Determination system of designing the best beach object in bali by using AHP method

A Susano*, S Sutrisno, A Darmawan, P Pujiastuti, D Novita, S Syamsiyah and A Mufti

Universitas Indraprasta PGRI Jl.Nangka No 58 Tanjung Barat Jagakarsa Jakarta Selatan, 12530

*adhi.susano@gmail.com

Abstract. This study aims to create a determinant system of awarding the best tourism object. Determining system of determination of the best tourist object based on internal and external criteria from the method which is done still found uncertainty of the assessment which is too subjective. Therefore, it is needed the selection method of determining the object of tourism in order to get more accountable results. The design of this decision support system used analytic hierarchy process method in giving consideration to the community to determine the destination of the tourist attraction. The basic concept of AHP is the use of pair wise comparison matrices (pair wise comparison attributes) to generate relative weights between criteria and alternatives. A criterion will be compared with other criteria in terms of how important it is to the achievement of the above objectives. The core of the AHP lies in pair wise comparisons depicted by the ratio of ratios related to the AHP scale. Based on the results of research can be taken conclusion, the results of the system in the form of candidate ranking Object tours are obtained from the calculation of priority values and value of the object of tourism.

1. Introduction

Tourism activities are one of the main sectors that can promote national economic activities, both as a foreign exchange earner, a provider of employment, as well as driver of income generation.

Empirically tourism has shown a steady growth marked by an increase in the frequency of people travelling. Many tourism activities create benefits such as the spread of development, foreign exchange income and local revenue through tax collection, employment and creating business opportunities. The problems that often arise are still many people who travel but instead create a new burden of thought. Travelling is also an important physical need without us knowing it. Because with the tour we can eliminate fatigue due to the activities during the day. The selection of the right attractions also has an effect on this. Therefore, aware of the importance of choosing the right tourism attraction needs a system in the field of tourism.

The system is expected to be used to obtain information and decision-making of tourism object selection effectively and able to help the community to determine the location of the tourism attraction that will be visited.
The above problems can be solved by building a Decision Support System (SPK) that can assist the community in conducting the assessment and selection of the best tourist object determination. SPK is a model built to solve structured problems.

Systems built by applying AHP method incorporation with approach. AHP is one of the decision support methods developed by Professor Thomas Lorie.[1][2]

1.1. Tourism Object
Understanding of tourist objects and attractions according to law No. 9 of 1990, namely Objects and attractions consist of:

1.1.1. Objects and attractions of the creation of God Almighty, which is the nature of the state, and the flora and fauna;
1.1.1. Objects and attractions of human works of manifestation of museums, ancient relics, historical relics, cultural arts, agro tourism, Tirta tours, hunting tours, nature adventure tours, recreational parks and entertainment venues.

1.2. Bali Geography Condition
Bali is one of the provinces in Indonesia whose territory consists of one island, namely Bali Island and some small islands around it. Among the small islands, the largest island is Nusa Penida located in the southeast of Bali Island. The total area of Bali Province is 5633 km2

1.3. Bali Tourism Object
Bali has a very diverse tourist attractions, both nature tourism, cultural tourism, and marine tourism. In Bali there are about 54 locations of attractions spread across eight districts.

1.4. AHP (Analytical Hierarchy Process)
In essence AHP is a comprehensive decision-making model taking into account the things that are qualitative and quantitative. AHP also allows the structure of a system and environment into interacting components and then unifies them by measuring and managing the impact of system error components [5].

2. Research Method
2.1. Types and Data Sources
Primary data is data taken directly from the source that is research object. In this study, the object of research in the form of materials and terms - requirements in determining the best tourist attraction is in Bali. Secondary data is data taken indirectly from source. In this final report, secondary data is obtained from library books, scientific journals, papers, theses, and searching information from the internet, which serve as the theoretical basis and complementary primary data.

2.2. Method of Collecting Data
In preparing this research to get the truth data, various data collection methods to conduct this research are used. The methods used are:
Questionnaire Method. The author conducted the provision of questionnaires to obtain the data used for the manufacture of the system, including categories and determination of value. The provision of questionnaires conducted in Bali, and the target is the visitors in the tourism attraction. Data collection is done by doing literature review on related theories of books, articles, journals, and articles on the web. The theory is about the design and the basics of making Decision Support System with Analytical Hierarchy Process (AHP) method.

2.3. Analysis and Design Method
2.3.1. Hierarchy Arrangement
From the determinants of the best tourism object is found 10 main criteria with each criterion has 10 alternatives.

| Criteria | Name of Criteria |
|----------|----------------|
| K1       | Attraction      |
| K2       | Accessibility   |
| K3       | Amenities      |
| K4       | Ancillary Services |
| K5       | Economy        |
| K6       | Socio Cultural |
| K7       | Environment    |
| K8       | Politics and Government |
| K9       | Technology Development |
| K10      | Competitiveness |

| Alternative | Alternative Name |
|-------------|------------------|
| A1          | Nusa Dua Bali Beach |
| A2          | Jimbaran Beach |
| A3          | Kuta Bali Beach |
| A4          | Pandawa Beach |
| A5          | Sanur Bali Beach |
| A6          | Karma Kandara Beach |
| A7          | Tanah Lot Beach |
| A8          | Virgin Karangasem Bali Beach |
| A9          | Dreamland Beach |
| A10         | Menjangan Bali Barat Beach |

2.3.2 Criteria and Alternative Assessment
Criteria and alternatives are assessed through pair wise comparisons. According to Saaty (1988), for various issues, the scale 1 to 9 is the best scale in expressing opinions. The value and definition of qualitative opinion from the Saaty comparison scale.

Comparisons are made on the basis of the policy of the decision maker by assessing the importance of one element to the other elements of the pair wise comparison process, starting from the uppermost hierarchy level aimed at selecting the criterion, eg A, and then the elements to be compared, eg A1, A2, A3, A4, A5.

To determine the relative importance value between elements is used the scale of numbers from 1 to 9 as in Table 2.1. This assessment is made by a decision maker who is expert in the subject matter being analyzed and has an interest in it. When an element is compared with itself it is given a value of 1. If element i compared with element j gets a certain value, then element j compared with element i is the opposite.

In this AHP, alternative assessment can be done by direct method (direct), the method used to enter quantitative data. Usually these values are derived from an earlier analysis or from the experience and a detailed understanding of the decision problem. If the decision maker has experience or a great understanding of the problem of the decision faced, then he can directly enter the weighting of each alternative.

2.3.3 Priority Setting
For each criterion and alternative, pairwise comparisons are necessary. The relative comparison values are then processed to rank alternatives from all alternatives. Both qualitative criteria, as well as quantitative criteria, can be compared in accordance with predetermined assessments to produce weight and priority. The weights or priorities are calculated by matrix manipulation or by solving
mathematical equations. Considerations for pairwise comparisons to gain overall priority through the following stages:

2.3.4 Selection Steps with AHP Method

a. The calculation of logical consistency is done by following the steps as follows:
   - Multiplying matrix with corresponding priority.

b. Summing the results per line.

c. The sum of each row is divided by the relevant priority and the results are summed.

d. The result is divided by the number of elements, will be obtained $\lambda_{max}$. e. Consistency Index (CI) = $(\lambda_{max} - n) / (n-1)$

e. Consistency Index = CR / RI, where RI is the index of random consistency. If the consistency ratio ≤ 0.1, the calculation results can be justified.

f. Calculate lambda value ($\lambda$) and Consistency Index (CI) and Consistency Ratio (CR) with the formula:

$$\lambda = \frac{\sum_{j=1}^{n} \frac{CI_j}{CI}}{n}$$

In this case RI (Random Index) is the consistency average index for the numerical numbers taken randomly from the scale of 1/9, 1/8, ..., 1, 2, ..., 9, based on a study conducted by Saaty on 500 samples. This RI value can be seen from table 2 below [6]).

3. Result And Discussion

3.1 Analytical Hierarchy Process (AHP)

Create a pairwise comparison matrix that describes the relative contribution or effect of each element to the above-stated objectives or criteria

| Table 3. Pairwise Comparison Matrices |
|--------------------------------------|
| K1 | K2 | K3 | K4 | K5 | K6 | K7 | K8 | K9 | K10 | Total |
|----|----|----|----|----|----|----|----|----|----|-------|
| K1 | 1.000 | 3.000 | 5.000 | 7.000 | 9.000 | 1.000 | 3.000 | 5.000 | 7.000 | 9.000 |
| K2 | 0.333 | 1.000 | 1.667 | 2.333 | 3.000 | 0.333 | 1.000 | 1.667 | 2.333 | 0.143 |
| K3 | 0.200 | 0.200 | 1.000 | 1.400 | 1.800 | 0.200 | 0.600 | 1.000 | 1.400 | 0.200 |
| K4 | 0.143 | 0.429 | 0.714 | 1.000 | 1.286 | 0.143 | 0.429 | 0.714 | 1.000 | 0.333 |
| K5 | 0.111 | 0.333 | 0.556 | 0.778 | 1.000 | 0.111 | 0.333 | 0.556 | 0.778 | 1.000 |
| K6 | 1.000 | 3.000 | 5.000 | 7.000 | 9.000 | 1.000 | 3.000 | 5.000 | 7.000 | 0.111 |
| K7 | 0.333 | 1.000 | 1.667 | 2.333 | 3.000 | 0.333 | 1.000 | 1.667 | 2.333 | 0.143 |
| K8 | 0.200 | 0.600 | 1.000 | 1.400 | 1.800 | 0.200 | 0.600 | 1.000 | 1.400 | 0.200 |
| K9 | 0.143 | 0.429 | 0.714 | 1.000 | 1.286 | 0.143 | 0.429 | 0.714 | 1.000 | 0.333 |
| K10 | 0.111 | 0.333 | 0.556 | 0.778 | 1.000 | 0.111 | 0.333 | 0.556 | 0.778 | 1.000 |
| Total | 3.575 | 10.324 | 17.873 | 25.022 | 32.171 | 3.575 | 10.724 | 17.873 | 25.022 | 12.463 |

The number 1 in Comfort line column describes the same level of interest between Comfort and Comfort, while the 2 in the Safe Line facility column indicates doubtful assessment of the Facilities and Comfort interest level. The 0.5 figure in the Safe Line of the Facility column is a $1/n$ value calculation on the Comfort Secrets column. The other numbers are obtained in the same way. The sum value is derived from the sum of each column.

| Table 4. Matrix Criteria and Matrix Normalization |
|-----------------------------------------------|
| K1 | K2 | K3 | K4 | K5 | K6 | K7 | K8 | K9 | K10 | Total | Vektor |
|----|----|----|----|----|----|----|----|----|----|-------|-------|
| K1 | 0.280 | 0.291 | 0.280 | 0.280 | 0.280 | 0.280 | 0.280 | 0.280 | 0.722 | 3.251 | 0.325 |
The value of 0.0833 in the Comfort row Comfort column is obtained from the column value of Safe row Comfort Table 4 is 1 divided by the number of column Comfort Table 4 is 12. Value 0.0588 row/on the column Secure line facility obtained from value row Comfort line facility Table 4 is 2 divided number of Facilities Table 4 is 0.088. Do it the same way for columns and the next line. The sum column values are derived from the summations on each line. For the first number of rows the value of 0.4031 is the result of the summation of the Safe column (0.0833), the Facility column (0.0588), the Price column (0.0968), the Location column (0.1154) and the Design column (0.0488).

The value in the priority column is obtained from the value in the sum column divided by the number of criteria, in this case 5. The value of the sum row is obtained from the priority line sum.

### Table 5. Multiplication of numbers and priorities.

| Criteria | Total   | Vektor  | Result |
|----------|---------|---------|--------|
| K1       | 3.251   | 0.325   | 1.056575 |
| K2       | 0.854   | 0.085   | 0.07259  |
| K3       | 0.483   | 0.048   | 0.023184 |
| K4       | 0.388   | 0.039   | 0.015132 |
| K5       | 0.361   | 0.036   | 0.012996 |
| K6       | 2.538   | 0.254   | 0.644652 |
| K7       | 0.854   | 0.085   | 0.07259  |
| K8       | 0.522   | 0.052   | 0.027144 |
| K9       | 0.388   | 0.039   | 0.015132 |
| K10      | 0.361   | 0.036   | 0.012996 |
| Total    | 1.952991|         |        |

The sum column value is derived from the total number of table 3.2, based on their respective criteria. The priority column value is derived from the priority table value of Table 3.3. The resulting column values are derived from the multiplication of number and priority column columns. The value of the number row is gained from the sum of the resulting columns.

### Table 6. AHP alternative priority for Safe criteria

| L1   | L2   | L3   | L4   | L5   | L6   | L7   | L8   | L9   | L10  | Total | Vektor |
|------|------|------|------|------|------|------|------|------|------|-------|--------|
| 0.28 | 0.291| 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.28 | 0.722| 3.251| 0.325 |
| 0.093| 0.097| 0.093| 0.093| 0.093| 0.093| 0.093| 0.093| 0.011| 0.854| 0.085 |
| 0.056| 0.019| 0.056| 0.056| 0.056| 0.056| 0.056| 0.056| 0.016| 0.483| 0.048 |
| 0.04 | 0.042| 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.027| 0.388| 0.039 |
| 0.027| 0.027| 0.027| 0.027| 0.027| 0.027| 0.027| 0.027| 0.027| 0.027| 0.027 |
After obtaining weights for all three criteria and scores for each of the five homes, the last step is to calculate the total score for the five houses. The results of the assessment will be summarized in the form of the so-called table Overall Composite Weight.

4. Conclusions
In a decision-making process involving multiple criteria, the AHP method can be used to determine the priority weights for each of the criteria on which the appropriate decision analysis is based. Based on the result of priority weight analysis on the main criterion with AHP, Competitiveness criterion (K10), has the greatest influence for the end in determining the tourism destination of 0605, The second criterion is Environment (K7), amounted to 0.531. The third criterion is Accessibility (K2) of 0.521. The fourth criterion is Social Culture (K6), of 0.44. The fifth criterion is Technological Progress (K9), of 0.439. The sixth criterion is Economics (K5), amounting to 0.419. The seventh criterion is Politics and Comfort (K3), amounting to 0.367. The eighth criterion is Political and Governmental (K8), of 0.367, The ninth criterion is Ancillary Services (K4), amounting to 0.521 The ninth criterion is Accessibility (K2) of 0.341 and the last is Attractiveness (K1) of 0.329.

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