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Implementation of the Preference Selection Index Method in a Decision Support System for Determining Customer Loan Eligibility

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Abstract–This study aims to apply the Preferential Selection Index (PSI) method in evaluating the eligibility of loan applicants for the PNM Mekaar program. The research investigates the effectiveness of PSI in selecting the most eligible borrowers based on multiple criteria, such as Age, Owns a Business, Loan Capital, Income, Business Permit, Business Permit Level and Customer History. The analysis is conducted using a decision support system (DSS), where each alternative is evaluated against these criteria and weighted accordingly. The study finds that the alternative with the highest value, C8 (0.222403657), is followed closely by alternative A7 (0.207720657). The results of this study demonstrate that PSI offers a more structured, objective, and efficient approach to loan eligibility assessment compared to traditional methods. The integration of PSI within the DSS allows for faster decision-making, improved consistency, and a reduction in the risk of loan defaults. These findings contribute to enhancing the decision-making process in microfinance institutions, particularly in improving financial inclusion and supporting the growth of micro, small, and medium enterprises (MSMEs). The research concludes that PSI is a valuable tool for financial institutions seeking to adopt data-driven, transparent, and reliable loan approval procedures.

Keywords: Selection Index of Preference Method; Eligibility; Loan; Customer; Decision Support System

1. INTRODUCTION

Permodalan Nasional Madani (PNM) plays a vital role in supporting the micro, small, and medium-sized enterprise (MSME) sector in Indonesia as a financial institution focused on providing loans and guidance to entrepreneurs, directly contributing to economic empowerment and inclusive growth. MSMEs are a crucial component of Indonesia's economy, significantly contributing to the gross domestic product (GDP) and generating extensive employment opportunities(Insani & Sucihati, 2024). However, many MSME owners face challenges in obtaining financing from conventional banks due to limited collateral and poor credit histories(Mariam et al., 2024). To address this issue, PNM bridges the financing gap by offering accessible loan products and continuous mentoring to help businesses grow and sustain themselves. Furthermore, PNM plays a significant role in expanding financial inclusion by reaching MSME owners who have not yet been served by formal banking systems, thereby promoting equitable economic development across various regions, particularly in underdeveloped areas(Ikbal et al., 2023). Through its various financing products, PNM provides both working capital and investment opportunities to support business development, including micro-financing programs with simplified procedures for small enterprises beyond the reach of traditional banks(Putri & Marsono, 2023). One of PNM's flagship initiatives is the Mekaar Program, which targets female micro-entrepreneurs by offering low-interest, collateral-free loans to promote women's economic empowerment. In addition to financing, PNM delivers mentoring and training to enhance clients' managerial and business management skills, while also encouraging the adoption of technology to improve operational efficiency(Yazdi Anugrah & Wilfridus B. Elu, 2023). Through the cluster financing program, PNM fosters collaboration among MSME owners within similar industries to boost competitiveness and productivity. Overall, the existence of PNM is strategic in driving inclusive and sustainable economic growth, reducing regional disparities, improving financial literacy, and enhancing the overall quality of life throughout Indonesia(Wulandari & Nasik, 2023), (Mohamad Januar Bagus Indranata & Siti Safaria, 2023).

One of the primary challenges faced by PNM is determining the creditworthiness of loan applicants, considering various factors such as Age, Owns a Business, Loan Capital, Income, Business Permit, Business Permit Level and Customer History. In this regard, a system is needed to help objectively and efficiently assess and evaluate loan eligibility.

The issues related to the process of determining loan eligibility at Permodalan Nasional Madani (PNM) highlight several critical challenges that affect the accuracy, efficiency, and sustainability of its decision-making system, forming the core of this research's urgency. One major problem is the limited availability of reliable data, particularly for MSME clients who often lack formal financial records or clear credit histories, making it difficult for PNM to conduct objective and data-driven assessments. The current evaluation process, which still relies heavily on manual procedures and subjective judgment, further increases the potential for human error and inconsistent decision-making. Additionally, the absence of an integrated and automated system results in slower loan approvals, extended waiting times for applicants, and higher risks of misjudging borrowers' risk profiles. These inefficiencies not only reduce operational effectiveness but also heighten the risk of non-performing loans, thereby threatening PNM's financial stability and reputation. The consequences of such weaknesses are far-reaching, as they may lead to the approval of high-risk borrowers while simultaneously delaying access to capital for creditworthy MSME entrepreneurs who rely on timely financing to sustain and grow their businesses. This situation ultimately undermines PNM's mission to empower the MSME sector and support inclusive economic growth. Therefore, the urgency of this research lies in developing solutions that can enhance the accuracy, efficiency, and objectivity of PNM's loan assessment process through the

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implementation of an integrated and automated decision-support system, enabling the institution to deliver faster, more precise, and reliable financial services while minimizing risk and reinforcing its role in promoting sustainable economic development.

One effective solution to address the issues in PNM's loan eligibility determination process is the implementation of a Decision Support System (DSS) integrated with the Preference Selection Index (PSI) method(Amalia, 2022). The DSS serves as a computerized system designed to assist decision-makers in producing more objective, accurate, and efficient evaluations by analyzing various factors that influence loan eligibility using available data(Suryadi et al., 2025). Through this system, multiple evaluation criteria such as Age, Owns a Business, Loan Capital, Income, Business Permit, Business Permit Level and Customer History can be processed systematically to provide reliable recommendations based on comprehensive data analysis(Ferdiyanti et al., 2022). The integration of the PSI method within the DSS further strengthens the system's analytical capability, as PSI assigns specific weights or scores to each criterion according to its level of importance, allowing the evaluation process to be conducted in a more structured and consistent manner(Parapat et al., 2023). By quantifying qualitative aspects of loan assessment, PSI minimizes subjectivity and enhances the precision of decision-making, ensuring that loan approvals are based on measurable and transparent parameters. The method works by identifying key evaluation criteria, assigning appropriate weights, and calculating a composite score for each applicant, which then becomes the basis for ranking and selecting the most eligible borrowers. This approach not only accelerates the loan approval process through automation but also reduces human error, improves transparency, and promotes consistency in decision-making(Putra et al., 2023). Consequently, integrating the PSI method into a DSS enables PNM to improve its operational efficiency, reduce the risk of non-performing loans, and strengthen its institutional performance, thereby supporting its broader mission of empowering MSMEs and promoting sustainable economic growth in Indonesia(Sulistiani et al., 2023).

Previous studies have examined the application of PSI in loan eligibility assessments, but none have specifically integrated the Preferential Selection Index (PSI) method into a decision support system (DSS) for evaluating loan eligibility at Permodalan Nasional Madani (PNM). Most previous studies have focused on analyzing factors that influence loan decisions or performance evaluations without directly applying the PSI method(Pon Bharathi et al., 2022).

A study by Maharani et al. (2025) applied the PSI method to employee performance evaluations, but not in the context of loan approval or evaluating loan eligibility for borrowers(Maharani et al., 2025). Similarly, a study by Devi (2021) also used the PSI method for evaluating professors, but not in the financial sector or for loan approvals(Devi, 2023). Furthermore, a study by Saharuddin et al. (2024) applied PSI to employee selection, but not in the context of a decision support system for evaluating loan eligibility.(Saharuddin et al., 2024).

Numerous studies have applied the Preferential Selection Index (PSI) method to employee performance evaluations in various sectors, such as PT Mawarindo in Bengkulu(Budi et al., 2021). Similarly, a study by Panggabean and Hasibuan (2020) used PSI for supervisor selection but did not apply it to loan approval or evaluating the eligibility of loan borrowers.(Al Islami & Rosyani, 2024).

Based on these comparisons, there is a gap in the research that can be filled by applying the PSI method within a decision support system to evaluate loan eligibility for borrowers at PNM, to enhance objectivity, efficiency, and accuracy in the loan approval process. Therefore, this research aims to fill this gap by developing and implementing a decision support system based on the Preferential Selection Index (PSI) method for evaluating loan eligibility for borrowers at Permodalan Nasional Madani (PNM). With this approach, it is expected that the research will improve objectivity, efficiency, and accuracy in the loan approval process, while reducing the risks of bad loans that may negatively impact both the institution and the borrowers.

The objective of this research is to develop and implement a decision support system (DSS) based on the Preferential Selection Index (PSI) method to evaluate the eligibility of loan applicants at Permodalan Nasional Madani (PNM). By integrating the PSI method into the DSS, it is expected that the accuracy and objectivity of the loan selection process will improve, while minimizing subjectivity that may occur in decision-making. This research aims to identify and determine relevant evaluation criteria in assessing loan eligibility, assign weights to each criterion based on priority, and develop a system that can generate recommendations more quickly and accurately based on objective data analysis.

The desired outcome of this research is to create a decision support system that can provide efficient and accurate recommendations for loan eligibility, which will help reduce the risk of bad loans for PNM. With this system in place, PNM can conduct loan evaluations faster and based on more comprehensive data, simplifying the decision-making process for loan approval. Furthermore, this research is expected to contribute to the development of technology-based systems in the financial sector, particularly in enhancing the quality of service and trust among borrowers in financial institutions such as PNM.

2. RESEARCH METHODOLOGY

2.1 Research Framework

The framework of this research aims to develop a decision support system based on the Preferential Selection Index (PSI) method for evaluating the creditworthiness of loan applicants at Permodalan Nasional Madani (PNM). The

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research process begins with identifying and determining relevant evaluation criteria, such as Age, Owns a Business, Loan Capital, Income, Business Permit, Business Permit Level and Customer History. Next, the PSI method is applied to assign weights to each criterion based on the priorities set. The subsequent step is the development of the decision support system (DSS) that integrates PSI to generate objective and efficient loan eligibility recommendations. Once the system is developed, the final stage is testing and evaluation to ensure the accuracy and effectiveness of the system in providing timely and accurate loan recommendations. By following this framework, the research aims to create a system that is more efficient, objective, and transparent in the loan approval process, while reducing the risk of bad loans that may harm both PNM and its borrowers.

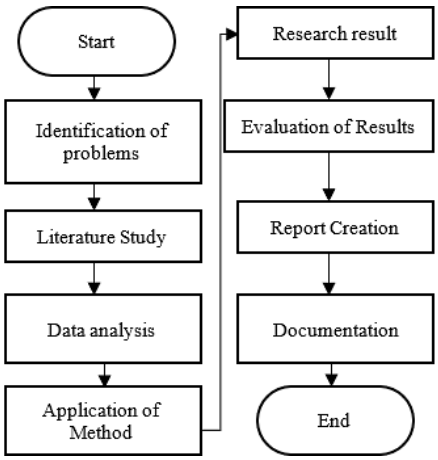

Figure 1. Research Framework

Figure 1 illustrates the research framework that guides the development and implementation of a decision support system (DSS) based on the Preferential Selection Index (PSI) method for evaluating the creditworthiness of loan applicants at Permodalan Nasional Madani (PNM). By following this framework, the research aims to create a more efficient, objective, and transparent loan approval process, while reducing the risk of loan defaults that could harm both PNM and its borrowers.

2.2 Decision Support System

A Decision Support System (DSS) is a computer-based system designed to assist decision-making in complex and unstructured situations. DSS integrates relevant data, models, and information to provide support in decision-making, whether in planning, evaluation, or problem-solving(Laia & Sinaga, 2021). In the context of loan provision, DSS enables financial institutions to analyze various factors influencing loan eligibility, such as Age, Owns a Business, Loan Capital, Income, Business Permit, Business Permit Level and Customer History. By using this system, the loan evaluation process becomes more efficient, objective, and structured, reducing reliance on subjective or manual assessments(Bahrudin, 2022).

The system works by generating recommendations based on a more comprehensive data analysis, helping decision-makers make more accurate choices. DSS employs various analytical techniques, including the processing of historical data and predictions based on mathematical models, to provide a clearer picture of the feasibility of a decision(Sabrina et al., 2022). The primary advantage of implementing DSS is its ability to process large volumes of data and generate decisions more quickly, accurately, and consistently. Furthermore, DSS allows for continuous monitoring and evaluation, which supports the improvement of decision quality over time(Nuryadi et al., 2023).

2.3 Selection Index Preference Method

The Preferential Selection Index (PSI) method is an approach used to assist decision-making in situations that involve multiple criteria that need to be evaluated simultaneously. PSI works by assigning weights to each criterion based on its level of importance, which are then used to assess various alternatives or options, such as in the context of evaluating loan eligibility. This method aims to generate a more objective and structured assessment by considering the preferences or priorities set by the decision-maker. Therefore, PSI reduces subjectivity in decision-making and ensures that the outcomes are more consistent and reliable. The following steps outline the process for applying this method(Cakranegara et al., 2022; Saragih & Sinaga, 2020):

1. Identification of Evaluation Criteria
   The first step in applying the PSI method is to identify the relevant criteria that will be used to assess the alternatives. In the context of loan provision, these criteria may include factors such as Age, Owns a Business, Loan Capital, Income, Business Permit, Business Permit Level and Customer History.
2. Determining the Weight of Each Criterion
   Once the criteria have been identified, the next step is to determine the weight for each criterion. These weights reflect the relative importance of each criterion in relation to the ultimate decision-making goal. Weights can be

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determined through discussions, comparisons between criteria, or by using methods such as pairwise comparison analysis.

3. Assessment of Alternatives
   Each alternative or option being evaluated, in this case, the loan applicants, is scored based on the criteria established. This assessment can be performed using a numerical scale that reflects how well the alternative meets the criteria.
4. Calculation of the Selection Index
   After assigning weights to the criteria and evaluating the alternatives, the next step is to calculate the final score or selection index for each alternative. This index is obtained by multiplying the score for each alternative by the weight assigned to each criterion, and then summing the results of these multiplications.
5. Selection of Alternatives
   Based on the final score or selection index calculated, the alternative with the highest score will be chosen as the best decision. In the context of loan provision, the applicant with the highest score is considered the most eligible for receiving the loan.

The following are the steps to apply the Preference Selection Index (PSI) method. In practice, these steps can be repeated multiple times to identify the best option that truly meets the established criteria and requirements. Several steps are involved in developing the PSI method, including(Husna et al., 2021; Sabandar & Ahmad, 2023; Waruwu & Mesran, 2021):

1. Problem Identification, Determining Alternatives, and Relevant Attributes in Decision-Making
2. Identification of the Decision Matrix.

$$X = [X_{ij}]m_{xn} = \begin{bmatrix} X_{11} & X_{12} \dots \dots & X_{1n} \\ X_{21} & X_{22} \dots \dots & xX_{2n} \\ X_{m1} & X_{m2} \dots \dots & X_{mn} \end{bmatrix} \quad (1)$$

$$\text{PSI} = \frac{\sum(wij \times xij)}{\sum(wij)} \quad (2)$$

3. Performing Matrix Normalization (x)
   Normalize the decision matrix as follows:

$$\bar{X}_{ij} = \frac{X_{ij}}{X_{ij}^{max}}, i = 1, , m \quad \text{For benefit criteria} \quad (3)$$

$$\bar{X}_{ij} = \frac{X_{ij}^{min}}{X_{ij}}, i = 1, , m \quad \text{For cost criteria} \quad (4)$$

4. Determine the preference variation values.

$$N = \frac{1}{n}\sum_{j=1}^{n} \bar{N}_{ij} \quad (5)$$

5. Calculate the preference variation values. In this step, the preference variation value $\emptyset_j$ for each attribute is determined using the following equation:

$$\emptyset_j = \sum_{i=1}^{m} (\bar{X}_{ij} - N)^2 \quad (6)$$

6. Determine the storage of preference values.

$$\Omega_j = 1 - \emptyset_j \quad (7)$$

7. Determine the criteria weights.

$$W_j = \frac{\Omega_j}{\sum_{i=1}^{n} \Omega_j} \quad (8)$$

8. Determine the preference selection index for the alternatives using the following equation:

$$\theta_i = \sum_{j=1}^{m} \bar{X}_{ij}\, w_j \quad (9)$$

9. Select the most suitable alternative for the given application.
   Each alternative is ranked in descending or ascending order, making it easier to interpret the results.

3. RESULTS AND DISCUSSION

The analysis of the application of the method in this study refers to the research title. The analysis explains each point that constitutes the problem formulation addressed in this study. The analysis of the business loan procedure at PNM is the first point in the problem formulation of this research, including the procedures and management of data in

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determining eligible borrowers at PNM, as follows:

1. The female borrower submits a loan proposal to Bank PNM.
2. Bank PNM receives the loan application proposal and then verifies the proposal in relation to the fulfillment of the requirements established by the applicant.
3. If the application documents are approved, the PNM management forms a monitoring team for the approved loan.
4. The loan funding is disbursed to the female borrower, who then directly receives the funds at the Bank PNM office.

The analysis of the implementation of the PSI method in determining eligible borrowers for the PNM loan involves establishing values for each criterion, which were obtained from interviews sourced from PNM, as follows:

Table 1. Criteria Data

Codw	Criterion	Type
C1	Age	Cost
C2	Owns a Business	Benefit
C3	Loan Capital	Benefit
C4	Income	Benefit
C5	Business Permit	Benetif
C6	Business Permit Level	Benetif
C7	Customer History	Benetif

Table 1 displays the criteria data used in the evaluation process to determine the eligibility of providing loans to customers.

1. Age (C1)

The Age criterion in this study is categorized as a cost type criterion based on the determination by the PNM Mekaar branch in Lubuk Pakam, where the age range is set between 18 to 55 years, with a criterion weight of 10%.

Table 2. Fuzzy Values for Age Criterion

Age	Value
18 – 35	0,5
36 – 46	0,3
47 – 55	0,2

Table 2 presents fuzzy values for age criteria, which are used as one of the factors in the loan eligibility assessment process.

2. Owns a Business (C2)

The "Owns a Business" criterion is a mandatory requirement for loan applications at PNM Mekaar. If the applicant does not own a business, they will not be eligible to receive the loan. This criterion is categorized as a "benefit" type with a weight of 30%.

Table 3. Fuzzy Values for the Owns a Business Criterion

Owns a Business	Value
Yes	1
No	0

Table 3 displays the fuzzy values for business ownership criteria, which is an important aspect in the loan eligibility assessment process.

3. Loan Capital (C3)

The Loan Capital criterion in this study is classified as a "benefit" type criterion, with a weight of 30%. This is because the higher the loan amount, the more favorable the evaluation.

Table 4. Fuzzy Values for the Loan Capital Criterion

Loan Capital	Value
4 - 5 million	0,5
2 - 3 million	0,3
1 million	0,2

Table 4 presents the fuzzy values for the loan capital criteria, which are used as one of the determining factors in the loan eligibility evaluation process.

4. Income (C4)

The Income criterion in this study is classified as a "benefit" type criterion with a weight of 30%, as higher income from the business results in a more favorable evaluation.

Table 5. Fuzzy Values for the Income

Income	Value
>= 10 million	0,4
5 - 10 million	0,3
3 - 4 million	0,2
1 - 2 million	0,1

Table 5 shows the fuzzy values for income criteria, which is one of the main indicators in the loan eligibility

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assessment process.

5. Business Permit (C5)
   The Business Permit criterion in this study is classified as a "benefit" type criterion with a weight of 15%, as the higher the value of the business permit, the more favorable the evaluation.

Tabel 6. Nilai Fuzzy Kriteria kredibilitas

Business Permit	Value
Large	0,5
Medium	0,3
Small	0,2

Table 6 presents the fuzzy values for the credibility criteria, which is an important aspect in the loan eligibility assessment process.

6. Business Permit Level (C6)
   The Business Permit Level criterion in this study is classified as a "benefit" type criterion with a weight of 15%. The higher the business permit level, such as being in the subdistrict, the more favorable the evaluation.

Tabel 7. Fuzzy Values for the Business Permit Level Criterion

Business Permit Level	Value
Subdistrict	0,7
Village	0,3

Table 7 displays the fuzzy values for the business permit level criteria, which are used as an important parameter in the loan eligibility assessment process.

7. Applicant's History (C7)
   The Applicant's History criterion in this study is classified as a "benefit" type criterion with a weight of 10%. A smooth and positive history of the applicant results in a more favorable evaluation.

Table 8. Fuzzy Values for the Applicant's History Criterion

Applicant's History	Value
Good	1
Bad	0

Table 8 displays the fuzzy values for the applicant's history criteria, which is used as an important factor in the loan eligibility assessment process.

8. Once the values for the sub-criteria are determined, the values for each criterion of the alternatives in the sample data are adjusted according to the fuzzy sub-criteria table.

Tabel 9. Customer Data Specifications

No	Name	Age	Owns a Business	Loan Capital	Income	Business Permit	Business Permit Level	History
1	Maimunah	40	Yes	3.000.000	1.000.000	Small	Village	Good
2	Siti Saparina	35	Yes	2.500.000	1.500.000	Medium	Village	Good
3	Legini	20	Yes	2.000.000	1.500.000	Medium	Village	Good
4	Sri Wati	25	Yes	2.500.000	1.000.000	Small	Village	Good
5	Rahmawati	31	Yes	2.500.000	1.500.000	Medium	Village	Good
6	Evi Susila	23	Yes	3.000.000	1.500.000	Medium	Village	Good
7	Sri Buana	50	Yes	3.500.000	2.000.000	Large	Subdistrict	Good
8	Leni Astuti	45	Yes	3.000.000	2.000.000	Large	Subdistrict	Good
9	Tika Pujianti	43	Yes	3.500.000	1.500.000	Medium	Village	Good
10	Leginem	40	Yes	3.000.000	1.500.000	Medium	Village	Good

Table 9 presents the customer data specifications used as the basis for the loan feasibility analysis process. The next step is the application of the PSI method according to the steps outlined in Chapter 2. Some of the key steps in the PSI calculation process are as follows:

9. Problem Identification, Determining Alternatives, and Relevant Attributes in Decision-Making

Tabel 10. Alternative Data

No	Name	Age	Owns a Business	Loan Capital	Income	Business Permit	Business Permit Level	History
1	A1	0,3	1	0,3	0,1	0,2	0,3	1
2	A2	0,5	1	0,3	0,1	0,3	0,3	1
3	A3	0,5	1	0,3	0,1	0,3	0,3	1
4	A4	0,5	1	0,3	0,1	0,2	0,3	1
5	A5	0,5	1	0,3	0,1	0,3	0,3	1

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No	Name	Age	Owns a Business	Loan Capital	Income	Business Permit	Business Permit Level	History
6	A6	0,5	1	0,3	0,1	0,3	0,3	1
7	A7	0,2	1	0,3	0,1	0,5	0,7	1
8	A8	0,3	1	0,3	0,1	0,5	0,7	1
9	A9	0,3	1	0,3	0,1	0,3	0,3	1
10	A10	0,3	1	0,3	0,1	0,3	0,3	1

The data above at table 10 has been converted into fuzzy values for each criterion according to the fuzzy table values that were previously established.

10. Identification of the Decision Matrix

$$\begin{bmatrix} 0,3 & 1 & 0,3 & 0,1 & 0,2 & 0,3 & 1 \\ 0,5 & 1 & 0,3 & 0,1 & 0,3 & 0,3 & 1 \\ 0,5 & 1 & 0,3 & 0,1 & 0,3 & 0,3 & 1 \\ 0,5 & 1 & 0,3 & 0,1 & 0,2 & 0,3 & 1 \\ 0,5 & 1 & 0,3 & 0,1 & 0,3 & 0,3 & 1 \\ 0,5 & 1 & 0,3 & 0,1 & 0,3 & 0,3 & 1 \\ 0,2 & 1 & 0,3 & 0,1 & 0,5 & 0,7 & 1 \\ 0,3 & 1 & 0,3 & 0,1 & 0,5 & 0,7 & 1 \\ 0,3 & 1 & 0,3 & 0,1 & 0,3 & 0,3 & 1 \\ 0,3 & 1 & 0,3 & 0,1 & 0,3 & 0,3 & 1 \end{bmatrix}$$

11. Normalizing the Matrix x

C1: As a "cost" criterion, the normalization of matrix C1 is as follows.

X_{ij} = (0,3 ; 0,5 ; 0,5 ; 0,5 ; 0,5 ; 0,5 ; 0,2 ; 0,3 ; 0,3 ; 0,3)

X_j min = 0,2

$$x_{1,1} = \frac{0,2}{0,3} = 0,666667$$

$$x_{1,2} = \frac{0,2}{0,5} = 0,4$$

$$x_{1,3} = \frac{0,2}{0,5} = 0,4$$

$$x_{1,4} = \frac{0,2}{0,5} = 0,4$$

$$x_{1,5} = \frac{0,2}{0,5} = 0,4$$

$$x_{1,6} = \frac{0,2}{0,5} = 0,4$$

$$x_{1,7} = \frac{0,2}{0,2} = 1$$

$$x_{1,8} = \frac{0,2}{0,3} = 0,666667$$

$$x_{1,9} = \frac{0,2}{0,3} = 0,666667$$

$$X_{7,10} = \frac{1}{1} = 1$$

C2: As a "benefit" criterion, the normalization of matrix C2 is as follows.

X_{ij} = (1 ; 1 ; 1 ; 1 ; 1 ; 1 ; 1; 1 ; 1 ; 1)

X_j max = 1

$$X_{2,1} = \frac{1}{1} = 1$$

$$X_{2,2} = \frac{1}{1} = 1$$

$$X_{2,3} = \frac{1}{1} = 1$$

$$X_{2,4} = \frac{1}{1} = 1$$

$$X_{2,5} = \frac{1}{1} = 1$$

$$X_{2,6} = \frac{1}{1} = 1$$

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$X_{2,7} = \frac{1}{1} = 1$

$X_{2,8} = \frac{1}{1} = 1$

$X_{2,9} = \frac{1}{1} = 1$

$X_{2,10} = \frac{1}{1} = 1$

Following the same solution steps, this process is continued for C7 and the following results were obtained

$$R_{ij} = \begin{bmatrix} 0.6667 & 1 & 1 & 1 & 2.5 & 2.333333 & 1 \\ 0.4000 & 1 & 1 & 1 & 1.666667 & 2.333333 & 1 \\ 0.4000 & 1 & 1 & 1 & 1.666667 & 2.333333 & 1 \\ 0.4000 & 1 & 1 & 1 & 2.5 & 2.333333 & 1 \\ 0.4000 & 1 & 1 & 1 & 1.666667 & 2.333333 & 1 \\ 0.4000 & 1 & 1 & 1 & 1.666667 & 2.333333 & 1 \\ 1.0000 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0.6667 & 1 & 1 & 1 & 1 & 1 & 1 \\ 0.6667 & 1 & 1 & 1 & 1.666667 & 2.333333 & 1 \\ 0.6667 & 1 & 1 & 1 & 1.666667 & 2.333333 & 1 \end{bmatrix}$$

At this stage, the summation is performed to calculate the total value for each criterion.
Total value for C1:

N_1 = 0,6667+ 0,4000 + 0,4000 + 0,4000 + 0,4000 + 0,4000 + 1,0000 + 0,6667 + 0,6667 + 0,6667 = 5,6667

Total value for C2:

N_2 = 1+1+ 1 + 1 + 1 +1 +1 + 1 + 1 + 1 = 10

Total value for C3:

N_3= 1+1+ 1 + 1 + 1 +1 +1 + 1 + 1 + 1 = 10

Total value for C4:

N_4= 1+1+ 1 + 1 + 1 +1 +1 + 1 + 1 + 1 = 10

Total value for C5:

N_5= 2,5+1,666667+1,666667+2,5+1,66667+1,666667+1+1+1,666667+1,666667 = 17

Total value for C6:

N_6= 2,33333+2,33333+2,33333+2,33333+2,33333+2,33333+1+1+2,33333+2,33333 = 20,66664

Total value for C7:

N_7= 1+1+ 1 + 1 + 1 +1 +1 + 1 + 1 + 1 = 10

Table 11. Total Value of Each Criteria

No	Name	Age	Owns a Business	Loan Capital	Income	Business Permit	Business Permit Level	History
1	A1	0,6667	1	1	1	2,5	2,333333	1
2	A2	0,4	1	1	1	1,666667	2,333333	1
3	A3	0,4	1	1	1	1,66667	2,333333	1
4	A4	0,4	1	1	1	2,5	2,333333	1
5	A5	0,4	1	1	1	1,66667	2,333333	1
6	A6	0,4	1	1	1	1,66667	2,333333	1
7	A7	1	1	1	1	1	1	1
8	A8	0,6667	1	1	1	1	1	1
9	A9	0,6667	1	1	1	1,66667	2,333333	1
10	A10	0,6667	1	1	1	1,66667	2,333333	1
	SUM	5,6667	10	10	10	19	20,664	10

Table 11 presents the total value of each criterion obtained from the calculation results using the Preference Selection Index (PSI) method.

12. Determine the average value of the normalized matrix.

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$N1 = \frac{1}{10} \times 5{,}6667 = 0{,}5667$

$N2 = \frac{1}{10} \times 10 = 1$

$N3 = \frac{1}{10} \times 10 = 1$

$N4 = \frac{1}{10} \times 10 = 1$

$N5 = \frac{1}{10} \times 19 = 1.9$

$N4 = \frac{1}{10} \times 20{,}66664 = 2.066664$

$N4 = \frac{1}{10} \times 10 = 1$

13. Calculate the preference variation value. In this step, the preference variation value ($\emptyset j$) for each attribute is determined using the following:

$\emptyset_{1,1} = (0{,}6667 - 0{,}5667)^2 = 0{,}0100$

$\emptyset_{2,1} = (0{,}4000 - 0{,}5667)^2 = 0{,}0278$

$\emptyset_{3,1} = (0{,}4000 - 0{,}5667)^2 = 0{,}0278$

$\emptyset_{4,1} = (0{,}4000 - 0{,}5667)^2 = 0{,}0278$

$\emptyset_{5,1} = (0{,}4000 - 0{,}5667)^2 = 0{,}0278$

$\emptyset_{6,1} = (0{,}4000 - 0{,}5667)^2 = 0{,}0278$

$\emptyset_{7,1} = (1 - 0{,}5667)^2 = 0{,}1878$

$\emptyset_{8,1} = (0{,}6667 - 0{,}5667)^2 = 0{,}0100$

$\emptyset_{9,1} = (0{,}6667 - 0{,}5667)^2 = 0{,}0100$

$\emptyset_{10,1} = (0{,}6667 - 0{,}5667)^2 = 0{,}0100$

$\emptyset_{1,5} = (2{,}5 - 1.9)^2 = 1{,}731302$

$\emptyset_{2.5} = (1.66667 - 1.9)^2 = 0{,}769471$

$\emptyset_{3.5} = (1{,}66667 - 1.9)^2 = 0{,}769471$

$\emptyset_{4.5} = (2{,}5 - 1.9)^2 = 1{,}731302$

$\emptyset_{5.5} = (1{,}66667 - 1.9)^2 = 0{,}769471$

$\emptyset_{6.5} = (1{,}66667 - 1.9)^2 = 0{,}769471$

$\emptyset_{7.5} = (1 - 1.9)^2 = 0{,}0277008$

$\emptyset_{8.5} = (1 - 1.9)^2 = 0{,}0277008$

$\emptyset_{9.5} = (1{,}66667 - 1.9)^2 = 0{,}769471$

$\emptyset_{10.5} = (1{,}66667 - 1.9)^2 = 0{,}769471$

$\emptyset_{1,6} = (2.33333 - 2.066664)^2 = 1{,}274681$

$\emptyset_{2,6} = (2.3333 - 2.066664)^2 = 1{,}274681$

$\emptyset_{3,6} = (2.3333 - 2.066664)^2 = 1{,}274681$

$\emptyset_{4,6} = (2.3333 - 2.066664)^2 = 1{,}274681$

$\emptyset_{5,6} = (2.3333 - 2.066664)^2 = 1{,}274681$

$\emptyset_{6,6} = (2.3333 - 2.066664)^2 = 1{,}274681$

$\emptyset_{7,6} = (1 - 2.066664)^2 = 0{,}234123$

$\emptyset_{8,6} = (1 - 2.066664)^2 = 0{,}234123$

$\emptyset_{9,6} = (2.3333 - 2.066664)^2 = 1{,}274681$

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$\emptyset_{10,6} = (2.3333 - 2.066664)^2 = 1{,}274681$

By doing the same thing as the steps above in each row, the following matrix is obtained:

$$\emptyset_{ij} = \begin{bmatrix} 0.0100 & 0.0000 & 0.0000 & 0.0000 & 1.731301 & 1.274681 & 0.0000 \\ 0.0278 & 0.0000 & 0.0000 & 0.0000 & 0.769471 & 1.274681 & 0.0000 \\ 0.0278 & 0.0000 & 0.0000 & 0.0000 & 0.769471 & 1.274681 & 0.0000 \\ 0.0278 & 0.0000 & 0.0000 & 0.0000 & 1.731301 & 1.274681 & 0.0000 \\ 0.0278 & 0.0000 & 0.0000 & 0.0000 & 0.769471 & 1.274681 & 0.0000 \\ 0.0278 & 0.0000 & 0.0000 & 0.0000 & 0.769471 & 1.274681 & 0.0000 \\ 0.1878 & 0.0000 & 0.0000 & 0.0000 & 0.077008 & 0.234123 & 0.0000 \\ 0.0100 & 0.0000 & 0.0000 & 0.0000 & 0.077008 & 0.234123 & 0.0000 \\ 0.0100 & 0.0000 & 0.0000 & 0.0000 & 0.769471 & 1.274681 & 0.0000 \\ 0.0100 & 0.0000 & 0.0000 & 0.0000 & 0.769471 & 1.274681 & 0.0000 \end{bmatrix}$$

14. Determine the storage of preference values

$\Omega 1 = 1 - 0{,}3667 = 0{,}6333$

$\Omega 2 = 1 - 0{,}0000 = 1$

$\Omega 3 = 1 - 0{,}0000 = 1$

$\Omega 4 = 1 - 0{,}0000 = 1$

$\Omega 5 = 1 - 8.1360316 = -7.13603$

$\Omega 6 = 1 - 10.665694 = -9$

$\Omega 7 = 1 - 0{,}0000 = 1$

Sum $\Omega j = 0{,}6333 + 1 + 1 + 1 + (-7.13603) + (-9) + 1 = -11{,}50273$

15. Determine the criteria weight (W_j).

$$W_1 = \frac{0{,}6333}{-11{,}50273} = 0{,}0550564953$$

$$W_2 = \frac{1}{-11{,}50273} = -0.086935884$$

$$W_3 = \frac{1}{-11{,}50273} = -0.086935884$$

$$W_4 = \frac{1}{-11{,}50273} = -0.086935884$$

$$W_5 = \frac{-7.13603}{-11{,}50273} = 0{,}620377076$$

$$W_6 = \frac{-9}{-11{,}50273} = -0{,}782422955$$

$$W_7 = \frac{1}{-11{,}50273} = -0{,}086935884$$

16. Determination of preference selection index

$\phi_{1,1} = 0{,}6667 * 0{,}0550564953 = 0.036706$

$\phi_{2,1} = 0{,}4000 * 0{,}0550564953 = 0.022023$

$\phi_{3,1} = 0{,}4000 * 0{,}0550564953 = 0.022023$

$\phi_{4,1} = 0{,}4000 * 0{,}0550564953 = 0.022023$

$\phi_{5,1} = 0{,}4000 * 0{,}0550564953 = 0.022023$

$\phi_{6,1} = 0{,}4000 * 0{,}0550564953 = 0.022023$

$\phi_{7,1} = 1{,}0000 * 0{,}0550564953 = 0.055056$

$\phi_{8,1} = 0{,}6667 * 0{,}0550564953 = 0.036706$

$\phi_{9,1} = 0{,}6667 * 0{,}0550564953 = 0.036706$

$\phi_{10,1} = 0{,}6667 * 0{,}0550564953 = 0.036706$

Determination of preference selection index

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$\phi_{1,6} = 2{,}5 * 0{,}620377076 = 1{,}55094269$

$\phi_{2,6} = 1.666667 * 0{,}620377076 = 1{,}033966$

$\phi_{3,6} = 1.666667 * 0{,}620377076 = 1{,}033966$

$\phi_{4,6} = 2{,}5 * 0{,}620377076 = 1{,}55094269$

$\phi_{5,6} = 1.666667 * 0{,}620377076 = 1{,}033966$

$\phi_{6,6} = 1.666667 * 0{,}620377076 = 1{,}033966$

$\phi_{7,6} = 1 * 0{,}620377076 = 0{,}620377076$

$\phi_{8,6} = 1 * 0{,}620377076 = 0{,}620377076$

$\phi_{9,6} = 1{,}666667 * 0{,}620377076 = 1{,}033966$

$\phi_{10,6} = 0{,}66667 * 0{,}620377076 = 1{,}033966$

Determination of preference selection index

$\phi_{1,1} = 2{,}33333 * -0{,}782422955 = -1.825650954$

$\phi_{2,1} = 2{,}33333 * -0{,}782422955 = -1.825650954$

$\phi_{3,1} = 2{,}33333 * -0{,}782422955 = -1.825650954$

$\phi_{4,1} = 2{,}33333 * -0{,}782422955 = -1.825650954$

$\phi_{5,1} = 2{,}33333 * -0{,}782422955 = -1.825650954$

$\phi_{6,1} = 2{,}33333 * -0{,}782422955 = -1.825650954$

$\phi_{7,1} = 1 * -0{,}782422955 = -0{,}782422955$

$\phi_{8,1} = 1 * -0{,}782422955 = -0{,}782422955$

$\phi_{9,1} = 2{,}33333 * -0{,}782422955 = -1.825650954$

$\phi_{10,1} = 2{,}33333 * -0{,}782422955 = -1.825650954$

By performing the same calculations as the steps above in each column, the following matrix is obtained:

$$\emptyset_{ij} = \begin{bmatrix} 0.036706 & 0.086935884 & 0.086935884 & 0.086935884 & 1.55094269 & 1.274681 & 0.086935884 \\ 0.022023 & 0.086935884 & 0.086935884 & 0.086935884 & 1.033966 & 1.274681 & 0.086935884 \\ 0.022023 & 0.086935884 & 0.086935884 & 0.086935884 & 1.033966 & 1.274681 & 0.086935884 \\ 0.022023 & 0.086935884 & 0.086935884 & 0.086935884 & 1.55094269 & 1.274681 & 0.086935884 \\ 0.022023 & 0.086935884 & 0.086935884 & 0.086935884 & 1.033966 & 1.274681 & 0.086935884 \\ 0.022023 & 0.086935884 & 0.086935884 & 0.086935884 & 1.033966 & 1.274681 & 0.086935884 \\ 0.022023 & 0.086935884 & 0.086935884 & 0.086935884 & 0.62037776 & 0.234123 & 0.086935884 \\ 0.036706 & 0.086935884 & 0.086935884 & 0.086935884 & 0.62037776 & 0.234123 & 0.086935884 \\ 0.036706 & 0.086935884 & 0.086935884 & 0.086935884 & 1.033966 & 1.274681 & 0.086935884 \\ 0.036706 & 0.086935884 & 0.086935884 & 0.086935884 & 1.033966 & 1.274681 & 0.086935884 \end{bmatrix}$$

The final step is to calculate the ranking value by totaling the values for each alternative, as shown in the following table:

Table 12. Ranking Results

No	Name	Age	Owns a Business	Loan Capital	Income	Business Permit	Business Permit Level	History	No	Name
1	A1	0,036706	0.086935884	0.086935884	0.086935884	1,550943	-1.825.650.954	0.086935884	0.109741272	3
2	A2	0,022023	0.086935884	0.086935884	0.086935884	1,033966	-1.825.650.954	0.086935884	-0.422487818	6
3	A3	0,022023	0.086935884	0.086935884	0.086935884	1,033966	-1.825.650.954	0.086935884	-0.422487818	6
4	A4	0,022023	0.086935884	0.086935884	0.086935884	1,550943	-1.825.650.954	0.086935884	0.095058272	4

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No	Name	Age	Owns a Business	Loan Capital	Income	Business Permit	Business Permit Level	History	No	Name
5	A5	0,022023	0.086935884	0.086935884	0.086935884	1,033966	-1.825.650.954	0.086935884	-0.422487818	6
6	A6	0,022023	0.086935884	0.086935884	0.086935884	1,033966	-1.825.650.954	0.086935884	-0.422487818	6
7	A7	0,022023	0.086935884	0.086935884	0.086935884	0,620377	-0,782422955	0.086935884	0.207720657	2
8	A8	0,036706	0.086935884	0.086935884	0.086935884	0,620377	-0,782422955	0.086935884	0.222403657	1
9	A9	0,036706	0.086935884	0.086935884	0.086935884	1,033966	-1.825.650.954	0.086935884	-0.407804818	5
10	A10	0,036706	0.086935884	0.086935884	0.086935884	1,033966	-1.825.650.954	0.086935884	-0.407804818	5

Based on the table 12 above, the PSI method calculation process that has been carried out has obtained a value of 0.222403657 as the highest value with the selected and recommended alternative being alternative A8 and the next alternative with a value of 0.207720657 which is recommended is alternative A7.

3.1 Discussion

The analysis of the alternatives presented in the table reveals that alternative C8 holds the highest value of 0.222403657, followed by alternative A7 with a value of 0.207720657. This ranking clearly demonstrates the effectiveness of the applied decision-making model in evaluating the loan eligibility of applicants. The use of the Preferential Selection Index (PSI) method has allowed for a more structured and objective evaluation process, which is essential when making decisions that involve multiple criteria such as Age, Owns a Business, Loan Capital, Income, Business Permit, Business Permit Level and Customer History.

Furthermore, the method's ability to assess and compare alternatives based on weighted criteria enables PNM to effectively select borrowers who demonstrate strong business potential, thus minimizing the risk of loan defaults. In line with the results, the approach provides a significant improvement over traditional manual assessment methods, offering a more reliable way of identifying qualified applicants. By implementing such a method, PNM can enhance its lending practices, increase the efficiency of the loan approval process, and ultimately support the growth of eligible micro, small, and medium enterprises (MSMEs) in Indonesia.

4. KESIMPULAN

Based on the research results, it was stated that alternative with code C8 had the highest score of 0.222403657, followed by alternative with code A7 which had a score of 0.207720657. Considering these results, it can be concluded that the top two alternatives, C8 and A7, are the most eligible candidates for business loans, as they achieved the highest overall performance scores after being evaluated using the Preference Selection Index (PSI) method, which considers several criteria systematically and quantitatively. High scores indicate that C8 and A7 demonstrate superior performance across the established criteria, reflecting their ability and reliability in managing and repaying business loans effectively. Conversely, alternatives with scores lower than C8 and A7 are considered less eligible for funding. This approach eliminates subjectivity and ensures that all candidates are assessed based on measurable data rather than personal judgment or bias. Therefore, the PSI method has proven to be an effective and efficient tool in ranking alternatives, as it provides a transparent, data-driven, and reliable framework for determining loan eligibility. By implementing this method, financial institutions can make fairer and more rational lending decisions, increase the credibility and accountability of the entire loan assessment process, while ensuring that resources are allocated to the most deserving and capable applicants based on a robust and systematic evaluation framework.

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