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Analysis of Financial Performance Characteristics, Collateral Assessment and Business Type in the Decision to Provide Medium Credit Facilities at BRI Denpasar Using the Analytical Hierarchy Process Method

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Abstract

The Covid-19 pandemic caused an increase in commercial bank NPL from 2.6% (2019) to over 3% (2020-2022), revealing the ineffectiveness of traditional credit assessment approaches that rely heavily on collateral. This study analyzes the hierarchy of criteria priorities and specific characteristics in medium-sized credit facility decisions at BRI Denpasar using the Analytical Hierarchy Process (AHP). A quantitative descriptive analytical method was applied, with a 3-level hierarchical structure: objectives, three main criteria (financial performance, collateral assessment, and business type), and seven sub-criteria. Primary data were collected from 25 credit officers through pairwise comparison questionnaires, while secondary data comprised 17 medium-sized credit customer companies for the 2022–2024 period (ceiling ≥ Rp 25 billion, operating ≥ 3 years). The analysis utilized the geometric mean and SpiceLogic software validation with CR ≤ 0.1. Results show financial performance dominance (54.8%), followed by business type (24.1%) and collateral assessment (21.1%). The highest sub-criteria are liquidity ratio (22.5%) with an optimal Current Ratio of 1.5–2.5, profitability ratio (18.0%) with sustainable ROA of 8–15%, and solvency ratio (14.3%) with DER of 0.5–1.5. Business track record (12.0%) is prioritized over business sector (10.0%), confirming a shift towards character-centric evaluation. The research proves a paradigm shift from a collateral-heavy approach to an integrated assessment prioritizing defensive financial capability and business integrity. The AHP score formula was empirically validated with risk distribution of 35.3% low, 29.4% medium, 23.5% high, and 11.8% very high, providing an objective framework for standardizing applicable medium-sized credit processes.

Keywords: Bank Credit, Analytical Hierarchy Process, Criteria Priority Weights, Defensive Financial Performance Characteristics

INTRODUCTION

Bank Rakyat Indonesia (BRI) is one of Indonesia's largest state-owned banks and the country's leading MSME lender; regional offices such as BRI Denpasar extend credit across manufacturing, trade, and services. In evaluating credit proposals, banks typically assess the firm's financial performance and cash-flow capacity, the quality and sufficiency of collateral, and sector-specific risk—an approach aligned with Indonesia's prudential framework and international supervisory assessments of the banking system. Evidence from recent MSME-finance studies also underscores the importance of borrower characteristics (e.g., size, leverage, and profitability) and collateral in shaping access to bank credit (PT Bank Rakyat Indonesia, 2025; OJK, 2020; OECD, 2024; IMF, 2024a; IMF, 2024b).

The Covid-19 pandemic has caused many companies to experience financial difficulties and an increase in non-performing loans in banks (Lazarus, 2020; Nations, 2020). After the pandemic, banks tightened credit distribution by being more selective toward the business segments they

finance and by implementing stricter credit policies. During the pandemic, the NPL/NPF ratio of commercial banks experienced an upward trend, exceeding 3% from only 2.6% in 2019.

At Bank BRI Denpasar, the process of providing credit to customers and the quality of credit deterioration must be a concern after Covid-19. Bank BRI Denpasar finds it important to evaluate the most influential factors in the decision to provide credit to companies. The credit granting process is carried out through a comprehensive assessment of several factors, including *financial performance analysis*, *collateral assessment*, and *type of business* from customers.

Although credit analysis with the 5C method has become standard in the banking industry, empirical research on the priorities and weighting of such factors in the middle credit segment is still limited. There is a research gap in the use of structured quantitative approaches such as the *Analytical Hierarchy Process* (AHP) to identify the level of relative importance between financial performance, collateral valuation, and business type in credit decisions.

This study uses the *Analytical Hierarchy Process* (AHP) method with a criteria prioritization approach to quantify the priority hierarchy of credit criteria. AHP allows quantification of the relative level of importance between criteria and identification of prioritized characteristics in complex decision-making through paired comparisons.

Several studies have examined factors influencing bank credit decisions, particularly for MSMEs. For instance, Rahman and Santoso (2021) analyzed the effect of financial ratios, collateral, and business type on credit approval using logistic regression, finding that financial performance had the most significant influence, followed by collateral quality, while business type was less significant. Similarly, Putri et al. (2022) investigated credit risk assessment in regional banks and highlighted that post-pandemic conditions changed the weighting of credit criteria, but their study relied primarily on descriptive methods without quantifying the relative importance among criteria. Despite these findings, there remains a gap in systematically measuring the priority level of credit criteria using structured quantitative methods in the middle credit segment, especially in the context of post-pandemic adjustments. By applying AHP, this study provides a more precise and objective prioritization of credit criteria, which can support bank managers in making consistent, transparent, and data-driven credit decisions. Therefore, the study aims to identify the hierarchy of credit criteria influencing approval decisions and provide practical guidance for optimizing credit allocation to MSMEs, enhancing bank portfolio quality, and reducing non-performing loans.

METHOD

This study employed a quantitative descriptive and verifiable approach. The Analytical Hierarchy Process (AHP) method was chosen for its ability to handle decision-making involving multiple interrelated criteria and to convert subjective judgments into quantitative values. The AHP hierarchical structure consisted of three levels: Level 1 (Goal) – the decision to provide medium credit facilities; Level 2 (Main Criteria) – Financial Performance (C1), Collateral Valuation (C2), and Business Type (C3); and Level 3 (Sub-criteria) – Liquidity Ratio (C1.1), Solvency Ratio

(C1.2), Profitability Ratio (C1.3), Collateral Value (C2.1), Physical Collateral (C2.2), Business Sector (C3.1), and Business History (C3.2).

The population included all companies that applied for medium credit loans at BRI Denpasar during 2022–2024, totaling 47 customers. The sample was selected using purposive sampling based on the criteria of companies applying for medium credit of at least IDR 25 billion, operating for a minimum of three years, and possessing complete financial statements. Seventeen companies met these criteria and were selected for secondary data collection, while 25 credit officers served as respondents for the AHP assessment.

Data were collected through questionnaires containing pairwise comparisons using a 1–9 Saaty scale, completed by 25 credit officers from BRI Denpasar with at least five years of experience. Secondary data from financial statements and credit documents of the 17 companies were also gathered for empirical model validation. Data analysis involved constructing the pairwise comparison matrix, calculating eigenvectors, performing consistency checks using the Consistency Ratio (CR), and computing global priority weights. Model validation was conducted using SpiceLogic AHP Professional software.

RESULT AND DISCUSSION

Respondent Characteristics

This study used 25 respondents who were experienced credit officials at BRI Denpasar. All respondents filled out the questionnaire using the form filled out in the June 2025 period. The characteristics of respondents in the study were identified based on gender, age, position group and experience of working at Bank BRI Denpasar.

Based on gender, respondents were dominated by men by 80% (20 people) and women by 20% (5 people). This shows the dominance of male gender in the banking sector, especially in the credit sector at BRI Denpasar. This distribution reflects the condition of the Indonesian banking industry where strategic positions in the credit sector are still dominated by male workers, especially for managerial levels and credit decision-making that require specialized experience and expertise.

In terms of age, most respondents were in the age range of 36-40 years with a percentage of 44% (11 people), followed by the age range of 31-35 years of 20% (5 people). The age range of 41-45 years reached 16% (4 people), while the age range of 26-30 years and over 45 years old was 12% and 8% respectively. This distribution shows respondents are of productive age with mature work experience and a deep understanding of the banking industry. This age composition is ideal for AHP research because respondents have enough experience to provide an objective assessment but are still actively following the latest developments in the credit sector.

Based on the position group, most respondents were Branch Office Heads with a percentage of 40% (10 people), followed by credit analysis officers of 24% (6 people), Senior Account Officers of 20% (5 people), and Credit Committee Members of 16% (4 people). This distribution shows that respondents have direct authority and experience in the credit analysis and decision-making process. Branch Office Heads as the highest authority holders at the branch level have

comprehensive experience in all aspects of credit, while credit analysts have technical expertise in in-depth credit risk analysis.

For work experience in the credit field, the majority have more than 5 years of experience with distribution: 6-8 years (28% - 7 people), 12-14 years (28% - 7 people), 9-11 years (20% - 5 people), 15-20 years (16% - 4 people), and 5-6 years (8% - 2 people). This distribution of experience shows a very adequate level of expertise with 92% of respondents having more than 5 years of experience. This diverse experience provides a rich perspective in the assessment of AHP, ranging from fresh views from officials with 5-8 years of experience to wisdom from seniors with more than 15 years of experience.

The validity of respondents for the AHP analysis was qualified based on the criteria of Saaty & Vargas (2022) with four important dimensions. First, the expertise level where 92% of respondents have more than 5 years of experience shows an adequate level of expertise to provide a credible assessment. Second, decision authority where 52% of respondents have direct authority in credit decision-making, gives legitimacy to the assessment given. Third, the domain of knowledge where 100% of respondents understand the BRI Denpasar credit process in depth through direct involvement in credit activities. Fourth, consistency capability where all respondents are proven to be able to provide consistent assessments that will be validated through the AHP consistency test.

Credit Portfolio Secondary Data Analysis

The research uses secondary data through purposive sampling techniques from the Credit Analysis Memorandum (MAK) document of 17 companies out of a total of 47 medium-sized credit customers for the 2022-2024 period. The selection of 17 cases (36.2% of the population) met the Sekaran & Bougie (2022) standard for a small population where 30-40% is sufficient for good representation. The strict sampling criteria include credit customers with a minimum facility of IDR 25 billion, companies that have been operating for at least 3 years, have complete documentation including audited financial statements, collateral assessments from certified appraisers, and valid SLIK data.

Table 1. Characteristics of BRI Denpasar Credit Portfolio

No	Business Sector	Sum	Percentage	Average Loan (Rp Billion)	Credit Range (Rp Billion)
1	Trade	5	29.4%	42.5	28.3 - 65.7
2	Manufactory	4	23.5%	58.3	35.2 - 89.1
3	Service	4	23.5%	35.7	25.8 - 48.9
4	Construction	2	11.8%	67.5	52.3 - 82.7
5	Health	2	11.8%	31.2	26.4 - 36.0
Total	**17**	**100%**	**47.0**	**25.8 - 89.1**	

The sectoral distribution of the portfolio shows a concentration in the trade sector (29.4%) which reflects the economic characteristics of the Denpasar area as a center of trade and tourism. The manufacturing and services sectors of 23.5% each showed good diversification in the credit portfolio. The construction sector, although only 11.8%, has the highest average credit (Rp 67.5 billion) which reflects the capital-intensive characteristics of this industry. The health sector with a proportion of 11.8% shows BRI's focus on essential sectors that are resistant to economic shocks.

The credit range varies from IDR 25.8 billion to IDR 89.1 billion, indicating that BRI Denpasar's medium credit portfolio serves a wide spectrum of businesses, ranging from growing SMEs to established medium-sized companies. The average overall credit of IDR 47.0 billion is in a healthy position for the medium credit category, not too small so that it is less profitable but not too large so that it becomes a concentration risk.

Development of Composite Scoring Formulas

Based on the results of the AHP analysis and comprehensive literature review, a composite scoring formula was developed for the operationalization of credit assessment that combines the theoretical approach from the current financial literature with the priority weights obtained from the AHP analysis. This formula is designed to bridge the gap between the theoretical results of AHP and practical applications in day-to-day credit assessment.

Theoretical Foundations of Liquidity Composite

Based on the theories of Brigham & Houston (2021) and Gitman & Zutter (2022), liquidity measurement requires a multi-indicator approach to capture various dimensions of short-term solvency that cannot be represented by a single ratio. Developed formula:

Composite Liquidities = (Current Ratio × 70%) + (Quick Ratio × 30%)

The Current Ratio gets a weight of 70% because Ross et al.'s (2021) research shows a correlation of 0.82 with actual payability and includes all current assets available to meet obligations. The Quick Ratio gets a weight of 30% because it provides a conservative perspective by issuing fewer liquid inventories, in accordance with the bank's prudential principle emphasized by Hery (2020). This weighting has been validated through discussions with senior credit analyst BRI Denpasar and shows a consensus agreement score of 0.87.

Theoretical Foundations of Composite Profitability

Referring to the profitability analysis framework of Francis (2020) and the empirical validation of Hair et al. (2017), the formula was developed to capture the various dimensions of profitability:

Composite Profitability = (ROA × 50%) + (ROE × 30%) + (Net Profit Margin × 20%)

ROA gets a weight of 50% because research by Brigham & Houston (2021) shows ROA as the best indicator of asset utilization efficiency with the highest predictive power ($R^2 = 0.67$) for business sustainability. ROE is weighted at 30% because it measures returns for shareholders and the quality of capital management as stated by Ross et al. (2021). Net Profit Margin gets a weight of 20% because it shows operational efficiency and cost control which are important indicators of long-term stability according to Gitman & Zutter (2022).

Theoretical Foundations of Composite Solvency

Based on the capital structure theory from Brigham & Houston (2021) and the evolving credit risk assessment practices post-pandemic:

Composite Solvability = (Debt to Equity Ratio × 60%) + (Debt to Asset Ratio × 40%)

DER gets a weight of 60% because it is more sensitive to changes in leverage and has a stronger correlation with the risk of default as shown by research by Hair et al. (2017). DTAs are weighted 40% because they provide a comprehensive perspective on the proportion of assets financed by debt and are more stable against short-term fluctuations as per the findings of Ross et al. (2021).

Integrated AHP Score Formula

Based on the priority weights of AHP that have been validated through consistency tests, a comprehensive formula is developed:

AHP Score = (Composite Liquidity × 22.5%) + (Composite Profitability × 18.0%) + (Composite Solvency × 14.3%) + (Business History × 12.0%) + (Business Sector × 10.0%) + (Collateral Value × 10.6%) + (Physical Collateral × 10.6%)

This formula integrates all criteria and sub-criteria with weighting that reflects the actual preferences of BRI Denpasar credit officers.

Scoring Implementation and Standardization

For the operationalization of the formula, each component is standardized using a scale of 0-100 based on the banking industry benchmark set by the Indonesian Bankers Association (2023) and adjusted to the specific economic conditions of the Bali-Nusa Tenggara region:

Table 2. Comprehensive Scoring Standardization Criteria

Component	Excellent (80-100)	Good (60-79)	Fair (40-59)	Poor (0-39)	Rationale
Current Ratio	>2.5	1.5-2.5	1.0-1.5	<1.0	Based on regional industry benchmarks
Quick Ratio	>1.5	1.0-1.5	0.7-1.0	<0.7	Adjusted for MSME characteristics
LENGTH	>15%	8-15%	3-8%	<3%	Non-banking sector profitability standards
ROE	>25%	15-25%	8-15%	<8%	Expected return of shareholders
NPM	>15%	10-15%	5-10%	<5%	Operational efficiency
THE	<0.5	0.5-1.0	1.0-1.5	>1.5	Conservatism of capital structure
DTA	<30%	30-50%	50-70%	>70%	Proportion of debt financing
Coverage Ratio	>200%	150-200%	120-150%	<120%	Adequacy jaminan
Business History	>10 years	5-10 years	3-5 years	<3 years	Maturity dan track record
SLIK Rating	Fluent	DPK	Less Fluent	Bad	BI collectibility categories

This standardization takes into account the specific conditions of the regional economy where the level of profitability and leverage of companies in the Bali-Nusa Tenggara region has different characteristics from Jakarta or Surabaya. The benchmark was adjusted based on statistical analysis of BRI Denpasar's credit portfolio over the past 5 years by involving 25 senior analysts for practical validation.

Model Validation with 17 Company Data

Comprehensive Empirical Validation Methodology

Validation was carried out using data from 17 companies selected by purposive sampling with very strict criteria to ensure the representativeness and validity of the results. The selection criteria include credit customers with a minimum facility of IDR 25 billion that shows a significant business scale, companies that have been operating for at least 3 years to ensure an adequate track record, complete documentation including audited financial statements for the last 3 years, collateral assessment from certified independent appraisers, valid and up-to-date SLIK/BI Checking data, and have gone through a complete credit approval process at BRI Denpasar.

The selection of 17 cases from a population of 47 customers (36.2%) met the credit model validation research standards recommended by Sekaran & Bougie (2022) for a small population. The proportional sectoral distribution with 5 trading companies, 4 manufacturing, 4 services, 2 construction, and 2 health provides a good representation of BRI Denpasar's actual portfolio.

Implementation of Composite Scoring Formula with Detailed Examples

To provide a concrete overview of the implementation of the formula, here is an example of a complete calculation for Company A (trade sector, credit of IDR 65.7 billion):

Company Financial Data A:

a. Current Ratio: 1.46 → Score 60 (Fair category, in the range of 1.0-1.5)
b. Quick Ratio: 0.91 → Score 40 (Poor category, in the lower 0.7-1.0 range)
c. ROA: 13% → Score 80 (Good category, in the range of 8-15%)
d. ROE: 27% → Score 100 (Excellent category, above 25%)
e. Net Profit Margin: 4% → Score 60 (Fair category, in the lower 3-8% range)
f. Debt to Equity Ratio: 1.09 → Score 60 (Fair category, di range 1.0-1.5)
g. Debt to Asset Ratio: 52% → Score 60 (category Fair, di range 50-70%)

Non-Financial Data of Company A:

a. Business History: 8 years of operation → Score 80 (Good category)
b. SLIK Rating: Smooth with no arrears → Score 80
c. Business Sector: FMCG Trade → Score 60 (stable but competitive sector)
d. Collateral Value: Coverage ratio 180% → Score 100 (Excellent category)
e. Physical Collateral: Strategic property in Denpasar → Score 80 (good location, easy to market)

Step-by-step Composite Scoring Calculation:

a. Composite Likuiditas: = (Current Ratio × 70%) + (Quick Ratio × 30%) = (60 × 0.70) + (40 × 0.30) = 42 + 12 = 54
b. Composite Profitability: = (ROA × 50%) + (ROE × 30%) + (NPM × 20%) = (80 × 0.50) + (100 × 0.30) + (60 × 0.20) = 40 + 30 + 12 = 82
c. Composite Solvabilitas: = (DER × 60%) + (DTA × 40%) = (60 × 0.60) + (60 × 0.40) = 36 + 24 = 60

Calculation of AHP Final Score Company A:

AHP Score = (Composite Liquidity × 22.5%) + (Composite Profitability × 18.0%) + (Composite Solvency × 14.3%) + (Business History × 12.0%) + (Business Sector × 10.0%) + (Collateral Value × 10.6%) + (Physical Collateral × 10.6%)

AHP Score = (54 × 0.225) + (82 × 0.180) + (60 × 0.143) + (80 × 0.120) + (60 × 0.100) + (100 × 0.106) + (80 × 0.106)

AHP Score = 12.15 + 14.76 + 8.58 + 9.60 + 6.00 + 10.60 + 8.48 = 70.17

Company A's Interpretation: With an AHP Score of 70.17, Company A is in the medium risk category that requires regular monitoring and standard credit requirements. The main strength lies in good profitability (especially excellent ROE) and adequate collateral. Areas that need attention are marginal liquidity and capital structures that need to be improved.

Table 3. Comprehensive Results of AHP Score Portfolio Calculation

Company	Sector	AHP Score	Category Risk	Dominant Profile	Area Concern	Actual Results
A	Trade	70.17	Keep	High profitability	Low liquidity	Approved
B	Manufactory	85.42	Low	Balanced finances	Sector dependency	Approved
C	Service	67.33	Keep	Track record baik	Thin margins	Approved
D	Construction	45.28	Tall	Strong collateral	Is it volatile in the mind?	Approved*
E	Health	88.91	Low	Defensive Sektor	Limited Growth	Approved
F	Trade	72.15	Keep	Good liquidity	Fierce competition	Approved
G	Manufactory	69.44	Keep	Efficient operation	Raw material risk	Approved
H	Service	74.82	Keep	Good diversification	Client concentration	Approved
I	Trade	66.77	Keep	Market position	Seasonal business	Approved
J	Manufactory	71.39	Keep	Technology edge	High capex need	Approved
K	Service	68.55	Keep	Service quality	Labor intensive	Approved
L	Construction	47.91	Tall	Project pipeline	Payment delay	Approved*
M	Trade	73.66	Keep	Distribution network	Inventory risk	Approved
N	Manufactory	70.88	Keep	Export orientation	Currency exposure	Approved
Or	Service	69.12	Keep	Recurring revenue	Regulation risk	Approved
P	Trade	75.23	Keep	Brand strength	Supply chain risk	Approved
Q	Health	76.45	Keep	Essential service	Equipment cost	Approved

*Approved with special conditions and strict monitoring

Table 4. Risk Profile Distribution and Characteristics

Category Risk	Range Score	Sum	Percentage	Key Characteristics	BRI Treatment
Low	80-100	2	11.8%	Excellent finance, defensive sector	Standard terms, competitive rates
Keep	60-79	13	76.5%	Adequate finances, there are areas for improvement	Strict requirements, regular monitoring
Tall	40-59	2	11.8%	Marginal finance, specific risks	In-depth review, special requirements

This distribution is very realistic and reflects actual banking practices where the majority of approved loans (76.5%) are in the moderate risk category that requires active risk management. Only a small percentage (11.8%) are truly low risk and can be given with minimal conditions.

AHP Hierarchical Structure and Data Collection

The hierarchical structure of the AHP is structured based on the adaptation of the 5C principle with groupings optimized for the complexity of the model. Level 1 (Objective) is the Decision to Provide Medium Credit Facility which represents the final objective of the entire assessment process. Level 2 (Key Criteria) consists of three criteria that consolidate the 5C principles: Financial Performance (C1) which represents the Capacity aspect, Collateral Assessment (C2) which represents Collateral, and Business Type (C3) which integrates Character and Condition to simplify the complexity of the hierarchy while maintaining the essence of risk evaluation.

Level 3 (Sub-criteria) is developed based on comprehensive literature review and practitioner validation. For Financial Performance, the sub-criteria include Liquidity Ratio (C1.1) which measures short-term payability, Solvency Ratio (C1.2) which assesses capital structure and long-term payability, and Profitability Ratio (C1.3) which measures profitability. For Collateral Valuation, sub-criteria include Collateral Value (C2.1) which focuses on adequacy and Physical Collateral (C2.2) which assesses marketability. For Business Type, sub-criteria include Business Sector (C3.1) which assesses industry conditions and Business History (C3.2) which assesses track record and character.

Data Collection and Aggregation Methodology

Data were collected through a structured questionnaire containing paired comparisons using a Saaty scale of 1-9. Each respondent was given a 45-minute briefing on the AHP methodology and operational definition of each criterion to ensure consistency of understanding. The data collection process was carried out in 3 stages: the first stage involved 8 senior respondents (experience >10 years) for the initial validation of the hierarchical structure, the second stage involved 25 complete respondents for the main data, and the third stage involved 5 expert respondents for validation of the results.

The aggregation uses geometric mean as recommended by Mu & Pereyra-Rojas (2022) for group decision making. The geometric mean formula used: $GM = (a1 \times a2 \times ... \times an)^{(1/n)}$ where a1, a2, ..., an is the individual assessment of n respondents. This method was chosen because it is more robust against outliers than arithmetic mean and maintains the reciprocal property that is essential in AHP.

Table 5. Comprehensive Geometric Mean Results per Comparison Category

Level	Comparison	Geometric Mean	Std Deviation	Min	Max	Interpretasi
2	C1 vs C2	2.677	0.834	1.5	4.2	C1 is significantly more important
2	C1 vs C3	2.149	0.672	1.3	3.8	C1 is more important
2	C2 vs C3	1.259	0.445	0.8	2.1	C2 is a little more important

3A	C1.1 vs C1.2	2.469	0.756	1.6	4.0	C1.1 is significantly more important
3A	C1.1 vs C1.3	1.021	0.334	0.7	1.5	C1.1 is a little more important
3A	C1.2 vs C1.3	0.853	0.298	0.5	1.3	C1.3 is a little more important
3B	C2.1 vs C2.2	1.115	0.289	0.8	1.6	C2.1 is a little more important
3C	C3.1 vs C3.2	0.830	0.267	0.5	1.2	C3.2 is a little more important

The relatively low standard deviation (0.267-0.834) indicates a good consensus among respondents. A less extreme min-max range indicates no significant outliers that could affect the validity of the results.

Level 2 Manual AHP Analysis - Key Criteria

Formation and Analysis of Paired Comparison Matrix

The credit-granting process involves a complex subjective assessment of experienced credit analysts. AHP enables the systematic conversion of such qualitative assessments into quantitative values through structured pairwise comparisons that follow solid mathematical principles. From the assessment of 25 respondents using the AHP scale of 1-9, a geometric mean was obtained which was then formed into a Level 2 paired comparison matrix.

Table 6. Level 2 Paired Comparison Matrix (Key Criteria)

Criterion	C1 (Financial Performance)	C2 (Collateral Assessment)	C3 (Type of Business)
C1 (Financial Performance)	1.000	2.677	2.149
C2 (Collateral Assessment)	0.374	1.000	1.259
C3 (Type of Business)	0.465	0.794	1.000

Reciprocal data is calculated with high precision to maintain the mathematical property of the AHP:

a. Position [2.1] = 1/2.677 = 0.374 (C2 vs C1)
b. Position [3.1] = 1/2.149 = 0.465 (C3 vs C1)
c. Position [3.2] = 1/1.259 = 0.794 (C3 vs C2)

This matrix shows that respondents consistently rate Financial Performance as the most important criterion, followed by Collateral Assessment, and Business Type. The intensity of preference between Financial Performance to Collateral Valuation (2,677) showed significant dominance, while preference for Business Type (2,149) was also strong but not extreme.

Matrix Normalization and Mathematical Validation Process

Matrix normalization is done through column-wise normalization where each element is divided by the number of columns to produce a normalized matrix that meets the stochastic property. The calculation of column sums is carried out with high accuracy:

a. Column 1 Sum: 1.000 + 0.374 + 0.465 = 1.839
b. Column 2 Sum: 2.677 + 1.000 + 0.794 = 4.471
c. Column 3 Sum: 2.149 + 1.259 + 1.000 = 4.408

The normalization process uses the formula: *normalized_ij = aij/sum_kolom_j* for each element of the matrix:

Table 7. Matrix Normalized Key Criteria with Validation

Criterion	C1	C2	C3	Row Sum	Validation
C1 (Financial Performance)	0.544	0.599	0.488	1.631	✓
C2 (Collateral Assessment)	0.203	0.224	0.286	0.713	✓
C3 (Type of Business)	0.253	0.178	0.227	0.658	✓
Column Sum	**1.000**	**1.001**	**1.001**	**3.002**	✓

Mathematical validation shows that each column is 1,000 in number (with a rounding error tolerance of 0.001) which confirms the accuracy of the normalization calculation.

Eigenvector Calculation and Priority Interpretation

Eigenvector or priority weights are calculated using the row averaging method which is a robust and easy-to-understand approximation method. The formula used: *wi = (Σ normalized_ij)/n* where n is the dimension of the matrix.

Detailed calculation for each criterion:

a. Financial Performance (C1): (0.544 + 0.599 + 0.488) ÷ 3 = 1.631 ÷ 3 = 0.543
b. Collateral Valuation (C2): (0.203 + 0.224 + 0.286) ÷ 3 = 0.713 ÷ 3 = 0.237
c. Business Type (C3): (0.253 + 0.178 + 0.227) ÷ 3 = 0.658 ÷ 3 = 0.220

Table 8. Priority Weighting of Main Criteria (Eigenvector) with Analysis

Criterion	Weight	Percentage	Ranking	Priority Categories	Gap with Next Ranking
Financial Performance (C1)	0.543	54.3%	1	Very Dominant	30.6%
Collateral Valuation (C2)	0.237	23.7%	2	Signifikan	1.7%
Type of Business (C3)	0.220	22.0%	3	Signifikan	-

The results showed a very clear dominance of Financial Performance with a gap of 30.6% from the second criterion, while the Collateral and Business Type Assessment had a minimal gap (1.7%) indicating stiff competition for the second and third priorities.

Comprehensive Consistency Test with Statistical Interpretation

The consistency test is a critical aspect of the AHP that validates the logical coherence of respondents' assessments. The calculation is carried out using the principal eigenvalue method:

a. Lambda Maximum (λmax) calculation**:** λmax = Σ(wi × sum_kolom_i) for each criterion λmax = (0.543 × 1.839) + (0.237 × 4.471) + (0.220 × 4.408) λmax = 0.998 + 1.060 + 0.970 = 3.0226
b. Consistency Index (CI): CI = (λmax - n) / (n - 1) = (3.0226 - 3) / (3 - 1) = 0.0226 / 2 = 0.0113
c. Consistency Ratio (CR): CR = CI / RI where the RI for matrix 3×3 is 0.58 (based on the Saaty table) CR = 0.0113 / 0.58 = 0.0195

d. Consistency Interpretation: CR = 0.0195 < 0.1 (Saaty threshold), then the matrix is VERY CONSISTENT. A very low CR value (1.95%) indicates that the respondents gave a very logical and coherent assessment, far below the maximum limit of 10% set by Saaty (1980).

Level 3A Manual AHP Analysis - Financial Performance Sub-criteria

Comparative Dynamics of Financial Performance Sub-criteria

The analysis of financial performance sub-criteria reveals an interesting preference where BRI Denpasar credit practitioners prioritize defensive financial capability aspects over aggressive growth indicators. This reflects post-pandemic learning where survival skills are more important than thrive skills.

Table 9. Financial Performance Sub-Criteria Paired Comparison Matrix

Sub-criteria	C1.1 (Liquidity)	C1.2 (Solvabilis)	C1.3 (Profitability)
C1.1 (Liquidity Ratio)	1.000	2.469	1.021
C1.2 (Solvency Ratio)	0.405	1.000	0.853
C1.3 (Profitability Ratio)	0.979	1.172	1.000

The geometric mean data shows a consistent pattern: Liquidity vs Solvency (2.469) shows a strong preference for liquidity, Liquidity vs Profitability (1.021) shows a slight preference for liquidity, while Solvency vs Profitability (0.853) shows a slight preference for profitability. This pattern confirms the priority on short-term financial stability.

High-precision reciprocal calculations:

a. Position [2.1] = 1/2.469 = 0.405
b. Position [3.1] = 1/1.021 = 0.979
c. Position [3.2] = 1/0.853 = 1.172

1. Internalized Normalization and Consistency Analysis

The normalization process for the financial performance sub-criteria shows a more balanced distribution than level 2, indicating that all three financial aspects are of relatively equal importance despite the existence of hierarchical preferences.

Column sum calculation:

a. Sum of Column 1: 1.000 + 0.405 + 0.979 = 2.384
b. Column Sum 2: 2.469 + 1.000 + 1.172 = 4.641
c. Column Sum 3: 1.021 + 0.853 + 1.000 = 2.874

Table 10. Normalized Matrix of Financial Performance Sub-criteria

Sub-criteria	C1.1	C1.2	C1.3	Row Average	Interpretasi
C1.1 (Liquidity)	0.420	0.532	0.355	0.436	Dominate
C1.2 (Solvabilis)	0.170	0.215	0.297	0.227	Weakest
C1.3 (Profitability)	0.411	0.253	0.348	0.337	Intermediate

Priority Weight Calculation and Implications Analysis

Eigenvector formula and calculation:

a. Liquidity Ratio (C1.1): (0.420 + 0.532 + 0.355) ÷ 3 = 0.436

b. Solvency ratio (C1.2): (0.170 + 0.215 + 0.297) ÷ 3 = 0.227
c. Profitability Ratio (C1.3): (0.411 + 0.253 + 0.348) ÷ 3 = 0.337

Table 11. Priority Weighting of Financial Performance Sub-criteria with Analysis

UB-Criteria	Local Weights	Percentage	Ranking	Gap vs Next	Priority Characteristics
Liquidity Ratio (C1.1)	0.436	43.6%	1	9.9%	Cash flow & payment ability
Profitability Ratio (C1.3)	0.337	33.7%	2	11.0%	Earning sustainability
Solitability Ratio (C1.2)	0.227	22.7%	3	-	Capital structure stability

Strategic Interpretation: Liquidity dominance (43.6%) confirms the paradigm shift from profitability-focused to cash flow-focused lending, reflecting the learning that companies with strong cash positions are better able to survive in uncertainty. Profitability remains important (33.7%) but not a top priority, while solvency (22.7%) is considered a supporting factor.

Consistency Test of Financial Performance Sub-criteria

Detailed consistency calculation: λmax = (0.436 × 2.384) + (0.227 × 4.641) + (0.337 × 2.874) = 1.040 + 1.054 + 0.969 = 3.063

CI = (3.063 - 3) / (3 - 1) = 0.063 / 2 = 0.0315

CR = 0.0315 / 0.58 = 0.0543

Interpretation: CR = 0.0543 < 0.1, is a CONSISTENT matrix. A CR value of 5.43% indicates good consistency although slightly higher than level 2, which is normal given the complexity of the more detailed sub-criteria assessment.

AHP Manual Level 3B and 3C Analysis - Collateral Sub-criteria and Business Type

Sub-criteria of Collateral Assessment: Balanced Assessment Approach

The analysis of collateral assessment sub-criteria reveals a near-balanced preference between the value and physical aspects of collateral, reflecting the sophisticated understanding that effective collateral assessment requires a dual perspective.

Table 12. Analysis of Collateral Assessment Sub-criteria

Sub-criteria	Geometric Mean	Local Weights	Percentage	Key Characteristics
Collateral Value (C2.1)	1.115	0.527	52.7%	Coverage ratio, valuation quality
Physical Collateral (C2.2)	0.897	0.473	47.3%	Marketability, liquidity, location

The geometric mean of 1.115 indicates a slight preference for collateral value, but a small gap (5.4%) indicates that both aspects are considered equally important. This reflects a balanced risk management approach where adequacy of value must be balanced with ease of execution.

Sub-criteria for Business Type: Character Over Condition

The analysis of the sub-criteria of the type of business confirms the fundamental paradigm shift in credit assessment from condition-based to character-based evaluation.

Table 13. Sub-criteria Analysis of Business Type

Sub-criteria	Geometric Mean	Local Weights	Percentage	Assessment Focus
Business Sector (C3.1)	0.830	0.454	45.4%	Industry outlook, regulatory environment
Business History (C3.2)	1.205	0.546	54.6%	Track record, management integrity

The dominance of Business History (54.6%) over the Business Sector (45.4%) with a gap of 9.2% empirically confirms that character and track record are considered more predictive than industry conditions. These findings are in line with post-pandemic learning where business resilience is more related to management quality than sector favorability.

Global Weight Calculation and Final Priority Ranking

Synthesis of Hierarchy and Global Weight Formulas

The calculation of global weights integrates all levels of the hierarchy through multiplicative synthesis where the global weight of each sub-criterion is calculated with the formula:

Global Weight = Criterion Weight (Level 2) × Local Weight Sub-criteria (Level 3)

Table 14. Comprehensive Calculation of Global Weights

Sub-criteria	Master Criteria	Bobot Level 2	Local Weights	Global Weight	Percentage	Relative Contribution
Liquidity Ratio (C1.1)	Financial Performance	0.543	0.436	0.237	23.7%	Highest
Profitability Ratio (C1.3)	Financial Performance	0.543	0.337	0.183	18.3%	Tall
Solitability Ratio (C1.2)	Financial Performance	0.543	0.227	0.123	12.3%	Keep
Collateral Value (C2.1)	Collateral Valuation	0.237	0.527	0.125	12.5%	Keep
Business History (C3.2)	Type of Business	0.220	0.546	0.120	12.0%	Keep
Physical Collateral (C2.2)	Collateral Valuation	0.237	0.473	0.112	11.2%	Medium-Low
Business Sector (C3.1)	Type of Business	0.220	0.454	0.100	10.0%	Lowest

Mathematical validation: Total global weights = 1,000 ✓

Final Global Priority Ranking with Strategic Analysis

Table 15. Global Priority Ranking and Strategic Implications

Rank	Sub-criteria	Weight	Gap vs Next	Category	Practical Implications

1	Racial Liquiditis	23.7%	5.4%	Super Priority	Focus utama: cash flow analysis
2	Profitability Ratio	18.3%	5.8%	High Priority	Sustainability vs growth balance
3	Collateral Value	12.5%	0.5%	Medium Priority	Adequate coverage essential
4	Solvency Ratio	12.3%	0.3%	Medium Priority	Capital structure monitoring
5	Business History	12.0%	0.8%	Medium Priority	Character assessment crucial
6	Physical Collateral	11.2%	1.2%	Medium-Low Priority	Marketability consideration
7	Business Sector	10.0%	-	Supporting Factor	Industry context awareness

Gap and Clustering Analysis:

a. Tier 1 (Super Priority): Liquidity with a significant gap of 5.4%
b. Tier 2 (High Priority): Profitability with substantial weight
c. Tier 3 (Medium Priority): 12-13% cluster (collateral value, solvency, business history)
d. Tier 4 (Supporting): Physical Collateral and Business Sector

Gap analysis shows that despite dominant liquidity, no single factor is overwhelmingly dominant, indicating a sophisticated balanced assessment approach.

SpiceLogic Validation and Model Stability

Cross-Validation with Software Professional

Validation using SpiceLogic AHP Professional is carried out to ensure the accuracy and reliability of manual calculation results. This software uses the exact eigenvalue method with high precision and advanced consistency checking.

Table 16. Comprehensive Manual vs SpiceLogic Comparison

Criteria/Sub-criteria	Manual	SpiceLogic	Absolute Difference	Relative Difference	Validation Status
Financial Performance (C1)	54.3%	54.8%	0.5%	0.9%	✓ Excellent
Collateral Valuation (C2)	23.7%	21.1%	2.6%	11.0%	✓ Acceptable
Type of Business (C3)	22.0%	24.1%	2.1%	9.5%	✓ Acceptable
Liquidity Ratio (C1.1)	23.7%	22.5%	1.2%	5.1%	✓ Very Good
Profitability Ratio (C1.3)	18.3%	18.0%	0.3%	1.6%	✓ Excellent
Solitability Ratio (C1.2)	12.3%	14.3%	2.0%	16.3%	✓ Acceptable
Business History (C3.2)	12.0%	12.0%	0.0%	0.0%	✓ Perfect
Collateral Value (C2.1)	12.5%	10.6%	1.9%	15.2%	✓ Acceptable
Physical Collateral (C2.2)	11.2%	10.6%	0.6%	5.4%	✓ Very Good
Business Sector (C3.1)	10.0%	10.0%	0.0%	0.0%	✓ Perfect

Validation Statistics:

a. Mean Absolute Deviation: 1.12%
b. Maximum Deviation: 2.6%
c. Perfect Match: 2 items (20%)

d. Excellent Match (<1%): 2 items (20%)
e. Very Good Match (1-2%): 3 items (30%)
f. Acceptable Match (2-3%): 3 items (30%)

Stability Interpretation: The average deviation of 1.12% with a maximum of 2.6% indicates VERY HIGH STABILITY and confirms the reliability of the manual calculation results. The minor difference is caused by SpiceLogic using the exact eigenvalue method vs approximation row averaging method in manual calculations.

Sensitivity and Robustness Analysis

Sensitivity analysis was carried out by changing the input by ±10% to measure the stability of ranking. The results show that the top 3 rankings (Liquidity, Profitability, Collateral Value) remain stable in various scenarios, confirming the robustness of the model for practical decision making.

CONCLUSION

The findings of this study reveal that the key financial performance characteristics prioritized in medium credit facility decisions at BRI Denpasar emphasize defensive financial capability, stability, and sustainability. The most critical indicators include optimal current and quick ratios with consistent trends over at least three years, sustainable profitability through stable ROA and profit growth, and a balanced capital structure with manageable debt ratios. In terms of collateral assessment, a balanced approach between collateral value and physical aspects is prioritized, focusing on assets with stable market value, ease of liquidation, strategic location, and complete legal documentation. For business type, priority is given to companies with strong operational history, clean credit records, and resilience during economic downturns, especially those operating in essential sectors such as health, education, and utilities. Based on these findings, it is recommended that BRI Denpasar implement an automated credit scoring system integrated with AHP priority weights, enhance employee training aligned with AHP hierarchy, and restructure its portfolio toward resilient sectors. Prospective debtors are encouraged to maintain optimal financial ratios, strengthen business documentation and governance, and prepare collateral that meets valuation and legal standards. Future research should focus on developing adaptive AHP models responsive to macroeconomic cycles, expand coverage to other credit segments using hybrid methods like AHP combined with machine learning, and explore technology integration through mobile and web-based applications linked to core banking systems for automated scoring and monitoring.

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