Multi-criteria Decision-Making Approaches to Analyze the Performance of the Best Conventional Banks in Indonesia

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Abstract. This article aims to evaluate the performance of conventional banks in Indonesia through the Analytical Hierarchy Process (AHP) based on their financial characteristics as a consideration for making decisions. The sample used in this research was chosen using purposive sampling approach with the criteria banks in Indonesia, especially Group IV Commercial Banks with core capital of more than IDR 30 trillion. This research is a quantitative study using secondary data taken based on the annual reports of each bank from the Indonesia Stock Exchange in 2019 which were analyzed using the AHP approach with several criteria, namely Capital, Asset Quality, Efficiency, Liquidity, and Earning. The results of data processing can be concluded that the output of traditional banks with the highest rating weight in Indonesia is BCA with a value of 34 percent. Based on these results, customers can choose BCA as the alternative bank of choice for savings, investment and loans.

Keywords: Bank, Financial Performance, Decision Making, Analytical Hierarchy Process

1 Introduction

The bank is an institution of financial intermediation which collects and distributes funds to the public. The company's situation is responsive to economic situation, so evaluating its output is very critical for any economic or financial institution [3] . A bank capable of sustaining and competing is a bank with a performance that meets the criteria of the bank soundness standard set by Bank Indonesia. Performance analysis is intended to determine management in utilizing its assets to generate profits efficiently [18] .

Bank health assessments can be carried out in various ways that have been regulated by Bank Indonesia. One of them can be accomplished by ensuring liquidity so that all parties who withdraw their deposits at any time can satisfy their obligations to the bank. In view of the position of banks as institutions that operate to facilitate payment transactions, readiness to fulfill obligations at any time becomes increasingly necessary. Liquidity and profitability are inversely related. Profitability decreases as liquidity increases, while, on the other hand, there is a direct correlation between a higher risk and a higher rate of return. It's difficult to find out balance between liquidity and profitability in liquidity management. [17] .

Indonesia's banking performance experienced a substantial decrease in 2019. This can be seen from data of Financial Services Authority (OJK) which states that until the end of 2019, bank credit growth was only 6.50 percent year-on-year (YOY). There is 9.88 percent growth rate rather than previous years based on figure below. OJK added that there are fundamental factors that slow down the credit, and it's because of most Indonesian companies tend to use foreign funding sources.

Table 1. Commercial Bank Performance December 2018 - December 2021

Indicator	2018	2019
Asset	9,21	6,13
Credit	11,75	6,08
LDR	94,04	93,64
NPL	2,37	2,53
CAR	23,42	23,31
ROA	2,50	2,44
NIM	5,00	4,80
OER	78,33	79,58

Source: Financial Services Authority (2020)

Indonesian banking performance in 2019 experienced a decline, but something different happened to the Commercial Banks based on Business Activities IV (BUKU IV) bank group. They are the only bank group that can still grow profits. Based on Bank Indonesia Statistics data released by the Financial Services Authority in 2019. the profit for Commercial Bank Business Activities (BUKU) I was recorded at IDR 457 billion, down 34.71 percent, BUKU II was recorded at IDR 9.00 trillion or down 1.9 percent, BUKU III was recorded at IDR

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34.478 trillion or down 10.04 percent, BUKU IV was recorded at IDR 108.356 trillion or an increase of 9.45 percent.

Bank performance assessment can be carried out using six indicators called CAMELS (Capital, Asset Quality, Management, Earning Power, Liquidity, and Sensitivity to Market Risk). The CAMELS evaluation takes into account both the quantitative and qualitative aspects in the context of expert judgment, but only the quantitative aspects are discussed in this report. Each indicator has limits set by Bank Indonesia regarding the percentage of financial performance that meets the bank's requirements to be declared healthy or endangers interested parties. There have been many studies using CAMELS as a benchmark for bank health, including research conducted by [11], [10], [7], [1] and [31].

Competition, which is increasingly tighter, makes customers more cautious in selecting banks. By meeting consumer needs, each bank is competing to be able to improve competitiveness. This purpose of this study is to analyze the performance of the BUKU IV bank as a consideration in decision making in choosing a bank institution for savings, investment and loans. The method of selecting a bank is done by considering several factors or criteria which are analyzed using the Analytical Hierarchy Process (AHP) method. This method is considered effective for making decisions with complex situations.

2 Literature Review

Bank performance is a description of the overall achievements that achieved by the institution from an operational perspective, both from the aspects of finance, marketing, fundraising, distribution of funds, technology and human resources. [9] and [29] conducted research related to bank performance by combining financial and non-financial aspects. Based on Bank Indonesia Regulation Number 6/10 / PBI / 2004 concerning the Commercial Bank Health Assessment System established by the Head of Bank Indonesia on April 12, 2004, the commercial bank health rating system is CAMELS (Capital, Asset quality, Management, Earnings, Liquidity and Sensitivity. against market risk).

1. Capital
   In this study, capital is reflected in the Capital Adequacy Ratio (CAR), which is the calculation of risk-weighted capital and assets based on the applicable minimum capital adequacy requirements. Several researchers such as [15] and [19] stated that high capital can reduce the risk of bankruptcy. If a bank has adequate capital, it may be determined whether it has the resources necessary to absorb unforeseen losses in the future.

$$\text{CAR} = \frac{\text{Tier 1 capital+Tier 2 capital}}{\text{Risk weighted assets}} \quad (1)$$

2. Asset Quality
   Another criterion for measuring the health of a bank is the quality of assets, which in this study is reflected in the Non-Performing Loan (NPL). Losses from non-performing loans provide the greatest risk to banks. According to [16], lending can present risks that lead to banks performing poorly. NPL is a formula for calculating NPL according to Bank Indonesia Circular Letter No.6 / 23 / DPNP of 2004.

$$\text{NPL} = \frac{\text{Non-performing Loans}}{\text{Total Loans}} \quad (2)$$

3. Efficiency
   The efficiency of a bank can be measured by a ratio called the Operational Efficiency Ratio (OER), which shows the ratio between operating costs or costs and operating income of a company in a period. Some researchers who use efficiency criteria as a measure of bank soundness include [19], [22], [5].

$$\text{OER} = \frac{\text{Operating Expenses}}{\text{Operating Income}} \quad (3)$$

4. Liquidity
   Liquidity is an important aspect related to a bank's ability to meet its obligations at maturity. Banks must keep their assets liquid so if customers suddenly withdraw their deposits, the bank can handle it. Liquidity can be measured using the Loan to Deposit Ratio (LDR) which is the ratio of the total loan amount to customer deposits as a whole, [12]. The formula for calculating LDR according to Bank Indonesia Circular Letter No.6/23/DPNP 2004.

$$\text{LDR} = \frac{\text{Total Loans}}{\text{Total Deposits}} \quad (4)$$

5. Earning
   Earning is a bank's ability to increase profits by maximum managing its resources so that the company's profitability can be measured. One indicator that can be used to measure profit is Return on Assets (ROA). This ratio measures the success of management in generating overall profits by comparing profit before tax to total assets. Several studies that use ROA to measure earnings include [2], [4], [13].

$$\text{ROA} = \frac{\text{Net income}}{\text{Total assets}} \quad (5)$$

2.2 Decision Making

George R. Terry argues that decision making is a selection based on several criteria from two or more possible alternatives [21]. The process involved in decision making consists of identifying situations, making alternative choices, evaluating and selecting, following up and implementing [25]. According to [30] there are four decision theories:

1. Decision making in certain conditions
2. Make decisions under risk
3. Decision making under uncertainty
4. Hierarchy of decision making (Analytical Hierarchy Process by Thomas Saaty)

2.3 Analytical Hierarchy Process *(*AHP)

Analytical Hierarchy Process (AHP) is a method used to solve various problems of decision-making using alternatives. This method was developed by Thomas L. Saaty, which is a general measurement theory to obtain ratio scales from discrete and continuous paired comparisons [24]. Problems in AHP are usually those that do not have a structure, which is measurable (quantitative), which requires judgment or in complex or unframed situations, in situations where information is minimal and only qualitatively based on perception, experience or intuition [20]. Some of the AHP stages are as follows [28] :

1. Defining the problem and purpose of decision making which is formed by a hierarchical structure based on the elements of the decision making.
2. Perform pairwise comparisons to illustrate the effect of each element on the objective or criterion. The pair scale is based on the value of importance as presented in table 2.6 below.

Table 2. Comparative Judgment

Intensity of importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
2	Weak or slight	
3	Moderate importance	Experience and judgment slightly favor one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgment strongly favor one activity over another
6	Strong plus	
7	Very strong	An activity is favored very strongly over another
8	Very, very strong	
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation

Source: Saaty's 1-9 scale of pairwise comparisons

3. Perform Eigen count and consistency testing. If the matrices are not compatible, the calculation must be repeated several times. Here's the formula for calculating consistency.

$$\text{Indeks Konsistensi (CI)} = \frac{\lambda_{max} - n}{n-1} \quad (6)$$

$$\text{Consistency Ratio (CR)} = \frac{\text{CI}}{\text{RI}} \quad (7)$$

The value of the Random Consistency Index (RI) is related to the dimensions of the matrix presented in table 3. If the consistency ratio is smaller than 0.10 then it proves that the comparison results are acceptable or consistent.

Table 3. Average Random Consistency Index

Size of matrix	1	2	3	4	5	6	7	8	9	10
RI	0	0	0,58	0,9	1,12	1,24	1,32	1,41	1,45	1,49

Source: Saaty, 1994 [24]

4. Perform eigen vector calculations from each paired comparison matrix to determine the priority of the elements at the lowest hierarchical level until they reach the goal.

3 Methodology

This research is a quantitative study using purposive sampling technique with the criteria for Commercial Banks Group of Business Activities Bank IV (BUKU IV) and has all the data required in the study. This study uses secondary data in the form of annual financial reports. The analytical tool used is the Analytical Hierarchy Process (AHP). The topic AHP become more popular among researchers after 1990s. and the most significant implementation of AHP was found after 2000.Several studies that use AHP to evaluate bank performance include [14], [27] , [8], [6], [23]. The framework in this research can be seen in Figure 1 as follows.

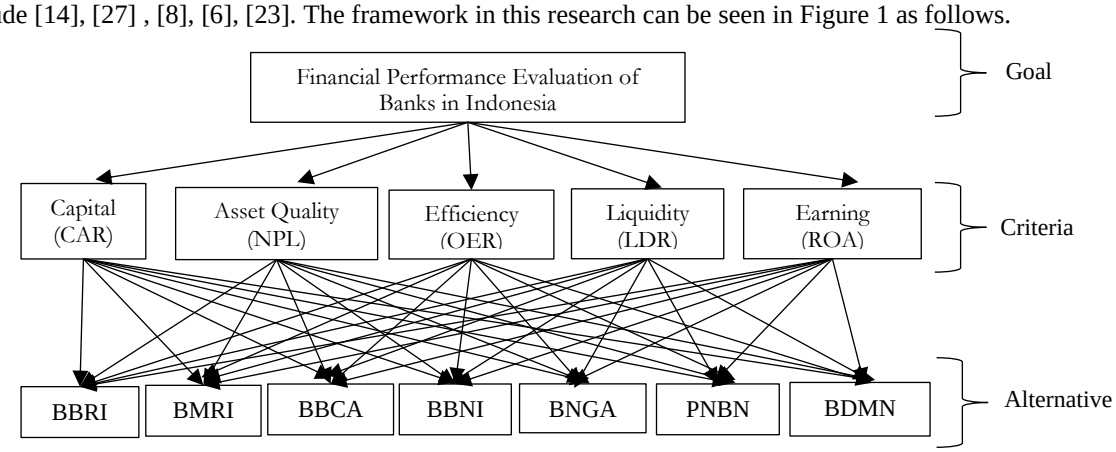

Figure 1. AHP Model for evaluating bank performance in Indonesia

4 Data Analysis and Result

4.1 Financial Analysis

Based on the data on the annual report of each bank, the financial value data for each indicator is obtained as shown in the following table:

Table 3. Financial Parameter Data

Banks	Capital (CAR)	Asset Quality (NPL)	Efficiency (OER)	Liquidity (LDR)	Earning (ROA)
BBRI	22,55%	1,04%	70,10%	88,64%	3,50%
BMRI	21,39%	0,84%	67,44%	93,93%	3,03%
BBCA	23,8%	0,5%	59,10%	80,5%	4,0%
BBNI	18,6%	1,22%	73,20%	91,5%	2,4%
BNGA	21,47%	1,30%	82,44%	97,75%	1,99%
PNBN	23,41%	1,12%	77,96%	115,26%	2,08%
BDMN	24,20%	2,00%	82,70%	98,9%	3,00%

Source: Indonesia Stock Exchange 2019

Based on table 3, for the criteria capital of each bank has a CAR of more than 12%, which means that the bank's capital adequacy is very good. Asset quality criteria is very good for each of these banks because they have an NPL of less than 10%. The operational efficiency ratio (OER) has a value below 83%, which means that the bank is efficient in managing costs and operating income. The sample banks are also very good at fulfilling their obligations at maturity. This can be seen from the LDR which is smaller than 75%. For profit criteria, banks have a very good ability to generate profits, seen from ROA of more than 1.5%. It can be concluded that the sample banks overall have a very good performance, but which bank is better?

4.2 Performance Evaluation of Banks by AHP

1. Pairwise Comparison Matrix with Saaty Scale

Table 4. Weights between Criteria

	Capital	Asset	Efficiency	Liquidity	Earning
Capital	1,00	3,00	5,00	0,20	0,33
Asset	0,33	1,00	3,00	0,14	0,20
Efficiency	0,20	0,33	1,00	0,11	0,14
Liquidity	5,00	7,00	9,00	1,00	3,00
Earning	3,00	5,00	7,00	0,33	1,00
Total	**9,53**	**16,33**	**25,00**	**1,79**	**4,68**

Source: Analysis Results (2020)

2. Calculation of criteria weight (priority vector) by:
   a. Normalization of the matrix
   Matrix normalization is done by dividing each entry in table 4.2 by the number of each criterion column. The results of the calculation of the normalization matrix are shown in table 5.

Table 5. Normalization Matrix

	Capital	Asset	Efficiency	Liquidity	Earning
Capital	1,00/9,53	3,00/16,33	5,00/25,00	0,20/1,79	0,33/4,68
Asset	0,33/9,53	1,00/16,33	3,00/25,00	0,14/1,79	0,20/4,68
Efficiency	0,20/9,53	0,33/16,33	1,00/25,00	0,11/1,79	0,14/4,68
Liquidity	5,00/9,53	7,00/16,33	9,00/25,00	1,00/1,79	3,00/4,68
Earning	3,00/9,53	5,00/16,33	7,00/25,00	0,33/1,79	1,00/4,68
Total	1	1	1	1	1

Source: Analysis Results (2020)

   b. Criteria Eigenvalues
   The next step is to calculate the average of each row which is called the criteria eigenvalues.

Table 6. Criteria Eigen Values

	Capital	Asset	Efficiency	Liquidity	Earning	Eigen Value
Capital	0.105	0.184	0.200	0.112	0.071	**0.134**
Asset	0.035	0.061	0.120	0.080	0.043	**0.068**
Efficiency	0.021	0.020	0.040	0.062	0.031	**0.035**
Liquidity	0.524	0.429	0.360	0.560	0.642	**0.503**
Earning	0.315	0.306	0.280	0.187	0.214	**0.260**
Total	1	1	1	1	1	1

Source: Analysis Result (2020)

This result is in line with research conducted by [6] which states that liquidity has the highest weight compared to other criteria. [26] States that the weight of profitability / profit is higher than the weight of capital, assets and efficiency. The following is the result of weighted criteria when depicted in a hierarchical arrangement as in Figure 2.

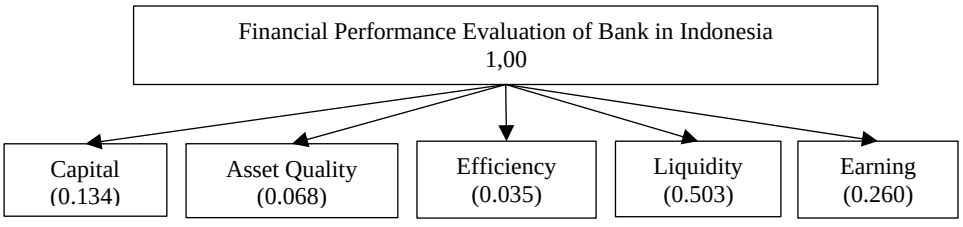

Figure 2. Hierarchical arrangement with weighted criteria

After knowing the eigenvalues, the matrix in table 4 will be multiplied by the matrix at the eigenvalues.

$$\begin{bmatrix} 1 & 3,00 & 5,00 & 0,20 & 0,33 \\ 0,33 & 1 & 3,00 & 0,14 & 0,20 \\ 0,20 & 0,33 & 1 & 0,11 & 0,14 \\ 5,00 & 7,00 & 9,00 & 1 & 3,00 \\ 3,00 & 5,00 & 7,00 & 0,33 & 1 \end{bmatrix} \begin{bmatrix} 0,134 \\ 0,068 \\ 0,035 \\ 0,503 \\ 0,260 \end{bmatrix} = \begin{bmatrix} 0,699 \\ 0,341 \\ 0,177 \\ 2,743 \\ 1,414 \end{bmatrix}$$

3. Calculating the consistency of the criteria matrix
   The first step is to calculate the consistency of vector weights with the following formula:

$$t = \frac{1}{5}\left(\frac{0,699}{0,134} + \frac{0,341}{0,068} + \frac{0,177}{0,035} + \frac{2,743}{0,503} + \frac{1,414}{0,260}\right) = 5,243$$

   Calculating the Consistency Index with the following formula:

$$CI = \frac{(5,243-5)}{(5-1)} = 0,061$$

   Calculating the Consistency Ratio

$$CR = \frac{0,061}{1,12} = 0,0542$$

   The result of the calculation of the consistency ratio shows the number 0.0542 < 0.10, thus proving that the comparison results are acceptable or consistent.
4. Calculating alternative eigenvalues for each criterion according to bank data. The steps are like calculating the eigenvalues of the above criteria.
5. After getting the value of each criterion weight and each alternative based on these criteria, a matrix is obtained as shown in table 7 below.

Table 7. Criterion-Alternative Eigenvalues

	Capital	Asset	Efficiency	Liquidity	Earning
BBRI	0,106	0,146	0,159	0,262	0,237
BMRI	0,046	0,247	0,237	0,098	0,159
BBCA	0,237	0,357	0,350	0,357	0,350
BBNI	0,032	0,069	0,106	0,145	0,070
BNGA	0,070	0,046	0,046	0,065	0,032
PNBN	0,159	0,104	0,070	0,030	0,046
BDMN	0,350	0,031	0,032	0,043	0,106

Source: Analysis Results (2020)

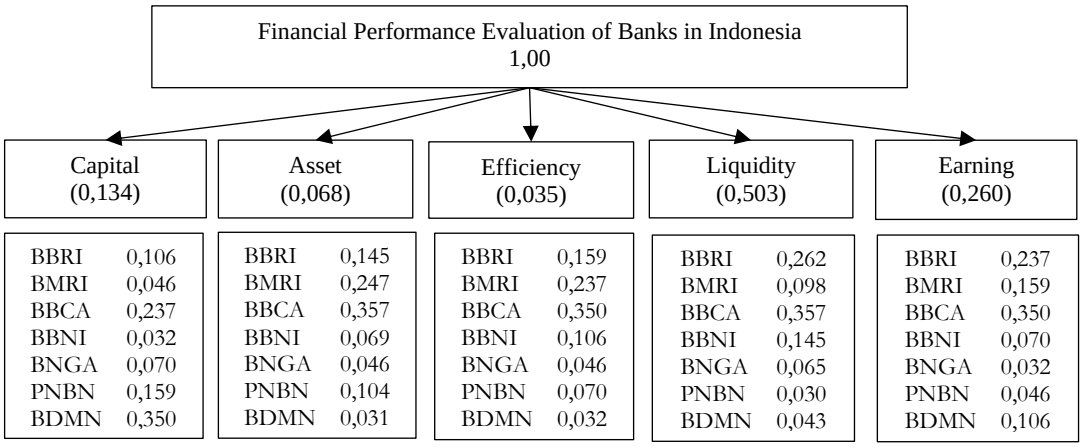

Figure 3. a new hierarchical arrangement completes with criteria weights and alternative weights

6. Calculating the final weight of each alternative by multiplying the matrix in table 7 with the criteria eigenvalues.

Table 8. Final Assessment Result Table

Bank Code	Final Weight	Percentage
BBRI	0,22	22%
BMRI	0,12	12%
BBCA	**0,34**	**34%**
BBNI	0,10	10%
BNGA	0,06	6%
PNBN	0,06	6%
BDMN	0,10	10%
Total	1	100%

Source: Analysis Results (2020)

5 Conclusions

Conventional commercial banks are financial institutions that carry out their business activities, namely collecting funds and channeling them back in the form of loans for consumptive purposes, working capital or conventional investment. Banks will offer interest on deposits for operations to collect funds from the public, as well as funds channeled in the form of loans, and banks will charge interest on these loans. People are also confused about which bank they can save and borrow from. Thus, the bank's rating may reflect the condition of a bank from a financial perspective to assist in decision making. Based on the results of data processing using the Analytical Hierarchy Process method, it can be concluded that the performance of conventional banks in Indonesia that has the highest-ranking weight is Bank BCA (BBCA) with a value of 34%. This assessment is based on the bank's financial condition as reflected in the indicators of capital, assets, efficiency, liquidity and earning.

The limitation of this research is only limited to conventional commercial banks in the BUKU IV category, so that the number of alternative options is limited to seven banks. The criteria used in this study are limited to the assessment of the soundness of the CAMELS bank without including management and sensitivity aspects. Based on the research limitations that have been mentioned, it is advisable to carry out further research by adding criteria from aspects of management, service, number of ATMs or other criteria. In addition, sub-criteria are expected to be used to make the AHP model more complex.

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