



Article

Decision Support System for The Provision of Umrah Packages with AHP and MOORA Methods

Naurah Huwaida¹, Septi Andryana²

^{1,2} Universitas Nasional, Fakultas Teknologi Komunikasi dan Informasi, Jakarta, Indonesia

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CORRESPONDENCE

E-mail: naurah.huwaida@student.unas.ac.id

A B S T R A C T

The COVID-19 pandemic had a major influence that forces several business entities in various types of sectors to take various ways in order to maintain business continuity. This is no exception also affects business entities in the tourism sector. Travel restrictions during this pandemic have an impact on the sales of conventional travel agents. However, that doesn't mean that conventional travel agents just disappear. Several travel agents can still exist, one of them is Bella Hamed Tour, which is a travel agent for Umrah. The qualified service they have all this time has made Bella Hamed Tour earn the trust of consumers, even in the midst of pandemic. However, the pandemic situation also makes Bella Hamed Tour need to make adjustments in making Umrah packages that required to be planned through consideration of the best decisions. Therefore, a decision support system is needed to assist the management of Bella Hamed Tour quickly arrange the Umrah package. The method applied in the decision support system is the Analytical Hierarchy Process (AHP) for weighting the criteria and Multi-Objective Optimization on the basis of Ratio Analysis (MOORA) for ranking the results of the decision selection. Making a decision support system executed in form of a website.

INTRODUCTION

Ever since World Health Organization (WHO) informed the status of the global pandemic caused by Corona virus disease 2019 (COVID-19) on March 11, 2020, Indonesia has taken quick steps by considering Large-Scale Social Restrictions (PSBB) as a provision in order to help control the virus[1]. The implementation of these restrictions also affects various types of industries, including the tourism industry which is one of the pillars of Indonesia's economic growth as the largest foreign exchange earnings[2]. One of the things that is a factor in marketing tourism services is a travel agent, which is a special company to organize funds to organize travel.

Travel agents themselves are also affected by the implementation of PSBB. Moreover, along with the development of technology, the role of several conventional travel agents is quite displaced by online ticketing applications such as Tiket.com, Traveloka, Pegipegi, and so on. In addition, the implementation of PSBB has indirectly changed consumer behavior in travel.. Even so, this doesn't mean that conventional travel agents will disappear. The existence of conventional travel agents has proven to be able to survive. Bella Hamed Tour is one of the conventional travel agents that can stand until now. This conventional travel agent, which was formed in 2015, has continued to run until now because of consumer trust in Bella Hamed Tour's services. Consumer loyalty is one of the supporting factors for the survival of a travel agent[3]. However, the state of the Bella Hamed Tour business is also affected by COVID-19 conditions. This makes the Bella Hamed Tour business have to adapt to the pandemic situation.

In the end, Bella Hamed Tour, which is famous for organizing Umrah and Hajj trips, is looking for a solution to adapt their travel packages to the conditions of COVID-19. However, travel package planning cannot be done arbitrarily and must be adjusted to the current environmental conditions [4][5]. Based on previous research entitled " Pemilihan Paket Travel Dengan Metode Technique for Order Preference by Similiarity to Ideal Solutiion (TOPSIS)" by Ardha, R. and Pamungkas, P.

(2019), it has been explained that conventional travel package data management can sometimes cause data inaccuracies which result in the length of the company's business processes[6][7]. The research also states that agile and precise decision making can be done by obtaining data quickly and accurately as well. The utilization of rapid technological developments is believed to be able to provide a set of quality information for decision making [8].

If being identified based on the attached background, there is need for a decision support system to help Bella Hamed Tour design Umrah packages that are suitable for the pandemic situation [9][10]. The results of the system will later be useful as decision support in order to produce an alternative to solving existing problems, so that the best decision can be made. The methods used in the construction of this decision support system are the Analytical Hierarchy Process (AHP) method and the Multi-Objective Optimization on the basis of Ratio Analysis (MOORA) method. The selection of the AHP method itself is because the AHP method is able to compare criteria so that a weighted value of the importance of each criterion is obtained. While the reason for using the MOORA method is because of the level of selectivity of the apparatus that is able to set goals and conflicting criteria, namely criteria with favorable (benefit) or unfavorable (cost) values.

II. FRAMEWORK

This research have a framework which gives structure and help the development of pertinent research topics.

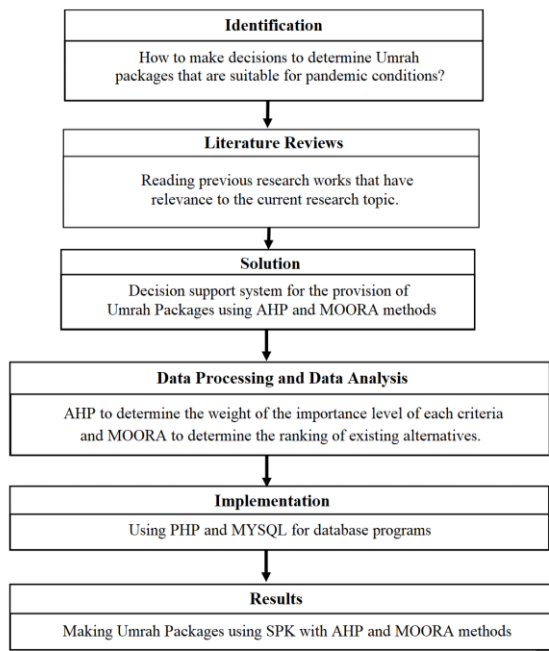


Figure 1. Research Framework

III. METHODS

The steps that are implemented to achieve research objectives are including the formulation of the research problem, which is how to choose a tour planning package using the AHP and MOORA methods. From the problems that have been identified, researchers will look for related literature sources that come from books, journals, or other types of scientific articles with similar themes, which discuss the application of decision support systems as well.

Then, data collection related to Bella Hamed Tour was gathered by interviewing the business entity. The research data that has been obtained will be processed with the AHP method to provide value weights and use the MOORA method for ranking.

Problem solving with AHP starts from creating a hierarchical structure to determine the decision hierarchy, which contains objectives, criteria, and alternatives as the object of discussion [11]. The three principles of AHP are as follows:

1. Decomposition, solving each whole problem into related elements in the form of a hierarchical structure.

Table 1. Saaty Rating Scale

Values	Meaning
1	Equally important
3	A little important

5	Obviously important
7	Very important
9	Extremely important
2, 4, 6, 8	The compromise between the two scale.
Multiplicative inverse	If activity i gets one number compared to activity j, then j has the opposite value compared to i.

2. Comparative judgment, giving value to the relative importance between two elements in a particular hierarchy that still has a relationship with the level above and determining the priority order of the elements. Saaty (1980) provides a quantitative scale of 1 to 9 in order to be able to measure the comparison of the level of importance of each element.

The results of this assessment will be more easily presented through the form of a pairwise comparison matrix. Then the consistency of each pairwise matrix can be tested using the following formula:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

3. Logical consistency, a characteristic of AHP to establish similar objects that can be grouped according to uniformity and relevance, and relate to objects based on certain criteria.

Whereas the use of MOORA method was chosen because it has a good level of selectivity where the criteria can be classified into favorable (benefit) and unfavorable (cost) values [12]. The MOORA method was introduced by Braures and Zavadkas, where Braures used it in 2004 in a multi-criteria decision making. MOORA is a multiobjective system that optimizes two or more conflicting attributes simultaneously.

IV. RESULT

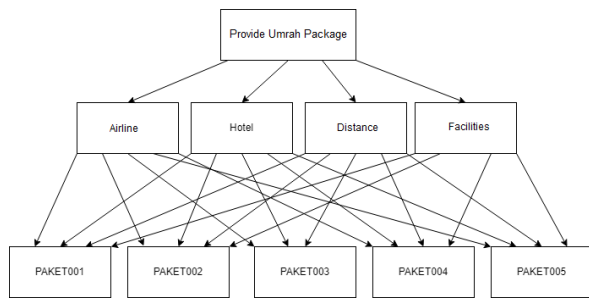


Figure 2. Hierarchy Structure

The problem solving with AHP starts from creating a hierarchical structure to determine the decision hierarchy, which contains objectives, criteria, and alternatives as the object of discussion.

The packages under comparison are individual category packages for a 10-day trip. After the criteria are determined, it can be carried out to give weighted values to the criteria and alternatives, then the results are divided by the number of criteria.

Table 2. Pairwise Comparison Matrix in Saaty Scale

	C1 Airlines	C2 Hotel	C3 Distance	C4 Facilities
C1	1	3	3	4
C2	0.33	1	3	3
C3	0.33	0.33	1	2
C4	0.25	0.33	0.5	1
Total	1.91	4.66	7.5	10

Table 3. Normalization of Pairwise Comparison Matrix

	C1 Airlines	C2 Hotel	C3 Distance	C4 Facilities
C1	1	3	3	4
C2	0.33	1	3	3
C3	0.33	0.33	1	2
C4	0.25	0.33	0.5	1
Total	1.91	4.66	7.5	10

The Consistency Index (CI) that obtained from the normalization is 0.05, and there is also a Consistency Ratio (CR) result of 0.06. The weighting between criteria is consistent, because CR is less than 0.1, so the calculation process can be continued to the alternative ranking process using the MOORA method. In the assessment with the MOORA method, a rating scale will be created to be used as a calculation material.

Table 4. Grading Scale

Code	Criteria	Type	Meaning	Value
C1	Airlines	Benefit	First Class	3
			Business Class	2
			Economy Class	1
C2	Hotel	Benefit	3 star	3
			2 star	2
			1 star	1
C3	Distance	Cost	≥ 1 km	3
			0.5 km – 0.9 km	2
			0.1 km – 0.4 km	1
C4	Facilities	Benefit	≥ 10 Facility	3
			8 – 10 Facility	2
			5 – 7 Facility	1

Attempts to create umrah packages on the Bella Hamed Tour DSS led to the alternative data listed below:

Table 5. Alternative Data

Code/ Name	Airlines	Hotel	Distance	Facilities
A01 PAKET 001	Business Class	3 star	0.1 km – 0.4 km	8 – 10 Facility
A02 PAKET 002	First Class	2 star	≥ 1 km	5 – 7 Facility
A03 PAKET 003	Economy Class	2 star	0.5 km – 0.9 km	5 – 7 Facility
A04 PAKET 004	Economy Class	3 star	0.5 km – 0.9 km	8 – 10 Facility
A05 PAKET 005	Business Class	3 star	0.1 km – 0.4 km	≥ 10 Facility

From the available alternative data, decision matrixes can be created:

Table 6. Decisional Matrix

Code/ Name	Airlines	Hotel	Distance	Facilities
A01 PAKET 001	2	3	1	2
A02 PAKET 002	3	2	3	1
A03 PAKET 003	1	2	2	1

003				
A04				
PAKET 004	1	3	2	2
A05				
PAKET 005	2	3	1	3

After that, the decisional matrix can be normalized by dividing the elements of the first column by the root of the sum of the squares of the first column. Next, divide the second column elements by the root of the sum of the squares of the second column, and so on.

Table 7. Normalized Matrix

	C1	C2	C3	C4
A01	0.45	0.50	0.22	0.45
A02	0.68	0.33	0.68	0.22
A03	0.22	0.33	0.45	0.22
A04	0.22	0.50	0.45	0.45
A05	0.45	0.50	0.22	0.68

Then, the normalization of the weighted matrix is done through the multiplication stage between the criteria weights that have been found from the AHP calculation and the normalization matrix results.

Table 8. Weighted Normalization Matrix

	C1	C2	C3	C4
Bobot	0.45	0.50	0.22	0.45
A01	0.45	0.50	0.22	0.45
A02	0.68	0.33	0.68	0.22
A03	0.22	0.33	0.45	0.22
A04	0.22	0.50	0.45	0.45
A05	0.45	0.50	0.22	0.68

If the weighted normalization matrix has been done, the next step is calculation of preference values. Sum process will be applied to one benefit attribute with other benefit attribute, while cost attribute will be summed up with other cost attribute. The final value can be obtained by subtracting the result between benefit and cost calculations.

Table 9. Preference Result

Alternative	Max (C1+C2+C4)	Min (C3)	Value
A01	0.40	0.03	0.37
A02	0.45	0.10	0.35
A03	0.22	0.06	0.16
A04	0.28	0.06	0.22
A05	0.42	0.03	0.39

After preference result has been found, the next stage is creating rank for alternative data.

Table 10. Alternative Ranking

Rank/Code	Air lines	Hotel	Distance	Facilities
1	A05	Business Class	3 star 0.1 km – 0.4 km	≥ 10 Facility
2	A01	Business Class	3 star 0.1 km – 0.4 km	8 – 10 Facility
3	A02	First Class	2 star ≥ 1 km	5 – 7 Fasilitas
4	A04	Economy Class	3 star 0.5 km – 0.9 km	8 – 10 Facility
5	A03	Economy Class	2 star 0.5 km – 0.9 km	5 – 7 Facility

The next stage is designing system of Bella Hamed Tour DSS.

A. Flowchart

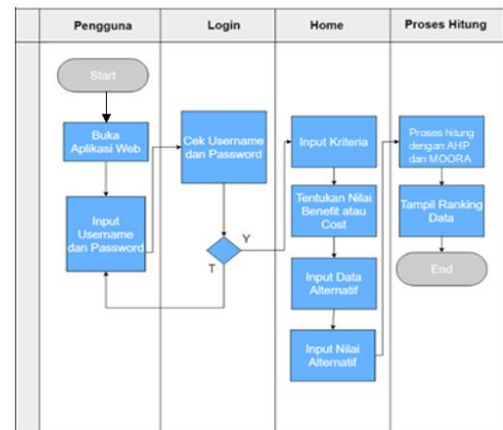


Figure 3. Flowchart

Users are supposed to fulfill the login process first. Users will not be able to enter the system if the username and password do not match. Upon successful login, user can now access the Home menu which contains the main display of the system, including the menus in the system. Then, the calculation process can be done by inputting criteria and inputting alternatives. Then, the data that has been inserted will be processed using AHP and MOORA.

B. Use Case Diagram

The following are preview of use case diagram for Bella Hamed Tour DSS:

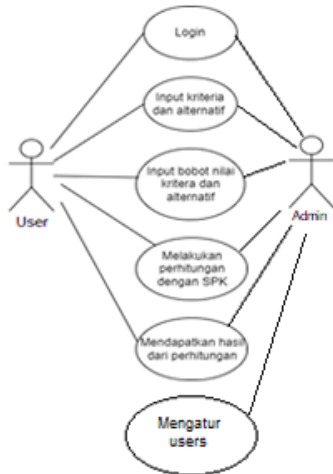


Figure 4. Use Case Diagram

Description:

- Admin and user can login.
- Admin and user can input criteria and alternative value.
- Admin and user can do calculation with DSS.
- Admin and user can see the result of the calculation.
- Admin can manage user.

After the data processing and system design are complete, then the existing data can be implemented into the form of a website. The development of Bella Hamed Tour DSS website uses PHP and MySQL. Bella Hamed Tour DSS website's first page is the Login Page.

The Login page is functioned as a page to identify who enters the Bella Hamed Tour SPK website. A username and password are required to enter the website. If you don't have an account, users can register first to the admin.

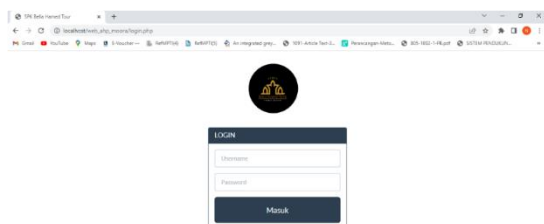


Figure 5. Login Page

Home page serves as the main page for the Bella Hamed Tour DSS website, and also provides navigation to other pages.

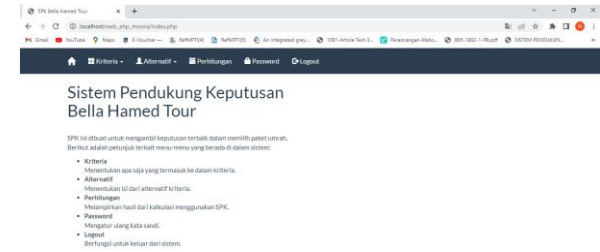


Figure 6. Home Page

The Criteria Page is used to organize information from the criteria on the Bella Hamed Tour DSS website, and the Criteria Weight Value Page is used to manage the value of existing criteria. Users can fill in and edit the criteria value as desired.

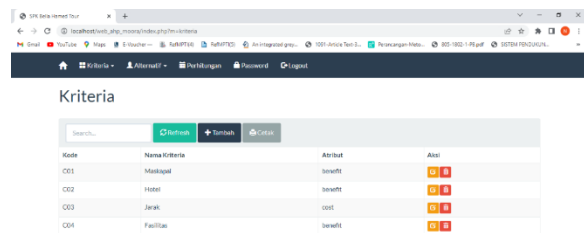


Figure 7. Criteria Page

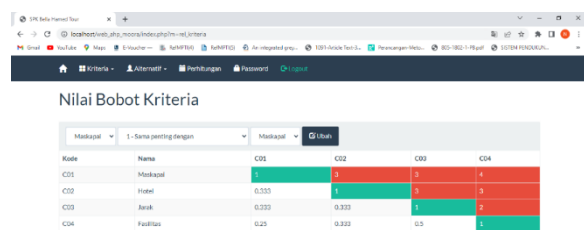


Figure 8. Criteria Weight Value Page

The Alternative Page works to organize information from alternatives on the Bella Hamed Tour DSS website, and the Alternative Weight Value Page functions to manage existing alternative values. Users can add edit alternative values.

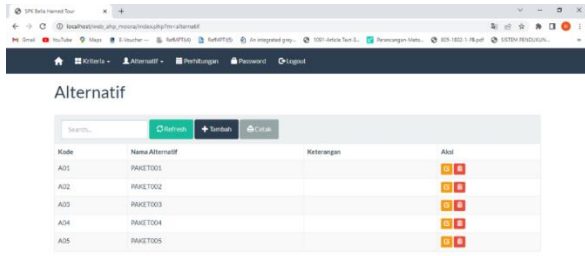


Figure 9. Alternative Page

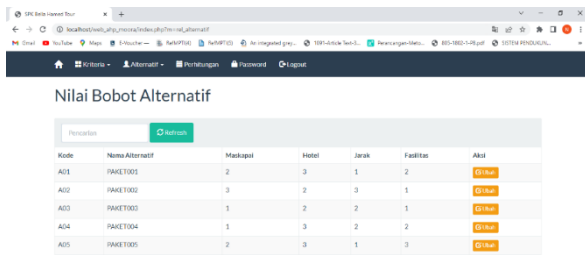


Figure 10. Alternative Weight Value Page

The Calculation page has the function of calculating the criteria and alternative values that exist in the Bella Hamed Tour DSS.

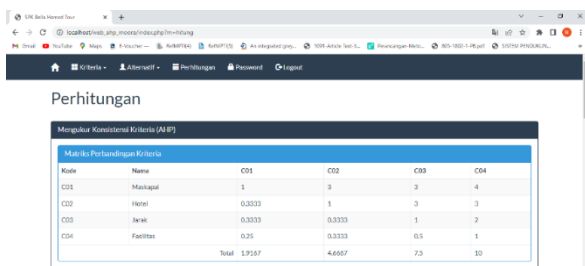


Figure 11. Calculation Page

The Password page is used for setting user passwords on the Bella Hamed Tour SPK website.

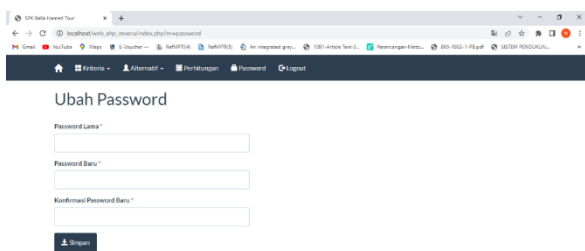


Figure 12. Password Page

Next stage is testing the application. Bella Hamed Tour DSS testing is done by entering criteria, criteria weight values, alternatives, and alternative weight values. Then, the calculation results of the values that have been entered can

be seen on the Calculation Page. The calculation process in the Bella Hamed Tour SPK uses the AHP method to weight the criteria values and alternative values. Then, the values that have previously been calculated will be sorted through the MOORA method.

Table 11. Test Result

Code	Name	Total	Rank
A05	PAKET005	0.3935	1
A01	PAKET001	0.3724	2
A02	PAKET002	0.3516	3
A04	PAKET004	0.2265	4
A03	PAKET003	0.1594	5

Test results in Table 11 show that of the 5 alternatives that have been calculated using the Bella Hamed Tour SPK, the result is PAKET005 as rank 1, which means that this package is recommended by SPK to be promoted. The reason for taking the highest rank is because it is considered to be the most suitable for consumer needs. In addition, the criteria used are also in accordance with the company's conditions in determining the Umrah package.

V. CONCLUSION

From the research that has been carried out, the following conclusions are obtained:

- A. Bella Hamed Tour DSS is proven to be able to help provide support in decision making for making tour packages. Based on 5 alternatives that have been calculated manually with the AHP and MOORA methods, the result is PAKET005 being the highest recommendation with a preference value of 0.39, and the last rank is held by PAKET003 with a preference value of 0.16.
- B. The results of manual calculation and calculation from the application are almost the same, except for the calculation of the preference value (max-min) where the result of manual calculation on PAKET003 is 0.16,

while the result of PAKET003 calculation through the application is 0.1594.

C. The disadvantage of the Bella Hamed Tour SPK is that it is still relatively simple, and has the possibility to be developed even better.

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BIOGRAPHY

Naurah Huwaida is one of Universitas Nasional's student who currently majoring in Information System.

Septi Andryana obtained her Doctor degree for Information Technology at Universitas Gunadarma in 2019. Currently working as a permanent lecturer at Universitas Nasional, and has been assigned as Dekan of the Faculty of Communication Technology and Informatics, since 2020.