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Implementation of the TOPSIS Method for Determining Raw Material Selection at Mooi Cake Simpang IV Sipin Branch

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Abstract. *The development of the culinary industry, particularly in bakery and cake shop businesses, requires companies to maintain consistent product quality while managing production costs efficiently. One important factor influencing production performance is the proper selection of raw materials. Mooi Cake Simpang IV Sipin Branch faces challenges in determining the best raw materials due to the availability of several suppliers with different characteristics, while the selection process is still conducted manually and tends to be subjective. Therefore, this study aims to apply the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method within a decision support system to support objective and structured decision making. This research uses a quantitative approach with a decision support system method. Data were collected through observation, interviews, and literature review, then analyzed using the TOPSIS method by considering six criteria, namely price, quality, delivery timeliness, raw material availability, supply consistency, and supporting criteria. The analysis stages include constructing a decision matrix, normalizing data, weighting criteria, determining positive and negative ideal solutions, calculating distances, and determining preference values and rankings. The results show that the TOPSIS method produces clear and easily understood preference values, making it easier for management to select the most suitable raw materials. Based on the results, Raw Material 2 obtained the highest preference value and is recommended as the best alternative for Mooi Cake Simpang IV Sipin Branch. The implementation of the TOPSIS method is expected to reduce subjectivity, improve decision-making effectiveness, and support operational efficiency and product quality improvement.*

Keywords: *Bakery; Decision Support System; Mooi Cake; Raw Material Selection; TOPSIS.*

1. INTRODUCTION

The development of the culinary industry, particularly in the bakery and cake shop sector, requires companies to consistently maintain product quality while efficiently managing production costs (SAFITRI n.d.). One of the most critical factors determining the success of the production process is the availability and quality of raw materials. Inappropriate raw material selection can lead to a decline in product quality, delays in the production process, and increased operational costs (Kinasih 2025). Therefore, a systematic and objective decision-making mechanism is required to determine the raw materials that best suit the company's needs.

Mooi Cake Simpang IV Sipin Branch is a business engaged in cake production and sales (JOUNG, Sumual, and Montolalu 2023). In its daily operations, Mooi Cake faces challenges in selecting raw materials from several suppliers with different characteristics. Each raw material alternative has its own advantages and disadvantages based on certain criteria, such as price, quality, availability, delivery timeliness, and supply consistency. To date, the raw material selection process has tended to be conducted manually and based on experience, which potentially leads to subjectivity and inefficiency in decision making.

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Along with the advancement of information technology, the implementation of a Decision Support System (DSS) has become one of the solutions that can assist management in making more structured and accurate decisions (Sari and Sari 2025). A decision support system is capable of processing relevant data and criteria to generate recommendations that can serve as a basis for selecting the best alternative (Akbar and Dani 2022). One of the widely used methods in DSS is the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), which is a multi-criteria decision-making method that selects the best alternative based on its closeness to the positive ideal solution and its distance from the negative ideal solution (Putra 2022).

The TOPSIS method has advantages in terms of its simple concept, efficient calculation process, and ability to consider multiple criteria simultaneously (Hanifah, Prianto, and Riza 2020). By using this method, each raw material alternative can be objectively evaluated based on the assigned weights of each predetermined criterion. The final result of the TOPSIS method is a preference value that can be used to rank raw material alternatives.

Based on these problems, this study aims to apply the TOPSIS method to determine the most appropriate raw material selection at Mooi Cake Simpang IV Sipin Branch. It is expected that the results of this study can assist management in making raw material selection decisions more objectively, effectively, and efficiently, as well as improve product quality and overall operational performance of the company.

2. LITERATURE REVIEW

Decision Support System

A Decision Support System (DSS) is a computer-based system designed to assist decision makers in solving semi-structured and unstructured problems (Wibowo and Priandika 2021). A DSS combines data, models, and specific analytical techniques to generate relevant information and alternative solutions that can be used as a basis for decision making. The existence of a DSS greatly supports management in improving the quality of decisions, especially when multiple criteria must be considered simultaneously.

In the context of raw material selection, a DSS plays an important role because the process involves various factors such as price, quality, availability, and delivery timeliness (Ramadhani et al. 2025). Without the support of a structured system, decision making tends to be subjective and prone to errors. Therefore, the implementation of a DSS is expected to help companies determine the best raw materials objectively, consistently, and efficiently.

TOPSIS Method (Technique for Order Preference by Similarity to Ideal Solution)

TOPSIS is one of the multi-criteria decision-making methods introduced by Hwang and Yoon. This method is based on the concept that the best alternative is the one that has the shortest distance from the positive ideal solution and the farthest distance from the negative ideal solution (Rianto 2023). The positive ideal solution represents the best value of each criterion, while the negative ideal solution represents the worst value of each criterion.

The TOPSIS procedure generally consists of several stages, including the construction of a decision matrix, normalization of the decision matrix, weighting of each criterion, determination of positive and negative ideal solutions, calculation of the distance of each alternative to the ideal solutions, and calculation of preference values to determine the ranking of alternatives (Ayudia, Nurcahyo, and Sumijan 2021). The main advantage of the TOPSIS method lies in its simple calculation concept, ease of understanding, and its ability to provide clear ranking results based on preference values.

The TOPSIS method has been widely applied in various fields, including supplier selection, location determination, performance evaluation, and raw material procurement (Rivaldi, Pulansari, and Kartika 2023). In this study, the TOPSIS method is used to help determine the best raw materials for Mooi Cake Simpang IV Sipin Branch by considering several relevant criteria in accordance with company needs.

Raw Materials

Raw materials are the main components that greatly determine the quality of the final product in a production process. In bakery and cake shop businesses, raw materials such as flour, sugar, butter, eggs, and other supporting ingredients play an important role in determining product taste, texture, and appearance (Haq 2023). High-quality raw materials will produce high-quality products, whereas poor-quality raw materials can reduce product quality and customer satisfaction.

In addition to quality, raw material selection must also consider aspects such as price, availability, and supply continuity. Raw materials with excessively high prices can increase production costs, while delays in raw material delivery can hinder the production process (Cahyadi and Hidayatulloh 2025). Therefore, companies need to carefully evaluate available raw material alternatives to optimally support a smooth production process.

Raw Material Selection Criteria

Raw material selection criteria are factors used as the basis for evaluating and determining the best raw material alternatives. Commonly used criteria include price, quality, delivery timeliness, stock availability, and supplier reliability (Yuneta, Aprian, and Sinaga

2024). Each criterion has a different level of importance; therefore, weights must be assigned according to the company's priorities.

In this study, the raw material selection criteria are adjusted to the needs and operational conditions of Mooi Cake Simpang IV Sipin Branch. The determination of criterion weights is intended to reflect the importance of each factor in supporting production continuity and product quality. These criteria and weights are then processed using the TOPSIS method to generate recommendations for the best raw materials.

3. METHOD

Type and Research Approach

This study employs a quantitative approach using a Decision Support System (DSS) method. The quantitative approach is chosen because the study processes numerical data derived from the evaluation of raw material alternatives based on specific criteria (Dani et al. 2024). The DSS method is used to assist the decision-making process in an objective and structured manner in determining the best raw materials at Mooi Cake Simpang IV Sipin Branch.

Research Object and Location

The object of this research is the raw material selection process used in the production activities at Mooi Cake Simpang IV Sipin Branch. The research location was chosen because this branch has relatively high raw material requirements and involves several supplier alternatives with different characteristics, thus requiring an appropriate decision-making method to determine the best raw materials.

Data Collection Techniques

The data collection techniques used in this study include:

a. Observation, which involves direct observation of the procurement and use of raw materials at Mooi Cake Simpang IV Sipin Branch.
b. Interviews, which involve conducting question-and-answer sessions with management or employees directly involved in the raw material procurement process to obtain information related to company criteria and requirements.
c. Literature review, which involves examining various literature sources, scientific journals, and references related to decision support systems and the TOPSIS method as the theoretical foundation of this study.

Research Criteria and Alternatives

The alternatives in this study consist of several types or suppliers of raw materials used by Mooi Cake Simpang IV Sipin Branch. Each alternative is evaluated based on predetermined criteria. The criteria used in this study include price, raw material quality, delivery timeliness, raw material availability, and supply consistency. These criteria are selected because they are considered to have the greatest influence on the smoothness of the production process and product quality.

Data Analysis Method Using TOPSIS

The data analysis method applied in this study is the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). The stages of implementing the TOPSIS method in this study are as follows:

a. Determining the alternatives and criteria used in raw material selection.
b. Constructing a decision matrix based on the values of each alternative for each criterion.
c. Normalizing the decision matrix to standardize the assessment scale.
d. Assigning weights to each criterion according to its level of importance.
e. Determining the positive ideal solution and the negative ideal solution.
f. Calculating the distance of each alternative from the positive and negative ideal solutions.
g. Calculating the preference values for each alternative and ranking them.

The results of the TOPSIS calculation are preference values used to determine the ranking of the best raw material alternatives. The alternative with the highest preference value is considered the most recommended raw material to be used by Mooi Cake Simpang IV Sipin Branch.

Context Diagram.

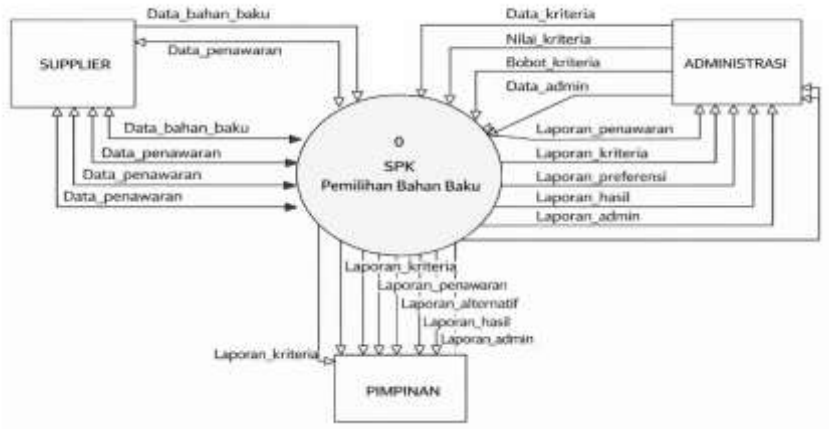

Figure 1. Context Diagram.

Description:

a. Administration

Responsible for inputting category data, criteria data, criteria values, preference values, alternative data, and admin data into the system, as well as receiving all reports generated from data processing results.

b. Warehouse

Provides raw material procurement data to the system and receives reports on categories, alternatives, criteria, preferences, decision support system (DSS) results, and procurement as references for inventory management.

c. Management

Receives system output reports in the form of category, criteria, preference, alternative, DSS, procurement, and admin reports as a basis for decision making.

d. Raw Material Selection Decision Support System

Processes data from the administration and warehouse using the TOPSIS method to generate recommendations for selecting the best raw materials.

Data Flow Diagram Level 0

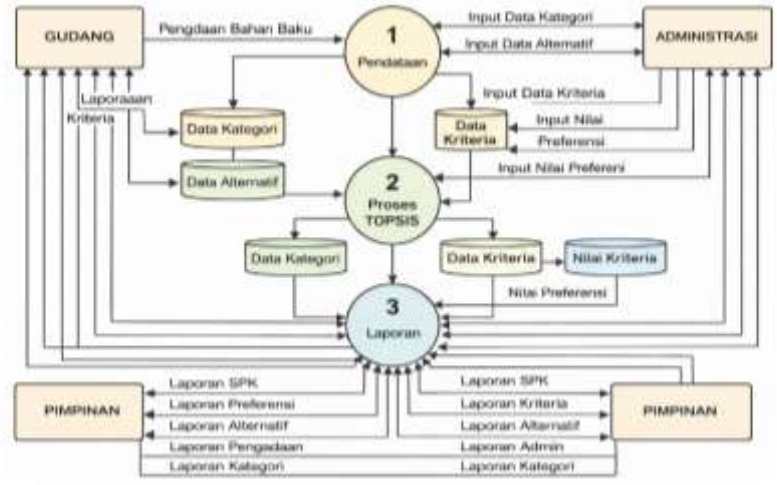

Figure 2. Data Flow Diagram Level 0.

Description:

a. Warehouse: Provides raw material procurement data and receives system-generated reports.

b. Administration: Inputs category data, alternative data, criteria data, criteria values, and preference values.

c. Data Management: Manages and stores category data and alternative data as the basis for analysis.

d. TOPSIS Process: Processes alternative and criteria data to calculate preference values and determine the ranking of the best raw materials.
e. Reports: Generates DSS reports, preference reports, criteria reports, alternative reports, and procurement reports.
f. Management: Receives system output reports as the basis for decision making in raw material selection.

Normalization

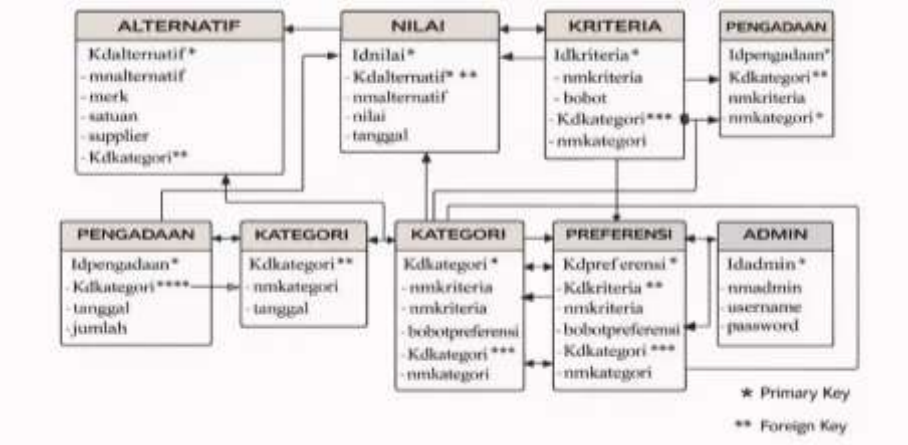

Figure 3. Normalization.

Figure 3 illustrates the relationships among tables that influence one another. Each relationship between tables must include primary key and foreign key attributes in the related tables to ensure data integrity.

ERD (Entity Relationship Diagram)

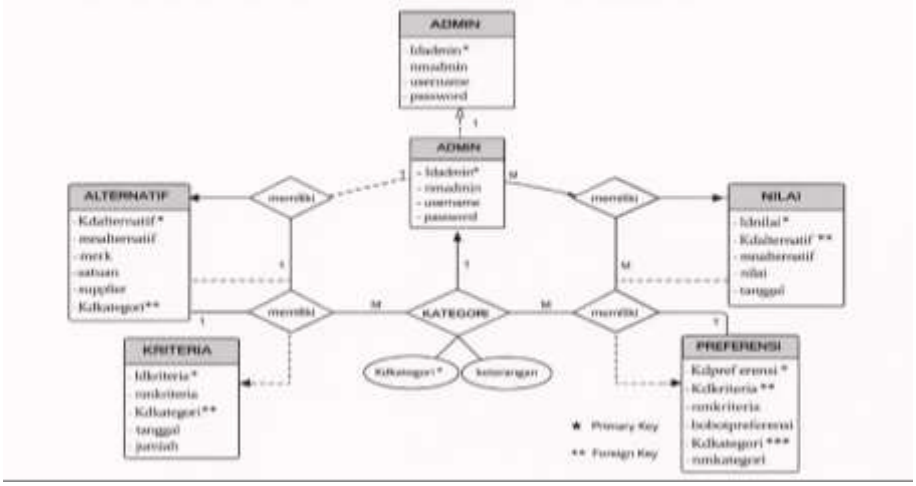

Figure 4. ERD (Entity Relationship Diagram).

Based on the ERD analysis shown in Figure 4, it can be explained that the decision support system for raw material selection using the TOPSIS method consists of several main entities, namely admin, category, criteria, alternative, value, preference, and procurement. The admin

entity is responsible for managing system data. The category entity functions as a data grouping entity that is related to the criteria, alternative, preference, and procurement entities.

The relationship between criteria and preference indicates a one-to-many relationship, as one criterion can have multiple preference values. The relationship between category and both alternative and criteria is also a one-to-many relationship. Furthermore, the relationship between alternative and value is a many-to-many relationship, because one alternative can have many evaluation values based on different criteria, and each value can be associated with more than one alternative.

a. Preliminary Field Testing

   This stage was conducted by performing validation tests on the design of the decision support system for raw material selection at Mooi Cake Simpang IV Sipin Branch. The validation was carried out by experts to assess the suitability of the ERD, data flow, and inter-entity relationships to ensure that the designed system meets user requirements and complies with the TOPSIS method.

b. Main Product Revision

   After the preliminary testing, improvements were made to the design of the decision support system for raw material selection using the TOPSIS method. Revisions were implemented based on expert feedback and suggestions if any deficiencies were found in the data structure, inter-entity relationships, or attribute completeness.

c. Main Field Testing

   At this stage, the system design that had been declared valid was implemented into program source code. Subsequently, the system was tested directly by users at Mooi Cake Simpang IV Sipin Branch to ensure that the system operates properly and generates raw material selection recommendations that meet the company's needs.\

4. RESULT AND DISCUSSION

Alternative and Criteria Data

Table 1. Alternative Values.

Alternative	C1	C2	C3	C4	C5	C6
Raw Material 1	5	4	4	8	4	5
Raw Material 2	4	5	3	3	5	6
Raw Material 3	5	5	5	5	5	7
Squared Sum	66	66	50	98	66	110

This table presents the initial values of each raw material alternative based on the six evaluation criteria used in this study, namely C1 to C6. These values were obtained from direct

assessments by Mooi Cake Simpang IV Sipin Branch, which understands the needs and characteristics of raw materials used in the production process.

The values in this table reflect the real conditions of each raw material alternative prior to further processing using the TOPSIS method. Therefore, this table serves as the main foundation for the decision-making process, as all subsequent calculation stages depend on the accuracy of these initial data.

Table 2. Normalized Decision Matrix.

Normalization R	C1	C2	C3	C4	C5	C6
Raw Material 1	25	16	16	64	16	25
Raw Material 2	16	25	9	9	25	36
Raw Material 3	25	25	25	25	25	49

This table shows the results of the normalization process of the alternative values from Table 1. Normalization is performed to equalize the assessment scale across criteria so that no single criterion dominates due to differences in value ranges.

Through normalization, each criterion contributes proportionally to subsequent calculations. This normalized decision matrix allows objective and fair comparisons among raw material alternatives in accordance with the TOPSIS method.

Table 3. Weighted Normalized Decision Matrix (Positive Ideal Solution).

Weighted Normalization Y	C1	C2	C3	C4	C5	C6
Raw Material 1	0.38	0.24	0.32	0.65	0.24	0.23
Raw Material 2	0.24	0.38	0.18	0.09	0.38	0.33
Raw Material 3	0.38	0.38	0.50	0.26	0.38	0.45
Highest Value	0.38	0.38	0.50	0.65	0.38	0.45

This table presents the weighted normalized values obtained by multiplying the normalized decision matrix by the weight of each criterion. This process incorporates the importance level of each criterion into the raw material selection calculation.

The highest value in each column represents the positive ideal solution, which reflects the best expected condition for raw material selection at Mooi Cake Simpang IV Sipin Branch. This positive ideal solution serves as the main reference for measuring the closeness of each alternative.

Table 4. Weighted Normalized Decision Matrix (Negative Ideal Solution).

Negative Ideal Normalization Y	C1	C2	C3	C4	C5	C6
Raw Material 1	0.38	0.24	0.32	0.65	0.24	0.23
Raw Material 2	0.24	0.38	0.18	0.09	0.38	0.33
Raw Material 3	0.38	0.38	0.50	0.26	0.38	0.45

Lowest Value	0.24	0.24	0.18	0.09	0.24	0.23

This table illustrates the negative ideal solution derived from the lowest values of each criterion. The negative ideal solution represents the worst condition that should be avoided in the raw material procurement process.

The values in this table are used to calculate the distance of each alternative from the negative ideal solution in the subsequent analysis stage.

Table 5. Preference Weights.

Preference Weights	C1	C2	C3	C4	C5	C6
Weight	8	9	10	5	10	7

This table shows the preference weights assigned to each criterion in the study. These weights reflect the relative importance of each criterion in supporting the quality and continuity of raw material procurement at Mooi Cake Simpang IV Sipin Branch.

The weighting process is based on management considerations and operational needs. With preference weights applied, the decision-making process becomes more focused, as more important criteria have a greater influence on the final results.

Table 6. Positive Separation Measure.

Alternative	C1	C2	C3	C4	C5	C6	SMP
Raw Material 1	1.15	0.83	1.60	2.13	0.92	0.71	7.33
Raw Material 2	0.73	1.29	0.90	0.30	1.43	1.02	5.68
Raw Material 3	1.15	1.29	2.50	0.83	1.43	1.39	8.60

This table presents the distance of each raw material alternative from the positive ideal solution. The SMP value indicates how close an alternative is to the best expected condition.

The smaller the SMP value, the closer the alternative is to the positive ideal solution. Therefore, this table plays an important role in determining the feasibility level of each raw material.

Table 7. Negative Separation Measure.

Alternative	C1	C2	C3	C4	C5	C6	SMN
Raw Material 1	0.73	0.53	0.58	0.30	0.59	0.36	3.09
Raw Material 2	0.47	0.83	0.32	0.04	0.92	0.52	3.10
Raw Material 3	0.73	0.83	0.90	0.12	0.92	0.71	4.21

This table shows the distance of each alternative from the negative ideal solution. The SMN value reflects how far an alternative is from the worst possible condition.

An alternative with a larger SMN value indicates greater distance from the negative ideal solution, making it a safer and more stable choice.

Table 8. Ranking Results.

Alternative	Preference Value
Raw Material 1	0.296
Raw Material 2	0.353
Raw Material 3	0.328

This table represents the final results of all TOPSIS calculation stages, displaying the preference values of each raw material alternative. The preference value is obtained from the comparison between the distance to the negative ideal solution and the total distance.

The alternative with the highest preference value is considered the best raw material. Based on these results, Raw Material 2 has the highest value and is therefore the most recommended option for use at Mooi Cake Simpang IV Sipin Branch.

5. CONCLUSION

The results of this study indicate that the application of the TOPSIS method within a decision support system for raw material selection at Mooi Cake Simpang IV Sipin Branch is capable of assisting the decision-making process in a more objective and systematic manner. By considering key criteria such as price, quality, delivery timeliness, availability, and supply consistency, the TOPSIS method processes data in a structured way to generate clear preference values for each raw material alternative. The calculation results show that Raw Material 2 obtained the highest preference value and is therefore identified as the best and most recommended alternative for use in the production process.

Furthermore, this study demonstrates that a TOPSIS-based decision support system can reduce subjectivity in raw material selection, which was previously based solely on experience and manual judgment. With the implementation of this system, management can obtain accurate and easily interpretable ranking information, enabling more effective and efficient decision making. The application of this method also has the potential to improve product quality and support sustainable operational performance.

As a recommendation, Mooi Cake Simpang IV Sipin Branch is encouraged to implement this decision support system continuously in its raw material procurement activities. In the future, the system can be further developed by adding other relevant criteria or by combining the TOPSIS method with other decision-making methods to achieve more optimal results. In addition, periodic data updates and evaluations of criteria and weighting are necessary to ensure that the system remains aligned with dynamic operational conditions and company needs.

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