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Best Hotel Selection Decision Support System using MOORA Method

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Abstract−The development of hotels has become an important part of the tourism industry, with the main function as a place to stay for guests. Hotels have evolved from simple structures to complex ones that offer various facilities and services to meet various guest needs. This study focuses on developing a system that can assist in making hotel selection decisions by considering various criteria such as hotel area, price, and room type. The problem discussed in this study is the difficulty in choosing the best hotel among many choices, which can be influenced by various factors. The purpose of this study is to design a system that can effectively evaluate and rank hotels based on their attributes, so that the decision-making process becomes more efficient and accurate. The MOORA method is used in this study to evaluate hotels based on their attributes. This method is very useful in situations where there are several criteria that are not mutually exclusive, allowing for a more comprehensive evaluation. This study uses a combination of data collection, definition of alternative criteria, and weighting to create a decision matrix. The results of this study demonstrate the effectiveness of the MOORA method in selecting the best hotel based on predetermined criteria. The result of this study is a decision support system that can be applied in various contexts where hotel selection is a crucial decision. This system provides a structured approach to evaluating hotels, ensuring that selection is based on a thorough analysis of the available options. This research contributes to the development of more effective decision-making tools in the hospitality industry, ultimately improving the overall customer experience.

Keywords: DSS; Best Hotel; Hotel Selection; MOORA Method

1. INTRODUCTION

A hotel is a form of accommodation that provides lodging, food, beverages, and other facilities for the general public, both for guests who stay overnight and those who only use certain facilities owned by the hotel. The field of science related to hotel management explores how to balance the tourism and hospitality aspects. business management to achieve success. Topics covered include customer service satisfaction, local cultural protection, financial benefits to local communities, and employee welfare [1].

The problem that often arises in choosing the best hotel is the difficulty in determining a hotel that fits the criteria of prospective visitors. This is due to the many choices of hotels in a city with different classes, prices, facilities, and locations. Therefore, prospective visitors must make a fairly complex comparison and take a long time to choose the best hotel. To solve this problem, a decision support system is needed that can help prospective visitors make faster and more accurate decisions.

Decision Support System (DSS) is part of a computer-based information system (including knowledge-based) that is used to support decision-making in an organization or company [2]. DSS can also be interpreted as a computer system that processes data into information that helps decision-making on semi-structured problems. This system is expected to function as an application that helps the decision-making process in determining the best hotel accurately, by providing various decision alternatives [3][4][5].

Hotel selection determination in Decision Support System to choose the best hotel using *Multi-Objective Optimization by Ratio Analysis* (MOORA) method [6]. MOORA is a multi-criteria decision-making method used to select the best alternative from a set of existing choices, especially when there are several conflicting criteria. This method is relatively simple but effective, and can be applied to various problems [7]. The usefulness of the MOORA method is as a flexible decision-making approach, can be used in various domains, especially when dealing with several conflicting criteria. Its ability to handle complex trade-offs between various factors makes it a valuable tool for various scenarios [8].

Based on previous research conducted by P. Marpaung and RF Siahaan in 2022 entitled "Implementation of the MOORA Method in a Decision Support System for Selecting the Best Hotel in Medan City", the results of this study show a comparison in determining the best hotel. With the application of the MOORA method in this study, it is known that the hotel that gets the highest stay value is the hotel located in the Padang Bulan area, Medan, namely the Kenaga Hotel [9].

Research conducted by Putra Heri in 2022 entitled "Decision Support System for Determining the Best Hotel in Medan City Applying the Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA) Method" shows that this method is able to solve problems in selecting hotels according to user desires. It is known that alternative A2 is the best alternative, because the MOORA value of alternative A2 is the highest value of all existing alternatives. A2 with the name Hotel with a value of 0.916 [10]. Research conducted by Angga Hazmi Harizah in 2020 entitled "Decision Support System in Determining the Location of Opening a New Branch of ABC Supermarket in Kutacane Using the MOORA Method" produced a method that makes it easier to determine the location of a new branch. From the ranking results obtained from the calculations, it is known that only one company on Jl.Kejaksaan was ranked first, namely: Cv. Berkah Oragnik Sidikalang with a value of 0.20535 [11]. Meanwhile, research conducted by Aulia Abdi Rohman et al in 2024 entitled "Determination of the Best Employees Using the MOORA Method at Supermarket M in Tegal City". The final

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results showed that Alternative 2 achieved the highest score of 0.461588847, indicating the superiority of the employee compared to others [12]. Further research was conducted by Teguh Bagus Wicaksono et al in 2024 entitled "Design of a Decision Support System for Scholarship Recipient Selection with a Web-Based MOORA Method Approach". The calculation results showed that A9 had the highest value of 0.20813, concluded that it was eligible as a scholarship recipient [13].

These studies have many important contributions, both for researchers and others. Research helps to increase knowledge, develop skills, open new opportunities, provide new information and insights, improve the quality of life, and encourage innovation and progress.

2. RESEARCH METHODOLOGY

2.1 Research Stages

From the example below or structure 1 is a framework for carrying out the stages or research steps as follows:

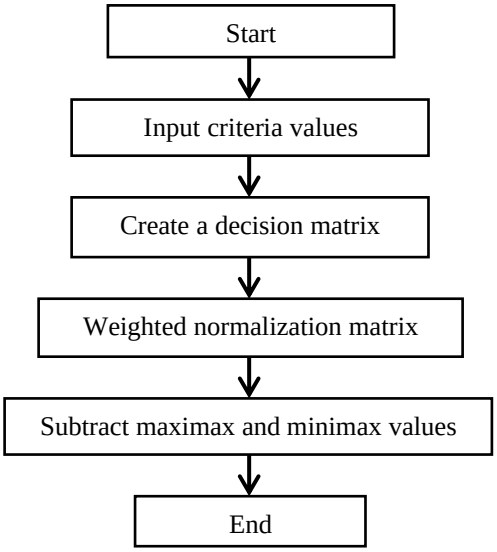

Figure 1. Research Stages

The following is a description and explanation of figure 1.

a. Inputting criteria values refers to the process of assigning values or assessments to each criterion used in an analysis or evaluation. This is an important step in various contexts, such as decision making, performance appraisal, or product evaluation.
b. A decision matrix is an analytical tool or technique used to visualize and analyze the relationship between various decision alternatives (options) and evaluation criteria (criteria). The main purpose of creating a decision matrix is to help decision makers in choosing the best alternative based on an assessment of the established criteria.
c. The weight normalization matrix is a step in the decision analysis process to ensure that the weights assigned to each criterion are comparable and relative to the weights of the other criteria. This is important because different criteria may have different scales or units, and normalizing the weights allows for fair comparisons between them.
d. Reducing the maximax and minimax values eliminates optimism or conservatism altogether, but rather ensures that the assessment of risk and potential returns is consistent with the conditions and data available. With a more balanced and realistic approach, decision makers can make more informed and informed decisions.

2.2 Decision Support System

Decision Support System (*DSS*) is a computer system designed to assist decision makers in collecting information, analyzing data, and presenting the results of the analysis in a structured manner [14]. The main purpose of DSS is to provide support in complex, data-oriented decision-making processes [15].

2.3 Hotels

A hotel is a type of accommodation provided for guests or travelers to stay temporarily, with various facilities and services provided for the comfort and needs of visitors. In general, a hotel is a place that provides bedroom services, food, drinks, and other services to paying guests. Here are some general characteristics of a hotel [16][17].

2.4 MOORA Method

The MOORA (*Multi-Objective Optimization by Ratio Analysis*) method is a method used for multi-criteria decision making. This method helps in sorting or evaluating alternatives based on several given criteria, which can be profit, cost,

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customer satisfaction, or other criteria relevant in the context of decision making [18]. The steps involved in completing this procedure are [19][20][21]:

a. Preparing the decision matrix.

$$X_{ij} = \begin{bmatrix} X_{11} & X_{12} & \cdots & X_{1n} \\ X_{21} & X_{22} & \cdots & X_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ X_{m1} & X_{m2} & \cdots & X_{mn} \end{bmatrix} \quad (1)$$

b. Calculate the normalization matrix.

$$X_{ij}^{*} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^{m} X_{ij}^{2}}} \quad (2)$$

c. Calculating preference values.
In this step, which is the core of the process, each attribute is multiplied by the criteria weight for each alternative, then the results of the profit criteria are added up and subtracted from the results of the loss criteria using the following formula:

$$y_i^{*} = \sum_{j=1}^{g} w_j X_{ij}^{*} - \sum_{j=g+1}^{n} w_{jX_{ij}^{*}} \quad (3)$$

3. RESULTS AND DISCUSSION

3.1 Data Analysis

Based on the description of the data that has been collected, the researcher and the object that is used as part of the research conduct data analysis so that sub-criteria are found as a need for the calculation process. The following are the results of the sub-criteria analysis.

Table 1. Sub-Criteria Data Analysis

Criteria Code	Information	Subcriteria Value
C1	Comfort	Very Good, Good, Fair, Bad.
C2	Facility	Very Good, Good, Fair, Bad.
C3	Rental price	Cheap, Standard, Expensive, Very Expensive
C4	Location	Very Good, Good, Bad, Very Bad
C5	Hotel Class	Star, Jasmine

3.2 Alternative Data

Where the alternative data needed to determine the best hotel through the MOORA Method calculation process can be seen in table 2 as follows:

Table 2. Sub-Criteria Data Analysis

Alternative	Hotel Name
A1	Lonary
A2	Crystal
A3	Grand Antares
A4	Healthy
A5	Diamond
A6	Memory

Table 3 is a table containing the criteria used.

Table 3. Criteria Data

Criteria	Information	Weight	Type
C1	Comfort	0.25	Benefits
C2	Facility	0.25	Benefits
C3	Rental price	0.15	Benefits
C4	Location	0.15	Benefits
C5	Hotel Class	0.20	Benefits

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Table 4. Performance Criteria Weighting (C1)

Information	Weight
Very good	90
Good	80
Enough	60
Bad	0

Table 5. Facility Criteria Weighting (C2)

Information	Weight
Very good	90
Good	80
Enough	60
Bad	0

Table 6. Rental Price Criteria Weighting (C3)

Rental price	Information	Weight
90	Cheap	8
80	Standard	5
60	Expensive	2
0	Very expensive	0

Table 6. Location Criteria Weighting (C4)

Information	Weight
Very good	90
Good	80
Enough	60
Bad	0

Table 7. Hotel Class Criteria Weighting (C5)

Information	Weight
Star	90
Jasmine	70

Table 8. Suitability Rating and Alternative Criteria

Alternative	C1	C2	C3	C4	C5
A1	70	75	75	80	80
A2	70	75	75	80	85
A3	90	75	60	80	60
A4	75	75	70	60	70
A5	60	80	75	80	80
A6	70	80	80	90	90

3.3 Application of the MOORA Method

After the weight value is found based on the criteria, the next step is to apply it using the MOORA method calculation:

a. Creating a decision matrix

$$X = \begin{bmatrix} 70 & 75 & 75 & 80 & 80 \\ 70 & 75 & 75 & 80 & 85 \\ 90 & 75 & 60 & 80 & 60 \\ 75 & 75 & 70 & 60 & 70 \\ 60 & 80 & 75 & 80 & 80 \\ 70 & 80 & 80 & 90 & 90 \end{bmatrix}$$

b. Then the next step is to normalize the X matrix using the 2nd equation.
Performance Criteria (C1)

$$X *_{1,1} = \frac{70}{\sqrt{70^2+70+90+75^2+60^2+70^2}} = 0{,}3912$$

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$$X*_{2,1} = \frac{70}{\sqrt{70^2+70+90+75^2+60^2+70^2}} = 0{,}3912$$

$$X*_{3,1} = \frac{90}{\sqrt{70^2+70+90+75^2+60^2+70^2}} = 0{,}5029$$

$$X*_{4,1} = \frac{75}{\sqrt{70^2+70+90+75^2+60^2+70^2}} = 0{,}4191$$

$$X*_{5,1} = \frac{60}{\sqrt{70^2+70+90+75^2+60^2+70^2}} = 0{,}3353$$

$$X*_{6,1} = \frac{70}{\sqrt{70^2+70+90+75^2+60^2+70^2}} = 0{,}3912$$

Facility Criteria (C2)

$$X*_{1,2} = \frac{75}{\sqrt{75^2+75^2+75^2+75^2+80^2+80^2}} = 0{,}3912$$

$$X*_{2,2} = \frac{75}{\sqrt{75^2+75^2+75^2+75^2+80^2+80^2}} = 0{,}3912$$

$$X*_{3,2} = \frac{75}{\sqrt{75^2+75^2+75^2+75^2+80^2+80^2}} = 0{,}3912$$

$$X*_{4,2} = \frac{75}{\sqrt{75^2+75^2+75^2+75^2+80^2+80^2}} = 0{,}3912$$

$$X*_{5,2} = \frac{75}{\sqrt{75^2+75^2+75^2+75^2+80^2+80^2}} = 0{,}4258$$

$$X*_{6,2} = \frac{75}{\sqrt{75^2+75^2+75^2+75^2+80^2+80^2}} = 0{,}4258$$

Rental Price Criteria (C3)

$$X*_{1,3} = \frac{75}{\sqrt{75^2+75^2+60^2+70^2+75^2+80^2}} = 0{,}4207$$

$$X*_{2,3} = \frac{75}{\sqrt{75^2+75^2+75^2+75^2+80^2+80^2}} = 0{,}4207$$

$$X*_{3,3} = \frac{60}{\sqrt{75^2+75^2+60^2+70^2+75^2+80^2}} = 0{,}3366$$

$$X*_{4,3} = \frac{70}{\sqrt{75^2+75^2+60^2+70^2+75^2+80^2}} = 0{,}3927$$

$$X*_{5,3} = \frac{75}{\sqrt{75^2+75^2+60^2+70^2+75^2+80^2}} = 0{,}4207$$

$$X*_{6,3} = \frac{80}{\sqrt{75^2+75^2+60^2+70^2+75^2+80^2}} = 0{,}4488$$

Location Criteria (C4)

$$X*_{1,3} = \frac{80}{\sqrt{80^2+80^2+80^2+60^2+80^2+90^2}} = 0{,}4142$$

$$X*_{2,3} = \frac{80}{\sqrt{80^2+80^2+80^2+60^2+80^2+90^2}} = 0{,}4142$$

$$X*_{3,3} = \frac{80}{\sqrt{80^2+80^2+80^2+60^2+80^2+90^2}} = 0{,}41428$$

$$X*_{4,3} = \frac{60}{\sqrt{80^2+80^2+80^2+60^2+80^2+90^2}} = 0{,}3107$$

$$X*_{5,3} = \frac{80}{\sqrt{80^2+80^2+80^2+60^2+80^2+90^2}} = 0{,}4142$$

$$X*_{6,3} = \frac{90}{\sqrt{80^2+80^2+80^2+60^2+80^2+90^2}} = 0{,}4660$$

Hotel Class Criteria (C5)

$$X*_{1,3} = \frac{80}{\sqrt{80^2+85^2+60^2+70^2+80^2+90^2}} = 0{,}4180$$

$$X*_{2,3} = \frac{85}{\sqrt{80^2+85^2+60^2+70^2+80^2+90^2}} = 0{,}4442$$

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$$X *_{3,3} = \frac{60}{\sqrt{80^2+85^2+60^2+70^2+80^2+90^2}} = 0{,}3135$$

$$X *_{4,3} = \frac{70}{\sqrt{80^2+85^2+60^2+70^2+80^2+90^2}} = 0{,}3658$$

$$X *_{5,3} = \frac{80}{\sqrt{80^2+85^2+60^2+70^2+80^2+90^2}} = 0{,}4180$$

$$X *_{6,3} = \frac{90}{\sqrt{80^2+85^2+60^2+70^2+80^2+90^2}} = 0{,}4703$$

So the result of normalizing the X matrix is the X* $_{\text{ii matrix}}$ below:

$$Xij = \begin{bmatrix} 0{,}3912 & 0{,}3992 & 0{,}4207 & 0{,}4142 & 0{,}4180 \\ 0{,}3912 & 0{,}3992 & 0{,}4207 & 0{,}4142 & 0{,}4442 \\ 0{,}5029 & 0{,}3992 & 0{,}3366 & 0{,}4142 & 0{,}3135 \\ 0{,}4191 & 0{,}3992 & 0{,}3927 & 0{,}3107 & 0{,}3658 \\ 0{,}3353 & 0{,}2458 & 0{,}2407 & 0{,}4142 & 0{,}4180 \\ 0{,}3912 & 0{,}2458 & 0{,}4488 & 0{,}4660 & 0{,}4703 \end{bmatrix}$$

c. Calculating preference values

$$Y*1 = \{025*0{,}3912\} + \{025*03992\} + \{015*0{,}4207\} + \{0{,}15*04142\} + \{020*0{,}4180\} = 0{,}4064$$

$$Y*2 = \{025*0{,}3912\} + \{025*03992\} + \{015*0{,}4207\} + \{0{,}15*04142\} + \{020*0{,}4442\} = 0{,}4117$$

$$Y*3 = \{025*0{,}5029\} + \{025*03992\} + \{015*0{,}3366\} + \{0{,}15*04142\} + \{020*0{,}3135\} = 0{,}4009$$

$$Y*4 = \{025*0{,}4191\} + \{025*03992\} + \{015*0{,}3927\} + \{0{,}15*03107\} + \{020*0{,}3658\} = 0{,}8332$$

$$Y*5 = \{025*0{,}3353\} + \{025*04258\} + \{015*0{,}4207\} + \{0{,}15*0{,}4142\} + \{020*0{,}4180\} = 0{,}3991$$

$$Y*6 = \{022*0{,}3912\} + \{025*0{,}4258\} + \{0{,}15*0{,}4488\} + \{0{,}15*4660\} + \{0{,}20*0{,}4703\} = 0{,}4355$$

Determining the Rank value from the ranking results, from the optimization ranking results, the ranking of each alternative can be seen from the calculation of the criteria for each hotel:

Table 9. Ranking Results

Alternative	Hotel Name	Mark	Ranking
A1	Lonary	0.4064	3
A2	Crystal	0.4117	2
A3	Grand Antares	0.4009	4
A4	Healthy	0.8332	6
A5	Diamond	0.3991	5
A6	Memory	0.4355	1

4. CONCLUSION

From the results of the study in selecting the best hotel, based on the existing criteria that the application of the MOORA method can produce the best alternative, namely rank 1 of each existing alternative. With the application of the method, it can help many people in making decisions to determine the best hotel effectively and professionally.

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