DECISION SUPPORT SYSTEM USING AHP ALGORITHMS TO DEVELOPMENT OF BALI TOURISM DESTINATION

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ABSTRACT

Development of Bali tourist destinations using the concept of local wisdom Tri Hita Karana (THK). THK is a concept that contains the philosophy of community life in Bali which means three causes of welfare. This concept is needed to realize a dynamic reciprocal relationship between tourism, culture and nature. In determining a decision to develop an object in a tourist destination using the THK concept, knowledge from several stakeholders is needed. To combine decisions from several stakeholders, a Decision Support System (DSS) is needed. DSS is a computer-based system that can support the Bali Provincial Government Tourism Office and several components involved in THK to take a decision in developing an object in a tourist destination. To determine the decision of each individual used the AHP model. The AHP model is a model that can solve complex multi-criteria problems into a hierarchy. This AHP model will produce alternative individual decisions from the results of parameter weight processing for each individual. Based on the final result of the DSS, the development of Bali tourism destinations based on THK is in the form of ranking of the six parameters used (Promotion of tourist destinations, Improvement of facilities, Human Resources, Synergy, Environmental preservation, Setting of holy places). The alternative that has the highest value is used as a reference in developing a THK-based tourist destination.

Keywords: *GDSS, AHP, Borda, THK*

1. INTRODUCTION

Bali Province is one of the provinces famous for its culture and nature tourism, so it has become an icon of Indonesian tourism in the eyes of the world. The socio-cultural life of the Balinese people is so unique and religious, which is based on belief and religion that is combined harmoniously with the concept of local wisdom Tri Hita Karana, making Bali very attractive to local and international tourists to visit. Tri Hita Karana is a cultural heritage of the past that contains the basic philosophy of life for the Balinese people. Tri Hita Karana is the basis for obtaining happiness in life if you are able to have a harmonious relationship based on yadnya (rituals, sacrifices) to Ida Sang Hyang Widhi in the form of devotion (sincere), to fellow humans in the form of devotion, and to the natural environment in the form of nature conservation lovingly [1][2].

The concept of Tri Hita Karana in the implementation of Bali tourism is a concept that can direct the development of Bali tourism for the future to be better and more advanced without losing the culture and norms that form the basis of Balinese life [3]. This has also been regulated in the Regional Regulations of the Province of Bali, precisely in Regional Regulation 5 years of 2020 concerning the Standards of Organizing Balinese Cultural Tourism with the Grace of God Almighty. In the regional regulation, specifically in Article 3, it is stated that the standard setting for the implementation of Balinese cultural tourism is aimed at preserving the natural environment and Balinese culture, which is imbued with the Tri Hita Karana philosophy based on the values of local wisdom of Sad Kerthi and improving the quality of the implementation of Bali tourism. Thus, it is hoped that this will later realize a dynamic reciprocal relationship between tourism and culture

that makes them develop synergistically, harmoniously, and sustainably to provide welfare to the community and cultural and environmental sustainability [4].

The management and development of Bali tourist destinations are carried out by the Bali Provincial Government Tourism Office. The number of components that need to be further developed in Bali tourist destinations based on the concept of local wisdom Tri Hita Karana makes the Bali Provincial Tourism Office unable to immediately develop a tourist destination based on the wishes and interests of the agency itself. There need to be discussions with the community and holy people (mangku/pinandita) so that the development that will be carried out can be in line with the Tri Hita Karana concept so that the development of Bali tourism can develop synergistically with the lives of all Balinese people. Based on data obtained from the three sources at the Tourism Office of the Bali Provincial Government, the three sources have the same view on the development of Bali tourism destinations based on the Tri Hita Karana concept that must be developed in stages because it requires relatively large funds, especially after the Covid-19 pandemic with the current situation. Bali's economy has not yet recovered, and to find out to what extent these developments can have an effect on the attractiveness of tourist destinations.

Bali for the sustainability of the sustainable development of Bali tourism which is good for the future. Based on this, the Bali Provincial Government Tourism Office needs to make a group decision by considering several aspects of the criteria that are closely related to the concept of local wisdom Tri Hita Karana, namely Parahyangan, Pawongan, and Palemahan, to be able to prioritize the components that will be developed in tourist destinations. In determining a decision, many factors influence the decision-making of a decision-maker, so it is deemed necessary to identify various important aspects and consider the influence of one element on other factors before making a final decision [5].

One of the DSS models that is able to manage the factors of perception, preference, experience and intuition from decision makers into a decision is the Analytic Hierarchy Process (AHP) model [8]. This model was chosen to be able to make an effective decision-making framework on a complex problem by simplifying the decision-making process and solving the problem into criteria and then arranging these criteria in a hierarchical arrangement. So that the results of the analysis can synthesize various considerations to determine which variables have the highest priority and act to influence the results in that situation [6][8]. The AHP method in developing tourist destinations is used to weight the parameters for each decision maker (DM) involved in the process of developing Bali tourist destinations.

One of the DSS models that can manage the factors of perception, preference, experience, and intuition from decision-makers into a decision is the Analytic Hierarchy Process (AHP) model [8]. This model was chosen to make a practical decision-making framework for a complex problem by simplifying the decision-making process and solving the problem into criteria, then arranging these criteria in a hierarchical arrangement. The AHP method in developing tourist destinations is used to weight the parameters for each decision-maker (DM) involved in developing Bali tourist destinations so that the results of the analysis can synthesize various considerations to determine which variables have the highest priority and act to influence the results in that situation [6][8].

2. RESEARCH METODOLOGY

2.1 *Alternatif, Decision Maker (DM) dan Criteria*

As for the alternatives, the decision-maker (DM) and the criteria used in developing Bali tourist destinations with the AHP and Borda algorithms based on the Tri Hita Karana concept are explained in the following sub-chapters.

2.1.1 *Alternative*

Alternatives are different objects with the same opportunity to be selected in a decision support system. In this study, some alternatives have the opportunity to be selected to be developed in Bali tourist destinations based on the concept of local wisdom Tri Hita Karana.

2.1.2 *Decision Maker (DM)*

A decision-maker is someone who has the right to determine or make a decision. In this study, DM to determine decisions in the development of Bali tourist destinations based on the concept of local wisdom. Tri Hita Karana is divided into three DMs. DM 1 is the Head of the Tourist Attractions Development Section representing the Parahyangan section, DM 2 is the Head of Human Resources Development and Institutional Division representing the Pawongan section, and DM 3 is the Head of the Tourism Destinations Division representing the Palemahan section.

2.1.3 *Criteria*

Criteria are parameters that are used as a reference in making a decision. In this study, each DM has its criteria to be able to determine the available choices.

2.2 *Decision Support System for Tourism Destination Development*

DSS is planned to assist organizational decision-making. A decision support system or decision support system is an information system at the management level of an organization that produces various alternative decisions by combining data and sophisticated analytical models or data analysis tools to support semi-structured and unstructured decisions. This decision support system is a further development of a computerized management information system that is designed in such a way that it is interactive with the user. This interactive nature is intended to facilitate decisions such as procedures, policies, analytical techniques, managerial experience, and insight to form a flexible decision framework (Budiman et al., 2020)(Putu Sugiartawan, Ni Nengah Dita Ardriani, 2019)(Bahari et al., 2018).

In determining a decision to develop a Bali tourist destination based on the concept of local wisdom Tri Hita Karana, the Tourism Office of the Provincial Government of Bali requires a group decision by considering several aspects of criteria that are closely related to the concept of local wisdom Tri Hita Karana, namely Parahyangan, Pawongan, and Palemahan. to be able to prioritize the components that will be developed in Bali tourist destinations. GDSS is a computer-based system that supports groups of people who are involved in a common task (goal).

2.3 *Analyctical Hierarchy Process (AHP)*

The AHP method is one of the decision-making methods proposed by Thomas L. Saaty. The workings of this method are almost similar to how the brain works, namely by breaking down complex problems into more structured and systematic problems. The decomposition of this problem is done by using the principle of hierarchy. According to Saaty, the hierarchy is structured into a structure consisting of several levels. The order of the levels/levels is the objectives, criteria, sub-criteria, and so on until the alternative level. (Bahari dkk., 2018).

The steps used in solving a problem with AHP are as follows (Alhogbi, 2018):

1) Defining a problem and determining the solution to the problem as desired, then compiling a hierarchy of problems encountered.
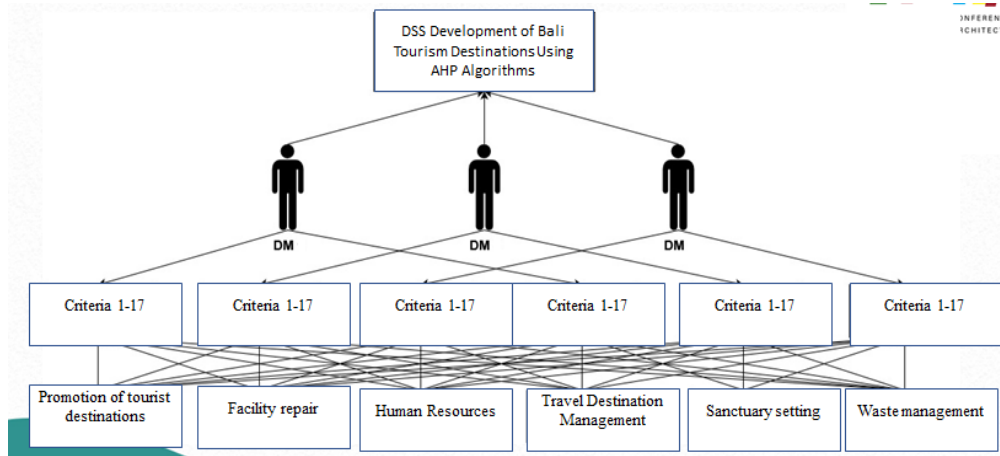
Figure 1 Hierarchical Structure

2) Determines the priority of an element. The step in determining priority is to create a pairwise comparison matrix. The comparison matrix is square A= $(a_{ij})_{nxn}$ which covers: $a_{ij}>0$, $a_{ij}=1/a_{ji}$ and $a_{ii}=a_{jj}=1$, which is often called the reciprocal matrix.

3) Synthesis.

Considerations for pairwise comparisons are synthesized to obtain priority values. The way this is done is:

a. Adding the values of each column in the matrix

$$\sum_{i=1}^{n} a_{ij} \text{, dengan i, j = 1, 2, ..., n.} \tag{1}$$

b. Divide each value in the column by the total column to get the normalized value of the matrix

$$a'_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}} \text{, dengan i,j = 1, 2, ..., n.} \tag{2}$$

c. The sum of each value in the row and then divided by the number of elements to get the average value.

$$W_i^T = \frac{\sum_{j=i}^{n} a_{ij}}{n} \text{, dengan i,j = 1, 2, ..., n.} \tag{3}$$

4) Measuring the value of consistency.

Consistent value is determined to determine how well it is used in a decision. In measuring the consistent value, the steps taken are:

a. Multiply each value in the first column by the relative priority of the first element, the value in the second column by the relative priority of the second element, and so on.

b. Sum each row.

c. The results obtained from adding up each row are then divided by the respective relative priority elements.

d. Adding the above quotient by the number of elements present, the final result is called max.

$$\lambda \max = \sum_{i=1}^{n} \sum_{j}^{n} a_{ij} W_j \tag{4}$$

5) Calculating Consistency Index (CI). By formula :

$$CI = \frac{(\lambda\max - n)}{n - 1} \tag{5}$$

Where: n = number of elements.

After the λmax value is found, the next step is to look for the CI value or consistency index. CI is λmax minus the number of elements, then divided by the number of elements minus 1.

6) Calculating *Consistency Ratio* (CR). By formula :

$$CR = \frac{CI}{RI} \qquad (6)$$

After the CI value is found, the next step is to look for the CR value or consistency ratio. The CR value can be obtained by dividing the value of CI by the IR value or random index.

7) Check the consistency of a hierarchy. If the value is more than 10%, then the assessment of a data judgment must be corrected. If the result value of the consistency ratio (CI/CR) is less or equal to 0.1, then the calculation is considered correct.

3. RESULTS AND DISCUSSION

3.1 Individual Ranking

The calculation process for determining alternative developments for Bali tourist destinations based on the THK concept begins with comparing the criteria for each DM. This comparison of criteria aims to find the weight of each criterion.

The following process is to find the Consistency Ratio (CR) value by determining the weight value for each DM. The CR value can be obtained by dividing the value of CI by the IR value or random index. The IR value can be obtained based on the number of elements that exist, then converted based on the IR table from the AHP model that has been provided. If the CR value obtained is less than or equal to 0.1, then the calculations can be declared consistent. However, if the calculations are carried out to get results greater than 0.1, the calculations can be declared inconsistent. The criteria comparison process must be repeated with a CR value of less than 0.1.

The individual ranking process is obtained from each alternative's results of the DM assessment. After carrying out the calculation process to obtain the alternative weight values of each of the criteria contained in each DM, the alternative ranking of each DM is determined. Where this process will produce a final score, the highest value will get the first rank, and the lowest value will get the last.

4. CONCLUSION

DSS in developing Bali tourism destinations based on THK is dynamic because the parameters used can be changed according to developments and critical needs. Based on the results of the research and discussions that have been carried out, it is concluded that the DSS modeling made by applying the AHP and Borda algorithms can determine the alternatives needed to develop a tourist destination based on THK local wisdom by using an assessment from each DM based on the following sections: Part of THK is Parahyangan, Pawongan, and Palemahan. The results obtained in this DSS can be a recommendation for the Bali Provincial Government Tourism Office to develop a tourist destination based on the THK concept.

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