest from the ideal solution.

III. RESEARCH METODOLOGY

A. Types of Research

This research includes descriptive research. The descriptive method for a method in researching the status of a group of humans, an object, a set of conditions, a system of thought, or an event in modern times. The purpose of this research is to create a descriptive, or painting a picture in a systematic, factual and accurate regarding the facts as well as the relationships between phenomena investigated [16].

This research was conducted to compare the methods of Saw and Topsis on the selection of attractions in Indonesia, where it shows the results of the ranking order is not always the same, because there is a different algorithm on both those methods and the difference in the scale of values of the weighting [5].

B. Variables And Measurements

1. Alternative Variables (Ai)

Alternate variable in this study is the Bunaken, Komodo island, Toba Lake, Kalimutu Lake, Lombok, Bromo, Monas, Borobudur Temple, Lot Land, Wakatobi, and Papua Raja Ampat.

2. Variable criteria (Cj)

Variable criteria used in this study consists of the location, costs, transportation, distance and time of the visit in advance in the analysis for the creation of the universe to the talks. Questionnaires are used as a benchmark achievement of this research with respondents to the youth, adults and older people who become sightseeing objects connoisseur.

Stages of the study consist of two phases, namely the stage of data collection and data analysis stages:

1. Data collection

In this method of writing do data collection using: (1) primary Data is carried out by (a) a Study of the literature, at this stage the author of digging the concept of research through the study of the literature based on studies that have been done before for supporters in the study of the topic of the research the author did. (b) the observation, at this stage of data collection, was done through direct observation of the famous sights in Indonesia, further process data observations, to be analyzed by the method of Saw and Topsis. (2) the secondary Data is derived from the collection and to identify and manipulate data written shaped books and journals related to the problem.

2. Data analysis method

Data analysis in the study is very important in research methodology, as with the analysis, the data can be processed, processed and given meaning and significance in solving the case. In this study either using two methods, namely Saws and Topsis is the method of decision-making that takes into account things qualitative and quantitative. In this study, the author uses quantitative data.

C. The methods and techniques of Data analysis

This research uses Topsis and Saw method. Both of these methods will be compared and analyzed for the selection of tourism destination in Indonesia.

The technical of the analysis uses the techniques of analysis of quantitative data, i.e., data analysis techniques using mathematical norms against numerical data/numeric.

IV. RESULT & DISCUSSION

This research is focused on the application of Multi-Attribute Decision Making on decision support system for the selection of attractions in Indonesia using Topsis and Saw method. Both of these methods is a framework to take decisions effectively. Testing this method focuses on the visible user actions and recognizes the output of the system. Comparative analysis of the method of Saw and Topsis shows ranked results are not the same, because there is a different algorithm on both the method and the difference in the scale of values of the weighting.

A. Determination of the alternative and the criteria used

The research is conducted to select of tourism destination in Indonesia. This has some criteria's as reference of the calculation using Topsis and Saw method. For the criteria

method is determined by K1=Location, K2= Cost, K3=Transportation, K4=Distance, and K5=Time to visit with the alternative assessment A1=Bunaken, A2= Komodo Island, A3=Toba Lake, A4=Kalimutu Lake, A5= Lombok, A6=Bromo, A7=Monas, A8=Borobudur Temple, A9=Lot Land, A10=Wakatobi, and A11=Raja Ampat Papua.

B. The algorithm Technique for Order Preference by Similarity of Ideal Solution (Topsis)

The criteria of Topsis algorithm is as same as Saw algorithm used. The process is to determine the standard weights. For the standard value of Topsis algorithm such as 1 = lowest, 2 = low, 3 = fair, 4 = high, 5 = highest. According to Preference weights criteria consist of W= (5, 3, 4, 4, 5). After getting the ideal solution, the next step is to determine the distance of an alternative to the ideal solution of positive and negative, the distance between each alternative with a positive ideal solution on table 1. and the distance between each alternative with a negative ideal solution can be seen in table 2. the following:

TABLE 1. THE IDEAL SOLUTION POSISTIF

Alternative	K1	K2	K3	K4	K5	Total
A1	2,21	0,00	1,09	0,00	1,56	2,20
A2	2,21	0,00	1,09	0,10	2,51	2,43
A3	2,21	0,17	0,57	0,00	1,56	2,12
A4	1,33	0,00	1,09	0,10	1,56	2,02
A5	1,33	0,04	1,09	0,00	2,51	2,23
A6	0,14	0,56	0,09	0,92	0,03	1,32
A7	0,02	0,46	0,05	0,92	0,22	1,29
A8	0,14	0,73	0,02	0,58	0,13	1,26
A9	0,03	0,56	0,09	0,92	0,07	1,29
A10	0,03	0,56	0,05	0,74	0,22	1,26
A11	0,00	0,90	0,00	1,34	0,00	1,50

TABLE 2. THE IDEAL SOLUTION NEGATIVE

Alternative	K1	K2	K3	K4	K5	Total
A1	0,00	0,90	0,00	1,34	0,11	1,53
A2	0,00	0,90	0,00	0,72	0,00	1,27
A3	0,00	0,29	0,09	1,34	0,11	1,35
A4	0,11	0,90	0,00	0,72	0,11	1,36
A5	0,11	0,55	0,00	1,34	0,00	1,42
A6	1,24	0,04	0,55	0,04	1,97	1,96
A7	1,79	0,07	0,69	0,04	1,24	1,96
A8	1,24	0,01	0,83	0,16	1,50	1,93
A9	1,73	0,04	0,55	0,04	1,73	2,02
A10	1,73	0,04	0,69	0,09	1,24	1,95
A11	2,21	0,00	1,09	0,00	2,51	2,41

Next search the value of preferences for each alternative (Vi) then created rankings and results can be seen in table 3:

TABLE 3. THE VALUE OF PREFERENCES AND RANKING

Alternative	Positive	Negative	Preferences	Rank
A1	2,20	1,53	0,41	7
A2	2,43	1,27	0,34	11
A3	2,12	1,35	0,39	9
A4	2,02	1,36	0,40	8
A5	2,23	1,42	0,39	10
A6	1,32	1,96	0,60	6
A7	1,29	1,96	0,60	5
A8	1,26	1,93	0,60	4
A9	1,29	2,02	0,61	2
A10	1,26	1,95	0,61	3
A11	1,50	2,41	0,62	1

The values Vi larger indicates that alternative Ai is preferred. V1 is indicated by the A11 was chosen as the attractions being the main options with a value of 0.62 Raja Ampat Papua.

C. The Algorithm Is Simple Additive Weighting (Saw)

First the algorithm performed the Saw is determining the value criteria set in an alternative Cj Ai, weighting of preference (Wj) any criteria of cj. To message is K1 = location with weighting of 20%, K2 = costs by 25% weighting, K3 = transportation with 30% weighting, K4 = distance with weights 12.5% and K5 = time to visit with weights 12.5%. For the default value algorithms Saw is 1 = lowest, 2 = low, 3 = fair, 4 = high, 5 = highest.

Alternative weights have been adjusted to match value than the normalization to the results in table 4:

TABLE 4. RESULTS NORMALIZATION ALGORITHM WITH SAW

Alternative	K1	K2	K3	K4	K5
A1	1,00	0,60	0,75	0,80	0,80
A2	1,00	0,60	0,75	0,60	1,00
A3	1,00	1,00	1,00	1,00	0,80
A4	0,80	0,60	0,75	0,60	0,80
A5	0,80	0,75	0,75	0,80	1,00
A6	1,00	0,75	0,60	0,60	0,60
A7	0,60	0,60	0,75	0,80	1,00
A8	1,00	0,75	0,75	1,00	1,00
A9	0,80	0,75	0,60	0,80	0,80
A10	0,80	0,60	0,75	0,80	1,00
A11	1,00	0,75	0,75	0,80	1,00

After obtaining the results from the normalization, then next will be made multiplication matrix (preferences) to get a ranking of all the alternatives.

TABLE 5. THE VALUE OF THE PREFERENCE AND RANK

Alternative	Result	Rank
A1	0,78	6
A2	0,78	6
A3	0,98	1
A4	0,71	11
A5	0,80	4
A6	0,72	10
A7	0,72	9
A8	0,86	2
A9	0,73	8
A10	0,76	7
A11	0,84	3

The end result of the process of calculation and matrix multiplication, it can be concluded that the highest value is the code (A3) with a value of 0.98 i.e. Toba Lake established as the election of the first attraction based on calculations algorithm of Saw.

D. Comparison of Results of method Topsis and Saw

TABLE 6. THE RESULTS OF THE COMPARISON OF THE METHODS OF THE SAW AND TOPSIS

SAW Method			Topsis Method		
Alternative	Total Value	Rank	Alternative	Total Value	Rank
A1	0,78	6	A1	0,41	7
A2	0,78	6	A2	0,34	11
A3	0,98	1	A3	0,39	9
A4	0,71	11	A4	0,40	8
A5	0,80	4	A5	0,39	10
A6	0,72	10	A6	0,60	6
A7	0,72	9	A7	0,60	5
A8	0,86	2	A8	0,60	4
A9	0,73	8	A9	0,61	2
A10	0,76	7	A10	0,61	3
A11	0,84	3	A11	0,62	1

Based on the method of Saw, the code (A3) with a value of 0.98 Toba Lake tour object set as the primary option. While the value of the V1 Topsis method based on directed by A11 on behalf of Raja Ampat Papua is designated as the primary option with a value of 0.62. The final results of these two methods of calculation can be inferred, there is a difference between the results because there are a different algorithm and value weighting scale. Basically, both the methods used in this research was instrumental in recommending.

V. CONCLUSION

The study uses five criteria i.e., location, costs, transportation, distance, and time to visit. For the selection of attractions in Indonesia by doing a comparison Saw and Topsis method. Both of these methods can be used to complete the selection of a number of alternatives based on some criteria that have been set. There is a difference between the results of the comparison because there is a different algorithm on both the method and the difference in the scale of values of the weighting. From the results of the comparison method, Topsis and Saw obtained results that Saw method is better than Topsis method. Based on the results of the comparison method Saw greater than 0.98 Topsis method with a value of 0.62. This method can be used to complete the selection of a number of alternatives based on some criteria that have been set. The determination of the criteria for decision makers pass judgment on an alternative. The weighting of each criterion is important factors that may affect the method. To research further, can add criteria and alternatives as well as created a complex program and use another method of a decision support system for the selection of tourist attractions.

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