

Application of AHP Method in Determining Bank Selection for Account Opening

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ABSTRACT

Banks are business entities that collect public funds as a place to carry out various financial-related transaction activities that people generally use to save money. Saving or saving money is an activity to set aside a portion of income for future needs. There are many kinds of banks in Indonesia that offer all the advantages ranging from administration to the interest given to customers. Decision Support System (DSS) is one of the decision-making methods that can assist a person in making accurate and targeted decisions. Many problems can be solved by using SPK, one of which is determining the selection of the best bank for account opening. Therefore, the author will examine and compare several bank names and bank criteria needed by prospective customers to open a new account. Data was collected by means of observation, interviews and literature study. It is hoped that this writing and research can add insight to anyone. The method used in this research is the Analytical Hierarchy Process (AHP) method. Analytical Hierarchy Process (AHP) is a method of decision support system by using a hierarchy and making comparisons on each criterion and alternative that is considered in decision making. It is very important in choosing a bank because the better the facilities and types of services provided by the bank, the greater satisfaction with the customer. In this study, the authors compare four banks that are widely chosen by the general public, namely Mandiri, BCA, BRI and BNI with four selection criteria including Administration, Interest, Transaction and Investment Limits located in the Greater Jakarta area (Jakarta Bogor Depok Tangerang Bekasi).

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1. INTRODUCTION

Saving is a necessity that is quite important to prepare the future for every prospective customer. Every prospective customer wants have quality savings or savings. The more banks which offers their own criteria and advantages (Prehanto et al., 2020). The criteria and advantages used as consideration for prospective customers in choosing a bank to make a savings account (Azhar, 2020). The more choices of banks, the more confusing potential customers to choose the right bank for saving. Less quantitative data and information in bank selection process, the selection is not objective and sometimes mistakes occur in choosing a bank give impact in material losses for the

long term to the prospective customers themselves. Because most prospective customers want profits in saving (Purnomo & Ariyanti, 2019).

Banking is a company that has a variety of facilities and criteria that can create a desire to prospective customers in determining saving place. Every prospective customer, surely expects a good and quality savings place (Poningsih et al., 2020). Each bank in Indonesia provides different offers and advantages such as administrative fees, transaction limits, interest and so on. This makes prospective customers hesitate in determining the choice of a bank to make a new account (Novika et al., 2018; Savitri, 2018).

Based on the problems above, a decision support system is needed because public still makes subjective decisions and not as expected. Without quantitative data to support the right decision-making process, bank selection is not objective (Andoyo, 2021). Due to the large number of bank names in Indonesia, this research takes 4 (four) samples of names or types of banks that are most in demand by customers, namely Bank Mandiri, BCA, BRI and BNI with 4 (four) main criteria: namely Administration, Interest, Transaction Limits and Investment (ANDARYANI, 2019).

Decision Support Systems are specific information-generating systems aimed at solving a particular problem that must be solved by managers at various levels (Mahendra & Aryanto, 2019; Narti et al., 2019). In other words, a Decision Support System is a computer-based information system that produces various alternative decisions to assist management in dealing with structured problems using data and models (Alkhairi & Windarto, 2018; Limbong et al., 2020).

This research method uses the Analytical Hierarchy Process (AHP) method. This method was chosen because the Analytical Hierarchy Process (AHP) method is a decision support model where the main component is a functional hierarchy by human perception as the main input, namely people who know about bank problems.

2. RESEARCH METHOD

The stages of the research methodology are research concepts that link the visualization of one variable to another, so that research is structured systematically and can be accepted by all parties (Diana, 2018; Latif et al., 2018). The stages of the research methodology are described as follows:

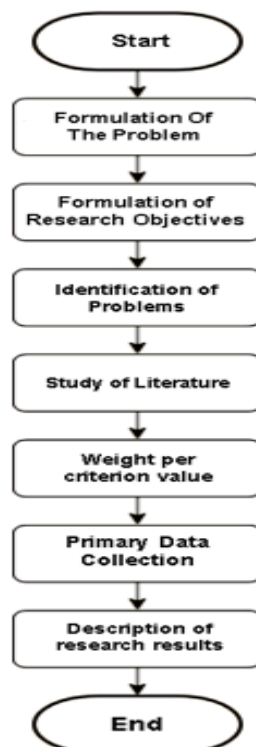


Figure 1. Research Stage Diagram

- a. Formulation of the problem
The stage in the formulation of this problem defines the existing problems regarding the Selection of the Best Bank for Account Opening for the Customer and formulates the problem according to the scope limitation.
- b. Formulation of Research Objectives
Determining the objectives to be achieved from the formulation of the problems that will occur in the research. The purpose of this research is to assist prospective customers in selecting the best bank for account opening using the Analytical Hierarchy Process (AHP) method.
- c. Identification of problems
Identification of this problem is carried out with the aim of finding the cause of the problem and looking for problems that occur with the Selection of the Best Bank for Customers
- d. Study of literature
Literature sources come from books, journals and previous studies from books, journals, articles and the internet.
- e. Weight per criterion value
Several criteria are used in the process of selecting the type of bank to the customer, namely: Administration Weight, Bank Interest, Transaction and Investment Limit. The criteria for assigning value are determined based on a questionnaire distributed to the customer.
- f. Primary Data Collection
Primary data collection is based on questionnaire data that has been filled out by respondents. The weight of the assessment based on the data of each respondent with determined criteria.
- g. Description of research results
Analyzing the results of data processing is based on existing theories using AHP calculations.

3. RESULTS AND DISCUSSIONS

From the results of filling out the questionnaires that have been made and distributed to respondents, then the results are divided into the form of a pairwise comparison matrix to get the weight of each criterion, to simplify the calculations, a table is made and each element is decimalized.

Based on the comparison matrix that, the data can be processed to obtain a consistency index and consistency ratio. The results of the paired matrix for each of the criteria and alternatives made.

a. Main Criteria

The following are the results of the recapitulation of the results of the calculation of the pairwise comparison assessment matrix from the processed data of 30 respondents:

Table 1. Pairwise Comparison Recapitulation Matrix Main Criteria

Criteria	Administration	Bank Interest	Transaction Limits	Investment
Administration	1	0.500	3.000	3.000
Interest	2.000	1	2.000	4.000
Transaction Limits	0.333	0.500	1	0.500
Investment	0.333	0.250	2.000	1
Amount	3.667	2.250	8.000	8.500

By dividing the elements in each column by the number of the corresponding column, a normalized relative weight will be obtained. The vector eigen values are generated from the average of the relative weights for each row. The results are in the following table:

Table 2. The Main Criteria Hierarchy Weighting Factor Matrix that is Normalized

Criteria	Administration	Bank Interest	Transaction Limits	Investment	Vector Eigen
Administration	0.273	0.222	0.375	0.353	0.306
Interest	0.545	0.444	0.250	0.471	0.428
Transaction Limits	0.091	0.222	0.125	0.059	0.124
Investment	0.091	0.111	0.250	0.118	0.142
Amount	1.000	1.000	1.000	1.000	1.000

Furthermore, the value of the vector eigen is multiplied by the original matrix, resulting in a value for each row, which is then divided again by the value of the vector itself. The average value of the results of this dividing is the Principal Eigen Value Maximum (λ_{max}).

$$\begin{bmatrix} 1 & 0.500 & 3.000 & 3.000 \\ 2.000 & 1 & 2.000 & 4.000 \\ 0.333 & 0.500 & 1 & 0.500 \\ 0.333 & 0.250 & 2.000 & 1 \end{bmatrix} \times \begin{bmatrix} 0.306 \\ 0.428 \\ 0.124 \\ 0.142 \end{bmatrix} = \begin{bmatrix} 1.318 \\ 1.856 \\ 0.511 \\ 0.599 \end{bmatrix}$$

Consistency Vector

$$\begin{bmatrix} 1.318 \\ 1.856 \\ 0.511 \\ 0.599 \end{bmatrix} : \begin{bmatrix} 0.306 \\ 0.428 \\ 0.124 \\ 0.142 \end{bmatrix} = \begin{bmatrix} 4.307 \\ 4.336 \\ 4.121 \\ 4.218 \end{bmatrix}$$

$$(\lambda_{max}) = \frac{(4.307 + 4.336 + 4.121 + 4.218)}{4} = 4.246$$

Because the matrix is of order 4 (consisting of 4 criteria), the consistency index value (CI) obtained is:

$$CI = \frac{(4.246 - 4)}{(4 - 1)} = 0.082$$

Next look for the Consistency Ratio value

With $n = 4$, it means the value of RI = 0.90

Then it can be calculated:

$$CR = \frac{0.082}{0.90} = 0.091$$

Because $CR < 0.100$ means that the respondent's preferences are declared consistent.

b. Administrative Criteria

Pairwise comparisons for administrative criteria on 4 selected bank names as samples, namely: Mandiri, BCA, BRI and BNI so that the average results of 30 respondents are obtained in the form of a matrix as follows::

Table 3. Pairwise Comparison Matrix Based on Administrative Criteria

Administrasi	Mandiri	BCA	BRI	BNI
Mandiri	1	2.000	0.333	2.000
BCA	0.500	1	0.250	0.333
BRI	3.000	4.000	1	4.000
BNI	0.500	3.000	0.250	1
Amount	5.000	10.000	1.833	7.333

By dividing the elements in each column by the number of the corresponding column, a normalized relative weight will be obtained. The eigenvector values are generated from the average of the relative weights for each row. The results are in the following table:

Table 4. Weighting Factor Matrix of Normalized Hierarchy of Administrative Criteria

Administrasi	Mandiri	BCA	BRI	BNI	Vector Eigen
Mandiri	0.200	0.200	0.182	0.273	0.214
BCA	0.100	0.100	0.136	0.045	0.095
BRI	0.600	0.400	0.545	0.545	0.523
BNI	0.100	0.300	0.136	0.136	0.168
Amount	1.000	1.000	1.000	1.000	1.000

Furthermore, the value of the vector eigen is multiplied by the original matrix, resulting in a value for each row, which is then divided again by the value of the vector itself. The average value of the results of this dividing is the Principal Eigen Value Maximum (λ_{max}).

$$\begin{bmatrix} 1 & 2.000 & 0.333 & 2.000 \\ 0.500 & 1 & 0.250 & 0.333 \\ 3.000 & 4.000 & 1 & 4.000 \\ 0.500 & 3.000 & 0.250 & 1 \end{bmatrix} \times \begin{bmatrix} 0.214 \\ 0.095 \\ 0.523 \\ 0.168 \end{bmatrix} = \begin{bmatrix} 0.914 \\ 0.389 \\ 2.217 \\ 0.691 \end{bmatrix}$$

Consistency Vector

$$\begin{bmatrix} 0.914 \\ 0.389 \\ 2.217 \\ 0.691 \end{bmatrix} : \begin{bmatrix} 0.214 \\ 0.095 \\ 0.523 \\ 0.168 \end{bmatrix} = \begin{bmatrix} 4.273 \\ 4.092 \\ 4.239 \\ 4.112 \end{bmatrix}$$

$$(\lambda_{\max}) = \frac{(4.273 + 4.092 + 4.239 + 4.112)}{4} = 4.179$$

Because the matrix is of order 4 (consisting of 4 criteria), the consistency index value (CI) obtained is:

$$CI = \frac{(4.179 - 4)}{(4 - 1)} = 0.060$$

Next look for the Consistency Ratio value

With $n = 4$, it means the value of RI = 0.90

Then it can be calculated:

$$CR = \frac{0.060}{0.90} = 0.066$$

Because $CR < 0.100$ means that the respondent's preferences are declared consistent

c. Interest Criteria

Pairwise comparisons for the Interest criteria on the 4 selected bank names that were used as samples, namely: Mandiri, BCA, BRI and BNI so that the average results of 30 respondents were obtained in the form of a matrix as follows:

Table 5. Pairwise Comparison Matrix Based on Interest Criteria

Interest	Mandiri	BCA	BRI	BNI
Mandiri	1	0.250	0.333	0.500
BCA	4.000	1	3.000	4.000
BRI	3.000	0.333	1	3.000
BNI	2.000	0.250	0.333	1
Amount	10.000	1.833	4.667	8.500

By dividing the elements in each column by the number of the corresponding column, a normalized relative weight will be obtained. The eigenvector values are generated from the average of the relative weights for each row. The results are in the following table:

Table 6. Matrix of Weighting Factors Hierarchy of Normalized Interest Criteria

Interest	Mandiri	BCA	BRI	BNI	Vector Eigen
Mandiri	0.100	0.136	0.071	0.059	0.092
BCA	0.400	0.545	0.643	0.471	0.515
BRI	0.300	0.182	0.214	0.353	0.262
BNI	0.200	0.136	0.071	0.118	0.131
Amount	1.000	1.000	1.000	1.000	1.000

Furthermore, the value of the vector eigen is multiplied by the original matrix, resulting in a value for each row, which is then divided again by the value of the vector itself. The average value of the results of this dividing is the Principal Eigen Value Maximum ($\lambda_{\max}$).

$$\begin{bmatrix} 1 & 0.250 & 0.333 & 0.500 \\ 4.000 & 1 & 3.000 & 4.000 \\ 3.000 & 0.333 & 1 & 3.000 \\ 2.000 & 0.250 & 0.333 & 1 \end{bmatrix} \times \begin{bmatrix} 0.092 \\ 0.515 \\ 0.262 \\ 0.131 \end{bmatrix} = \begin{bmatrix} 0.374 \\ 2.193 \\ 1.103 \\ 0.531 \end{bmatrix}$$

Consistency Vector

$$\begin{bmatrix} 0.374 \\ 2.193 \\ 1.103 \\ 0.531 \end{bmatrix} : \begin{bmatrix} 0.092 \\ 0.515 \\ 0.262 \\ 0.131 \end{bmatrix} = \begin{bmatrix} 4.061 \\ 4.258 \\ 4.209 \\ 4.054 \end{bmatrix}$$

$$(\lambda_{\max}) = \frac{(4.061 + 4.258 + 4.209 + 4.054)}{4} = 4.145$$

Because the matrix is of order 4 (consisting of 4 criteria), the consistency index value (CI) obtained is:

$$CI = \frac{(4.145-4)}{(4-1)} = 0.048$$

Next look for the Consistency Ratio value

With $n = 4$, it means the value of $RI = 0.90$

Then it can be calculated:

$$CR = \frac{0.048}{0.90} = 0.054$$

Because $CR < 0.100$ means that the respondent's preferences are declared consistent.

d. Transaction Limits

Pairwise comparisons for the Transaction Limit criteria on the 4 selected bank names that were used as samples, namely: Mandiri, BCA, BRI and BNI so that the average results of 30 respondents were obtained in the form of a matrix as follows:

Table 7. Pairwise Comparison Matrix Based on Transaction Limit Criteria

Transaction Limits	Mandiri	BCA	BRI	BNI
Mandiri	1	0.500	0.250	3.000
BCA	2.000	1	0.500	2.000
BRI	4.000	2.000	1	4.000
BNI	0.333	0.500	0.250	1
Amount	7.333	4.000	2.000	10.000

By dividing the elements in each column by the number of the corresponding column, a normalized relative weight will be obtained. The eigenvector values are generated from the average of the relative weights for each row. The results are in the following table:

Table 8. Matrix of Weighting Factors Hierarchy of Transaction Limit Criteria

Transaction Limits	Mandiri	BCA	BRI	BNI	Vector Eigen
Mandiri	0.136	0.125	0.125	0.300	0.172
BCA	0.273	0.250	0.250	0.200	0.243
BRI	0.545	0.500	0.500	0.400	0.486
BNI	0.045	0.125	0.125	0.100	0.099
Amount	1.000	1.000	1.000	1.000	1.000

Furthermore, the value of the vector eigen is multiplied by the original matrix, resulting in a value for each row, which is then divided again by the value of the vector itself. The average value of the results of this dividing is the Principal Eigen Value Maximum (λ_{max}).

$$\begin{bmatrix} 1 & 0.500 & 0.250 & 3.000 \\ 2.000 & 1 & 0.500 & 2.000 \\ 4.000 & 2.000 & 1 & 4.000 \\ 0.333 & 0.500 & 0.250 & 1 \end{bmatrix} \times \begin{bmatrix} 0.172 \\ 0.243 \\ 0.486 \\ 0.099 \end{bmatrix} = \begin{bmatrix} 0.712 \\ 1.028 \\ 2.056 \\ 0.399 \end{bmatrix}$$

Consistency Vector

$$\begin{bmatrix} 0.712 \\ 1.028 \\ 2.056 \\ 0.399 \end{bmatrix} : \begin{bmatrix} 0.172 \\ 0.243 \\ 0.486 \\ 0.099 \end{bmatrix} = \begin{bmatrix} 4.140 \\ 4.230 \\ 4.230 \\ 4.034 \end{bmatrix}$$

$$(\lambda_{max}) = \frac{(4.140 + 4.230 + 4.230 + 4.034)}{4} = 4.159$$

Because the matrix is of order 4 (consisting of 4 criteria), the consistency index value (CI) obtained is:

$$CI = \frac{(4.159-4)}{(4-1)} = 0.053$$

Next look for the Consistency Ratio value

With $n = 4$, it means the value of $RI = 0.90$

Then it can be calculated:

$$CR = \frac{0.067}{0.90} = 0.059$$

Because $CR < 0.100$ means that the respondent's preferences are declared consistent.

e. Investment

Pairwise comparisons for the Transaction Limit criteria on the 4 selected bank names that were used as samples, namely: Mandiri, BCA, BRI and BNI so that the average results of 30 respondents were obtained in the form of a matrix as follows:

Table 9. Pairwise Comparison Matrix Based on Investment Criteria

Investment	Mandiri	BCA	BRI	BNI
Mandiri	1	0.333	5.000	3.000
BCA	3.000	1	5.000	4.000
BRI	0.200	0.200	1	0.333
BNI	0.333	0.250	3.000	1
Amount	4.533	1.783	14.000	8.333

By dividing the elements in each column by the number of the corresponding column, a normalized relative weight will be obtained. The eigenvector values are generated from the average of the relative weights for each row. The results are in the following table:

Table 10. Investment Criteria Hierarchy Weighting Factor Matrix

Investment	Mandiri	BCA	BRI	BNI	Vector Eigen
Mandiri	0.221	0.187	0.357	0.360	0.281
BCA	0.662	0.561	0.357	0.480	0.515
BRI	0.044	0.112	0.071	0.040	0.067
BNI	0.074	0.140	0.214	0.120	0.137
Amount	1.000	1.000	1.000	1.000	1.000

Furthermore, the value of the vector eigen is multiplied by the original matrix, resulting in a value for each row, which is then divided again by the value of the vector itself. The average value of the results of this dividing is the Principal Eigen Value Maximum (λ_{max}).

$$\begin{bmatrix} 1 & 0.333 & 5.000 & 3.000 \\ 3.000 & 1 & 5.000 & 4.000 \\ 0.200 & 0.200 & 1 & 0.333 \\ 0.333 & 0.250 & 3.000 & 1 \end{bmatrix} \times \begin{bmatrix} 0.281 \\ 0.515 \\ 0.067 \\ 0.137 \end{bmatrix} = \begin{bmatrix} 1.199 \\ 2.241 \\ 0.272 \\ 0.560 \end{bmatrix}$$

Consistency Vector

$$\begin{bmatrix} 1.199 \\ 2.241 \\ 0.272 \\ 0.560 \end{bmatrix} : \begin{bmatrix} 0.281 \\ 0.515 \\ 0.067 \\ 0.137 \end{bmatrix} = \begin{bmatrix} 4.266 \\ 4.351 \\ 4.058 \\ 4.091 \end{bmatrix}$$

$$(\lambda_{max}) = \frac{(4.266 + 4.351 + 4.058 + 4.091)}{4} = 4.191$$

Because the matrix is of order 4 (consisting of 4 criteria), the consistency index value (CI) obtained is:

$$CI = \frac{(4.191 - 4)}{(4 - 1)} = 0.064$$

Next look for the Consistency Ratio value

With $n = 4$, it means the value of RI = 0.90

Then it can be calculated:

$$CR = \frac{0.064}{0.90} = 0.071$$

Because $CR < 0.100$ means that the respondent's preferences are declared consistent.

After calculating the data from the results of filling out the questionnaire and then using it as a comparison matrix, from the whole, the following results are obtained:

Table 11. Final Calculation Results

.Peringkat	Bank	Aggregate	Percent
1	BCA	0.358	35.80%

2	BRI	0.344	34.40%
3	Mandiri	0.164	16.40%
4	BNI	0.134	13.40%
Jumlah		1	100.00%

4. CONCLUSION

In selecting the best bank for account opening, using the Analytical Hierarchy Process (AHP) method on Expert Choice software can make it easier for prospective customers to make an account to chosen bank with the best in terms of Administration, Interest, Transaction Limits and Investment. The criteria used in data processing consist of 4 criteria, namely Administration, Interest, Transaction and Investment Limits and 4 alternatives (Mandiri, BCA, BRI, BNI). After processing and analyzing respondent data from 30 samples from the Jabodetabek area, it was obtained that Mandiri had the third priority weight, namely 16.40%, BCA had the highest priority weight with a value of 35.80%, BRI had the second highest priority weight after BCA, which was 34.40%, BNI has a priority weight with the lowest value of 13.40%. The results of the CR hypothesis for the criteria show a value of less than 0.1 or less than 10%, so the overall hierarchy is consistent, so the conclusions obtained are acceptable, meaning that the decisions made are reliable.

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