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# The Decision Model for Selection of Tourism Site Using Analytic Network Process Method

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***Abstract***—The criteria and sub criteria-based decision model for selection of tourism site using Analytic Network Process (ANP) method was to be implemented in Yogyakarta, Indonesia. In this study, we proposed criteria and sub criteria that influenced each other and had feedback between the two so that there was a comparison of tourism site alternatives according to sub criteria and pairwise comparative assessment with scale 1-9 that was then calculated in form of matrix of pairwise comparison. The result of this study was in form of decision alternatives in form of ranking to facilitate decision makers (DMs) in finding tourism sites.

***Index Terms***—Decision-Making, Analytic Network Process, Decision Support System, Tourism, Temple.

## I. Introduction

Decision model for selection of tourism site is used by tourists as decision makers (DMs) to assist in decision-making. The model was made using assessment based on analytic network process (ANP) method to determine the weight of criteria, sub criteria, the interdependence of criteria/sub criteria [1]-[3], and the ranking process based on data of tourism site alternatives in Yogyakarta, Indonesia. Yogyakarta is a city that has various tourism places such as temples, palaces, beaches, and other natural tourisms. The city is relatively safe and comfortable to visit that makes the city frequently visited by domestic or international tourists [4] and gives impact on economic development with AHP [2]. The problem of tourism site search needs to be addressed in the decision-model-based decision supporting system that can visually display the map to assist the DMs. ANP model is a good decision support system (DSS) model in weighing and ranking method because the model can complete the criteria and sub criteria [5].

Meanwhile, some criteria in decision model are Quality of Tourist Attraction ($C_1$), Condition of the Tourist Attraction ($C_2$), and Accessibility ($C_3$), and the sub criteria are Tourist attraction ($S_1$), Attractions diversity ($S_2$), Supporting facilities ($S_3$), Cleanliness ($S_4$), Safety ($S_5$), Neatness ($S_6$), Availability of Transportation ($S_7$), Distance ($S_8$), and Condition of the Road ($S_9$). The model also uses scores between 1 to 9 for assessment of the criteria and sub criteria as has been done in [12]. The model also has some alternatives that can be the output of a ranking to be the destination, namely temples, palaces, and beaches. The tourism sites are the most frequently visited by domestic and international tourists so that we need to make the three alternatives to be modeled into the system done using ANP.

## II. Related Work

Weighing becomes an important issue to yield ranking such as the issue of weight update [6], new Entropy weight [7], Sensitivity-Simple Additive Weighting (S-SAW) [8], mutual weight [9]-[11].

Meanwhile, ANP method is the development of AHP method [12]-[14]. ANP is mostly implemented in previous studies, such as in the development of employee performance assessment model because ANP is a mathematic theory that enables us to give the dependence and feedback systematically that can catch and combine the tangible and intangible factors [14].

Meanwhile, the studies that have linkage in the completion of DSS in ANP issues are such as the selection of a tourism development site involved with GIS and ANP [15], asset maintenance [2], interpretation of criteria weights [9]. Furthermore, issues of ANP method for selection problems such as fuel using Analytical Hierarchy Process (AHP) method [16], tourism development site selection ANP and ordered weighted averaging (OWA) method [15], sustainable tourism planning using ANP and GIS [17], the selection of solar-thermal power plant investment projects using AHP and ANP [1], the optimization of marketing strategy selection using ANP and technique for order preference by similarity to an ideal solution (TOPSIS) [18], decision-making model for the stock market [19], group decision-making using fuzzy approach for evaluating criteria of electrician [20], tourist hotel selection using AHP [21] and geographical visualization approach on tourism issues. From some approaches of related studies, we need to modify the weighing method in ANP and display GIS-based tourism sites. The decision model is expected not only to help solving tourism issues but also to develop ANP method for other location selection.

## III. RESEARCH METHOD

### A. Analytic network process (ANP) method

The steps used in decision-making system using ANP method consist of [14], [22]:

1. Defining the issues by determining the destination;
2. Decomposition, namely describing the issues or problems by making decisions hierarchy structure;
3. Doing comparative judgment by forming pairwise comparison matrix then summing each vector column in the matrix;
4. Matrix normalization by dividing each comparison value in accordance with the total value of each column; testing whether the comparative assessment filled has been consistent or not, namely by the calculation of consistency index (CI) and consistency ratio (CR) in the matrix. If CR > 0.1, then revising judgment is done until the comparative assessment is stated consistent namely CR < 0.1 to obtain the value of consistency index as in equation (1) [14].

$$\lambda_{\max} = \sum_{j=1}^{n} a_{ij} \frac{w_j}{w_i} \tag{1}$$

After the value of $\lambda_{max}$ was obtained, then finding the value of consistency index as in equation (2):

$$CI = \frac{\lambda_{\max} - n}{n-1} \tag{2}$$

Then using the value of random index (RI) to obtain the value of consistency ratio (CR) as in equation (3):

$$CR = \frac{CI}{RI} \tag{3}$$

CR was used to check whether pairwise comparison has been done consistently or not [14]. If the value of CR ≤ 0.1, then the fulfillment of comparison matrix done by user will be consistent using the next step as follows:

5. Repeating step 3, 4, and 5 for all hierarchy levels;
6. Implementing the principle of synthesize the priorities, namely starting from the second level by diverting criteria weight (local criteria) with the sub-criteria weight (local weight).
7. Formation of super matrix, super matrix is a two-dimension matrix from elements and vector priorities of pairwise comparison occurring in corresponding columns of super matrix [23]. Matrix resulted from the components with their elements was displayed vertically and horizontally shown in equation (4) [13]-[15], [23]:

$$W = \begin{array}{cc} & \begin{array}{ccccc} C_1 & \cdots & C_k & \cdots & C_n \\ e_{11}\cdots e_{1m_1} & \cdots & e_{k1}\cdots e_{km_k} & \cdots & e_{n1}\cdots e_{nm_n} \end{array} \\ \begin{array}{c} C_1 \begin{array}{c} e_{11} \\ \vdots \\ e_{1m_1} \end{array} \\ \vdots \\ C_k \begin{array}{c} e_{k1} \\ \vdots \\ e_{km_k} \end{array} \\ \vdots \\ C_n \begin{array}{c} e_{n1} \\ \vdots \\ e_{nm_k} \end{array} \end{array} & \begin{bmatrix} W_{11} & \cdots & W_{1k} & \cdots & W_{1n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ W_{k1} & \cdots & W_{kk} & \cdots & W_{kn} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ W_{n1} & \cdots & W_{nk} & \cdots & W_{nn} \end{bmatrix} \end{array} \tag{4}$$

From equation (4), symbol *C* states the clusters existing in an issue system, while *e* is the element existing in a cluster. Each column in $W_{ij}$ where $W_{ij} = (w_1, \dots, w_n)^k$ is eigenvector showing the importance of the *i*-th element existing in a cluster against the *j*-th element existing in the same or different cluster by pairwise comparison.

If the criteria interrelate, the entry of the second row second column (2,2), where $W_n$ will be $W_{nn}$ showing interrelation and super matrix as in follow:

$$W = \begin{pmatrix} 0 & 0 & 0 & \dots & . & 0 & w_{1.n} \\ w_{21} & 0 & 0 & \cdots & . & 0 & 0 \\ 0 & w_{32} & 0 & \cdots & . & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \vdots & \vdots & \vdots & \vdots & w_{n-1,n-2} & \vdots & \vdots \\ 0 & 0 & 0 & \cdots & & w_{n,n-1} & 0 \end{pmatrix}$$

After the process of pairwise comparison was done on each level, the local priority vector was obtained. The priority vector was derived into super matrix calculated in 3 steps, namely unweighted super matrix by collecting all eigenvector. Furthermore, weighted super matrix constitutes the value obtained by normalization of unweighted super matrix, limit super matrix.

8. To choose the best alternative, the super matrix formed with the third step includes all networks. The form of network in the study, super matrix includes all networks shown in Fig. 1.

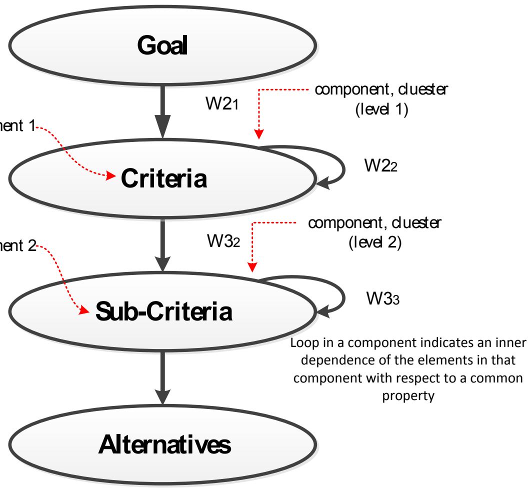


Fig.1. Structural difference between a linear and a nonlinear network [22]

## B. Proposed method for tourism site selection

In system architecture design, we added in external data a map using Google to visually display DSS in tourism site selection. The database in internal and external data was extracted to be saved in DSS database in database management section. Furthermore, ANP method was used for knowledge base in model management system so as to analyze data criteria to produce decision alternatives. Meanwhile, the system architecture in we proposed can be observed in Fig. 2.

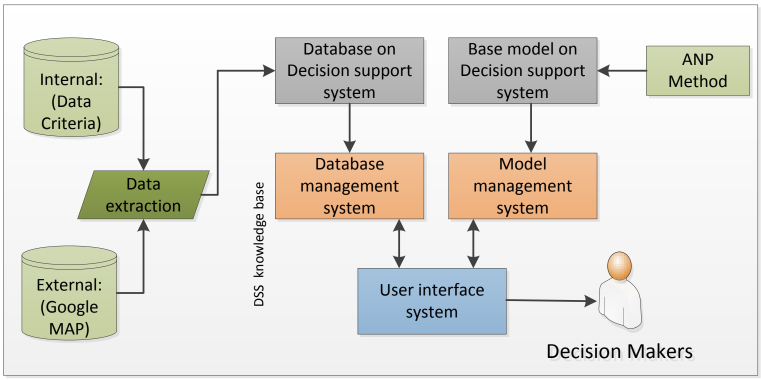


Fig.2. Proposed in DSS architecture of tourism site determination

The determination of tourism site destination priority was modeled using ANP approach as the basis of decision-making process based on ranking obtained from pairwise comparison matrix calculation between criteria and sub criteria. Meanwhile, the stages of decision model can be observed in Fig. 3.

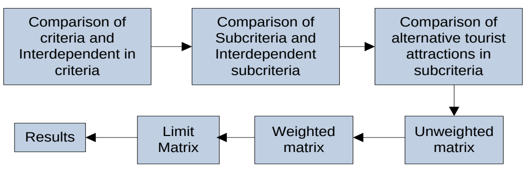


Fig.3. The stages of decision model in knowledge-based management for proposed

The proposed method in determination of tourism site destination was done using ANP approach as the basis of decision-making process based on ranking so as to obtain pairwise comparison matrix calculation between criteria and sub criteria using Saaty scale 1-9 [12], [13]. The model basis subsystem designing was done in some steps [12]:

Step 1: Determining criteria/sub criteria for Determination of tourism sites. From the determination of the best tourism destinations and the result of literature review, field observation, including interview involving expert opinions in tourism field, the criteria influencing tourists as decision makers (DMs) in determining tourism sites could be determined. The criteria were classified as follows:

1. Quality of tourism sites ($C_1$): form of attraction, attraction diversity and related facilities, consisting of three sub criteria: (1) main tourism attraction ($S_1$), (2) attraction diversity ($S_2$), and (3) supporting facilities ($S_3$);
2. Condition of tourism site ($C_2$): namely the condition of tourism site and around tourism site consisting of three sub criteria: (1) cleanliness ($S_4$), (2) safety ($S_5$), and (3) order ($S_6$);
3. Accessibility ($C_3$): the entry road to tourism site that becomes important access in tourism activities in form of infrastructure and transportation to tourism site with sub criteria: (1) availability of transportation mode ($S_7$), (2) distance ($S_8$); and (3) condition of road ($S_9$).

Step 2: Making hierarchy structure and ANP. The predetermined criteria and sub criteria then managed the groups and were classified according to each criterion to be decision variables to form hierarchy structure. Furthermore, for determining the interdependence between criteria and sub criteria into ANP model as in Fig. 4.

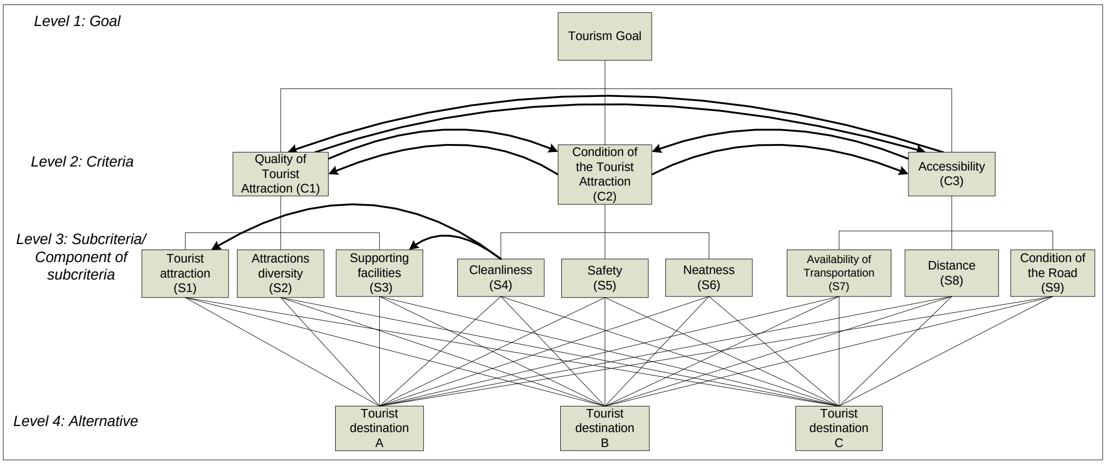


Fig.4. Hierarchy structure and ANP for network of tourism site

Step 3: Forming pairwise comparison matrix and obtaining eigenvector, comparison between criteria and sub criteria based on hierarchy and interdependence comparison between criteria and sub criteria to show pairwise comparison matrix between criteria in Table 1. Meanwhile, comparison matrix between sub criteria based on criteria is available in Table 2.

Table 1. Pairwise comparison matrix between criteria of level 2

| Criteria of tourism site (Level 2) | Criteria of tourism site | | | Eigenvector ($W_{21}$) |
|---|---|---|---|---|
| | $C_1$ | $C_2$ | $C_3$ | |
| C1 | 1 | 3 | 4 | 0.623 |
| C2 | 0.333 | 1 | 2 | 0.239 |
| C3 | 0.250 | 0.500 | 1 | 0.137 |
| $\lambda_{max}$ = 3.018; CI = 0.009; CR = 0.017 ≤ 0.1 Consistent | | | | |

Table 2. Pairwise comparison matrix between sub criteria of level 3

| Quality of tourism site ($C_1$) | | | | | Condition of tourism site ($C_2$) | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | $S_1$ | $S_2$ | $S_3$ | e Vector ($W_{32}$) | | $S_4$ | $S_5$ | $S_6$ | e Vector ($W_{32}$) |
| $S_1$ | 1 | 2 | 3 | 0.548 | $S_4$ | 1 | 2 | 4 | 0.557 |
| $S_2$ | 0.500 | 1 | 1 | 0.240 | $S_5$ | 0.500 | 1 | 3 | 0.320 |
| $S_3$ | 0.333 | 1.000 | 1 | 0.210 | $S_6$ | 0.250 | 0.333 | 1 | 0.122 |
| $\lambda_{max}$ = 3,018; CI = 0,009; CR = 0,017 ≤ 0,1 | | | | | $\lambda_{max}$ = 3,018; CI = 0,009; CR = 0,017 ≤ 0,1 | | | | |
| Accessibility of tourism site ($C_3$) | | | | | | | | | |
| | $S_7$ | $S_8$ | $S_9$ | e Vector ($W_{32}$) | | | | | |
| $S_7$ | 1 | 2 | 3 | 0.524 | | | | | |
| $S_8$ | 0.500 | 1 | 3 | 0.333 | | | | | |
| $S_9$ | 0.333 | 0.333 | 1 | 0.141 | | | | | |
| $\lambda_{max}$ = 3,053; CI = 0,026; CR = 0,051 ≤ 0,1 | | | | | | | | | |

 

Step 4: Forming interdependence pairwise comparison matrix to form pairwise comparison matrix regarding the effect of one criterion on another (inner dependence) was done by the experts in form of questionnaire, so that it shows the inner dependence of pairwise comparison matrix showing the effect of a criterion compared to another as observable in Table 3.

Furthermore, Table 4 shows the outer dependence between sub criteria cleanliness.

Table 3. Interdependence pairwise comparison matrix between criteria

| $C_1$ | $C_2$ | $C_3$ | e Vector ($W_{22}$) |
|---|---|---|---|
| $C_2$ | 1 | 3 | 0.750 |
| $C_3$ | 0.333 | 1 | 0.250 |
| $\lambda_{max}$ = 2,000; CI = 0,000; CR = 0,000 ≤ 0,1 | | | |
| $C_2$ | $C_1$ | $C_3$ | e Vector ($W_{22}$) |
| $C_1$ | 1 | 0.500 | 0.333 |
| $C_3$ | 2 | 1 | 0.666 |
| $\lambda_{max}$ = 2,000; CI = 0,000; CR = 0,000 ≤ 0,1 | | | |
| $C_3$ | $C_1$ | $C_2$ | e Vector ($W_{22}$) |
| $C_1$ | 1 | 1 | 0.500 |
| $C_2$ | 1.000 | 1 | 0.500 |
| $\lambda_{max}$ = 2,000; CI = 0,000; CR = 0,000 ≤ 0,1 | | | |

Table 4. Comparison matrix influenced by sub criteria cleanliness

| Environment cleanliness | Environment cleanliness | | Eigenvector ($W_{33}$) |
|---|---|---|---|
| | Main attraction | Supporting facilities | |
| Main attraction | 1 | 2 | 0.666 |
| Supporting Facilities | 0.500 | 1 | 0.333 |
| $\lambda_{max}$ = 2.000; CI = 0.000; CR = 0.000 ≤ 0.1 Consistent | | | |

Step 5: Comparison of tourism site alternatives based on sub criteria was used to select the best tourism site alternatives, it required comparison between tourism site alternatives against each existing sub criterion. In the study, the assessment of comparison between tourism site alternatives against each sub criterion was done by tourists.

Step 6: Determining the weight of ANP and selecting tourism sites according to ranking. After all eigenvector of each hierarchy level was obtained including the interdependence between criteria and sub criteria, all eigenvector was synthesized consecutively into a super matrix that was then called as unweighted super matrix that contained all weights of DMs.

## IV. Result and Discussion

From limit super matrix, we can find the ranking of tourism sites based on criteria and/or sub criteria to facilitate DMs in selecting tourism sites based on the excellence of criteria or sub criteria. Meanwhile, the result in weighing super matrix on goal and criteria can be observed in Table 5 and Table 6.

Table 5. Weighted Super matrix (Goal and $C_1$-$C_3$)

| Criteria of tourism site | Goal | $C_1$ | $C_2$ | $C_3$ |
|---|---|---|---|---|
| Goal | 0 | 0 | 0 | 0 |
| Quality of tourist ($C_1$) | 0.623 | 0.000 | 0.166 | 0.250 |
| Condition of the tourist attraction ($C_2$) | 0.239 | 0.375 | 0.000 | 0.250 |
| Accessibility ($C_3$) | 0.137 | 0.125 | 0.333 | 0.000 |
| Tourist attraction ($S_1$) | 0 | 0.274 | 0 | 0 |
| Attractions diversity ($S_2$) | 0 | 0.120 | 0 | 0 |
| Supporting facilities ($S_3$) | 0 | 0.105 | 0 | 0 |
| Cleanliness ($S_4$) | 0 | 0 | 0.278 | 0 |
| Safety ($S_5$) | 0 | 0 | 0.160 | 0 |
| Neatness ($S_6$) | 0 | 0 | 0.061 | 0 |
| Transportation ($S_7$) | 0 | 0 | 0 | 0.262 |
| Distance ($S_8$) | 0 | 0 | 0 | 0.166 |
| Road ($S_9$) | 0 | 0 | 0 | 0.070 |
| Tourist destination A | 0 | 0 | 0 | 0 |
| Tourist destination B | 0 | 0 | 0 | 0 |
| Tourist destination C | 0 | 0 | 0 | 0 |

 

Table 6. Weighted Super matrix ($S_1$-$S_9$)

| Criteria of tourism site | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | $S_6$ | $S_7$ | $S_8$ | $S_9$ |
|---|---|---|---|---|---|---|---|---|---|
| Goal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Quality of tourist ($C_1$) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Condition of the tourist attraction ($C_2$) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Accessibility ($C_3$) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tourist attraction ($S_1$) | 0 | 0 | 0 | 0.333 | 0 | 0 | 0 | 0 | 0 |
| Attractions diversity ($S_2$) | 0 | 0 | 0 | 0.000 | 0 | 0 | 0 | 0 | 0 |
| Supporting facilities ($S_3$) | 0 | 0 | 0 | 0.166 | 0 | 0 | 0 | 0 | 0 |
| Cleanliness ($S_4$) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Safety ($S_5$) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Neatness ($S_6$) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Transportation ($S_7$) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Distance ($S_8$) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Road ($S_9$) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tourist destination A | 0.193 | 0.250 | 0.192 | 0.070 | 0.333 | 0.239 | 0.701 | 0.668 | 0.333 |
| Tourist destination B | 0.723 | 0.250 | 0.632 | 0.166 | 0.333 | 0.623 | 0.085 | 0.088 | 0.333 |
| Tourist destination C | 0.083 | 0.500 | 0.174 | 0.262 | 0.333 | 0.137 | 0.213 | 0.243 | 0.333 |

Meanwhile to produce limit super matrix, we used the same criteria as in Table 5 and Table 6.

In Table 7 and Table 8, we cut them by displaying alternative values as follows:

Table 7. Result of Limit Super matrix (Goal and C1-C3)

| Criteria of tourism site | Goal | $C_1$ | $C_2$ | $C_3$ |
|---|---|---|---|---|
| Tourist destination A | 0.316 | 0.281 | 0.318 | 0.469 |
| Tourist destination B | 0.439 | 0.485 | 0.410 | 0.284 |
| Tourist destination C | 0.245 | 0.234 | 0.272 | 0.247 |

Table 8. Result of Limit Super matrix (S1-S9)

| Criteria of tourism site | $S_1$ | $S_2$ | $S_3$ | $S_4$ | $S_5$ | $S_6$ | $S_7$ | $S_8$ | $S_9$ |
|---|---|---|---|---|---|---|---|---|---|
| Tourist destination A | 0.193 | 0.250 | 0.192 | 0.167 | 0.333 | 0.239 | 0.701 | 0.669 | 0.333 |
| Tourist destination B | 0.724 | 0.250 | 0.633 | 0.514 | 0.333 | 0.623 | 0.085 | 0.088 | 0.333 |
| Tourist destination C | 0.083 | 0.500 | 0.175 | 0.319 | 0.333 | 0.137 | 0.213 | 0.243 | 0.333 |

From Table 8 and Table 9 in the result of limit super matrix as shown in Table 10 to show three alternatives based on decision support system application for determination of tourism sites based on the first ranking was (1) Temple; the second ranking (2) was Sultan Palace; and the third ranking (3) was Beach as in Table 9.

Table 9. Alternatives in the result of tourism site decision

| Alternatives | Preferences values | | | Ranking |
|---|---|---|---|---|
| | Total | Normal | Ideals | |
| $A_1$ (Sultan Palace) | 0.1700 | 0.3400 | 0.8066 | 2 |
| $A_2$ (Temple) | 0.2108 | 0.4216 | 0.9031 | 1 |
| $A_3$ (Beach) | 0.1192 | 0.2384 | 0.5655 | 3 |

In the next stage, we conducted the process of testing of alternatives based on sub criteria to yield the value of CR based on destination, score, and eigenvector as in Table 10.

Table 10. Testing with Three Alternatives

| No. | Sub Criteria | Tourism Destination (TD) | Score | Eigenvector | CR |
|---|---|---|---|---|---|
| 1. | Tourist attraction ($S_1$) | TD (A) – (B) | 5 | KR : 0.193<br>CP : 0.723<br>MJ : 0.083 | 0.063 |
| | | TD (A) – (C) | 3 | | |
| | | TD (B) – (C) | 7 | | |
| 2. | Attractions diversity ($S_2$) | TD (A) – (B) | 1 | KR :0.250<br>CP :0.250<br>MJ :0.500 | 0.000 |
| | | TD (A) – (C) | 2 | | |
| | | TD (B) – (C) | 2 | | |
| 3. | Supporting facilities ($S_3$) | TD (A) – (B) | 3 | KR :0.192<br>CP :0.632<br>MJ :0.174 | 0.008 |
| | | TD (A) – (C) | 1 | | |
| | | TD (B) – (C) | 4 | | |
| 4. | Cleanliness ($S_4$) | TD (A) – (B) | 3 | KR :0.141<br>CP :0.333<br>MJ :0.524 | 0.051 |
| | | TD (A) – (C) | 3 | | |
| | | TD (B) – (C) | 2 | | |
| 5. | Safety ($S_5$) | TD (A) – (B) | 1 | KR :0.333<br>CP :0.333<br>MJ :0.333 | 0.000 |
| | | TD (A) – (C) | 1 | | |
| | | TD (B) – (C) | 1 | | |
| 6. | Neatness ($S_6$) | TD (A) – (B) | 3 | KR :0.239<br>CP :0.623<br>MJ :0.137 | 0.017 |
| | | TD (A) – (C) | 2 | | |
| | | TD (B) – (C) | 4 | | |
| 7. | Transportation ($S_7$) | TD (A) – (B) | 7 | KR :0.701<br>CP :0.085<br>MJ :0.213 | 0.031 |
| | | TD (A) – (C) | 4 | | |
| | | TD (B) – (C) | 3 | | |
| 8. | Distance ($S_8$) | TD (A) – (B) | 7 | KR :0.668<br>CP :0.088<br>MJ :0.243 | 0.006 |
| | | TD (A) – (C) | 3 | | |
| | | TD (B) – (C) | 3 | | |
| 9. | Road ($S_9$) | TD (A) – (B) | 1 | KR :0.333<br>CP :0.333<br>MJ :0.333 | 0.000 |
| | | TD (A) – (C) | 1 | | |
| | | TD (B) – (C) | 1 | | |

Based on the testing in Table 10, we could compare the result of alternatives in Table 11 as follows:

Table 11. Comparison of proposed method results with initial ranking

| Alternatives | Comparison in a ranking | |
|---|---|---|
| | Proposed | Initial rank |
| $A_1$ (Sultan Palace) | 2 | 3 |
| $A_2$ (Temple) | 1 | 1 |
| $A_3$ (Beach) | 3 | 2 |

## V. Conclusion

Based on the analysis in Analytic Network Process (ANP) method in our paper, we found that the best tourism site alternatives in Yogyakarta were Temple that became the first recommendation. The result of a recommendation in form of alternative of a ranking of criteria values, weights, and alternative data used. In the next study, we require analysis using other method and conduct MCDM hybrid model for completion of group decision support system (GDSS) so that the complexity in tourism site selection can be less for DMs.

## VI. Future Work

For future work, we will develop the group decision models by the method of a hybrid using multi-criteria decision-making (MCDM) and social networks analysis (SNA). The next model also presents a web service based application system to integrate each DMs in a group decision support system application to facilitate stakeholders in decision-making.

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