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OPTIMIZING THE SELECTION OF THE BEST EDUCATIONAL TEACHING AIDS SUPPLIER IN DECISION-MAKING USING THE MOORA METHOD

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Abstract: In the business world, supplier selection plays a crucial role in ensuring smooth company operations. Suppliers are responsible for providing raw materials with consistent quality, timely delivery, and competitive prices. The supplier selection process requires evaluation based on various criteria such as product quality, availability, packaging, price, and warranty. Currently, SNM Store places orders by contacting suppliers one by one via telephone to inquire about item availability. This method is time-consuming and may lead to delays in fulfilling item requirements. To address this issue, a Decision Support System (DSS) is needed to assist in efficiently determining the best supplier. One method that can be used in this system is MOORA (Multi-Objective Optimization on the Basis of Ratio Analysis). MOORA is known to be effective in handling multi-criteria decision-making by simultaneously optimizing multiple objectives. This method also reduces subjectivity by assigning weights to each criterion and uses simple and fast calculations to evaluate the available alternatives. The objectives of this research are to identify the key criteria in supplier selection, apply the MOORA method in an efficient and user-friendly evaluation and selection process, and improve the operational efficiency of SNM Store in procurement so that item availability can be ensured in a timely manner.

Keywords: decision support system ; MOORA; supplier

Abstrak: Dalam dunia bisnis, pemilihan supplier memegang peranan penting dalam memastikan kelancaran operasional perusahaan. Supplier bertanggung jawab menyediakan bahan baku dengan kualitas konsisten, pengiriman tepat waktu, dan harga kompetitif. Proses seleksi supplier memerlukan evaluasi terhadap berbagai kriteria seperti kualitas produk, ketersediaan, pengemasan, harga, dan garansi. Toko SNM saat ini melakukan pemesanan dengan menghubungi supplier satu per satu melalui telepon untuk menanyakan ketersediaan barang. Metode ini memakan waktu dan dapat menyebabkan keterlambatan dalam pemenuhan kebutuhan barang. Untuk mengatasi hal tersebut, diperlukan sistem pendukung keputusan (Decision Support System) yang dapat membantu dalam menentukan supplier terbaik secara efisien. Salah satu metode yang dapat digunakan dalam sistem ini adalah MOORA (Multi-Objective Optimization on the Basis of Ratio Analysis). MOORA dikenal efektif dalam menangani keputusan multi-kriteria dengan mengoptimalkan berbagai tujuan secara bersamaan. Metode ini juga mengurangi subjektivitas melalui pemberian bobot pada tiap kriteria dan menggunakan perhitungan yang sederhana serta cepat dalam mengevaluasi alternatif yang tersedia. adapun tujuan dari penelitian ini adalah untuk mengidentifikasi kriteria-kriteria penting dalam pemilihan supplier, menerapkan metode MOORA dalam proses evaluasi dan seleksi yang efisien dan mudah digunakan, serta meningkatkan efisiensi operasional Toko SNM dalam hal pengadaan barang agar ketersediaan barang dapat terjamin tepat waktu.

Kata kunci: MOORA; sistem penunjang keputusan; supplier;

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INTRODUCTION

Educational teaching aids serve as supporting tools in the learning process, intended to facilitate better understanding. These aids are typically physical objects such as globes, puzzles, mathematical blocks, and others[1]. At the kindergarten level, the use of educational teaching aids plays a crucial role in stimulating children's interest, developing their motor skills, and enhancing their comprehension of the material delivered by teachers. In its business operations, SNM Store collaborates with multiple suppliers to procure educational teaching aids, each offering different standards in terms of quality, pricing, and product availability. This diversity presents challenges for the store in selecting a consistent and reliable supplier to ensure efficient procurement. Additionally, schools often have their own specific criteria when selecting the teaching aids that best meet their instructional needs.

In the business world, suppliers are responsible for delivering raw materials to support the smooth operation of a company by ensuring consistent product quality, timely delivery, and competitive pricing [2]. Supplier selection is a crucial aspect of the procurement process, as it directly influences the efficiency and effectiveness of operations. The selection criteria commonly considered include product quality, availability, packaging, price, and warranty. These factors play a significant role in ensuring that the goods procured meet the required standards and support the operational goals of the organization[3].

SNM Store has so far conducted its purchasing and ordering processes by contacting each supplier individually via telephone to confirm the availability of required items. This approach prolongs the business process, as it takes considerable time to secure the necessary goods. Based on past experiences, there is a clear need for a decision support system to assist the store in selecting the most suitable supplier. Such a system would help streamline business operations and ensure the timely availability of products as needed.

A Decision Support System (DSS) is a computer-based tool that aids users in the decision-making process by analyzing data and evaluating alternatives according to predefined criteria [4]. There are many methods used in decision support systems, one of which is the MOORA method. MOORA (Multi-Objective Optimization on the Basis of Ratio Analysis) is an effective and flexible decision-making technique that can be utilized by companies. This method is capable of solving various complex decision problems by optimizing multiple objectives simultaneously. MOORA separates subjective elements by assigning weights to each criterion and employs simple, fast, and selective calculations to evaluate alternatives. [5][6].

Several previous studies have shown the application of the MOORA method combined with weighting techniques such as ROC, Entropy, and PIPRECIA in various decision-making contexts. Research [7], for example, focuses on the selection of honorary employees at the village level by adding more diverse and objective selection criteria using a combination of ROC and MOORA. [8] applied MOORA to evaluate the performance of the health systems of 36 OECD countries longitudinally, demonstrating the flexibility of this method in international and macro contexts. Meanwhile, [9] utilized the objective weights of the Entropy method to accurately assess employee performance before ranking with MOORA. [10] applied MOORA and PIPRE-CIA in the barista selection process by considering criteria such as ability and appearance, which have not been widely discussed in the context of

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service workforce selection. Research [11] and [12] ocused on the world of education, respectively in the selection of work practice students and teacher performance evaluation, by utilizing MOORA to increase objectivity and efficiency. Finally, [13] combined ROC and MOORA to help select the best tutoring institution based on the criteria of cost, installments, and discounts.

Based on this study, it can be concluded that the novelty of these studies lies in the combination of the weighting method and MOORA, as well as its application in various fields that have not been widely explored before. In addition, the development of a decision support system based on digital applications or the application of MOORA in crisis situations such as determining recipients of social assistance can also be a novel contribution that is valuable both academically and practically.

METHOD

This study employs a quantitative approach with a descriptive method. The purpose of this research is to design and implement a decision support system for selecting the best supplier using the MOORA (Multi-Objective Optimization on the Basis of Ratio Analysis) method.
The research steps undertaken include:

Data Collection

Data were collected through field observations and interviews with the store management. Field observations were conducted to obtain direct information regarding operational conditions and interactions with suppliers. Interviews with store personnel aimed to identify the criteria considered important in selecting the best supplier. These criteria include product quality, price, delivery punctuality, service, and flexibility in meeting the store's needs.

Literature Study

A literature study was conducted to gain an understanding of the theories underlying multi-criteria decision-making. Data were gathered through library research by reviewing various journals to obtain theoretical foundations relevant to the problem discussed.Sistem penunjang keputusan menggabungkan data, model, dan antarmuka pengguna untuk mendukung proses pengambilan keputusan yang lebih efektif dan efisien [14].

MOORA (Multi-Objective Optimization on the Basis of Ratio Analysis) is a method used for decision-making by considering multiple criteria that may be interrelated or conflicting [15]. This method operates by mathematically calculating and comparing data to find the best solution to a given problem. The steps involved in the MOORA method are as follows [16][17]:

Determine the criteria values, weights, and alternative values. The criteria established in this study are quality, product availability, packaging, price, and warranty. After determining the criteria values, the weights and alternative values are assigned based on the results of interviews and questionnaires.

Convert the criteria values into a decision matrix in this process, the criteria values are transformed into a decision matrix based on Equation 1

$$X = \begin{bmatrix} x_{11} & x_{12} & x_{13} \\ x_{21} & x_{22} & x_{23} \\ x_{m1} & x_{m2} & x_{mn} \end{bmatrix} \quad (1)$$

Determine the matrix normalization

Matrix normalization aims to standardize the scale among values of different characteristics and can be explained

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by Equation 2

$$X_i^* = \frac{X_{ij}}{\sqrt{\left[\sum_{i=1}^{m} X_{ij}^2\right]}} \quad (2)$$

Determine the optimization of attributes

After the decision matrix is normalized and weighted, the next step in the MOORA method is to calculate the optimization value for each alternative. This process is carried out using the maximax and minmax approaches, which aim to evaluate the performance of alternatives based on the criteria specified in Equation 3.

$$Y_i = \sum_{j=1} w_j w_{ij}^* - \sum_{j=g+1} w_j w_{ij}^* \quad (3)$$

Determine the ranking based on the *Yi* values

After calculating the optimization values using the MOORA method, the next step is to determine the ranking of the alternatives based on the optimization results. The alternative with the highest value is considered the best, while the one with the lowest value is considered the worst.

RESULT AND DISCUSSION

The initial step in applying the MOORA method is to assign values to each criterion, determine the weight of each criterion, and evaluate the available alternatives. This process aims to collect data that will be used in subsequent analysis. The explanation can be seen in Table 1 and Table 2.

Table 1. Criteria and Weights Table

Criteria	Bobot	Tipe
Quality	5	benefit
Product Availability	4	benefit
Packaging	3	benefit
price	5	cost
Warranty	2	benefit

Table 2. Alternatives Table

Alternatif	C1	C2	C3	C4	C5
A1	2	5	3	3	4
A2	2	5	3	4	5
A3	5	4	4	3	5
A4	3	3	2	5	3
A5	5	4	4	5	3
A6	2	3	2	5	4

The next step in applying the MOORA method is to construct the decision matrix. This involves organizing the alternative data for each predetermined criterion into a matrix format to facilitate the subsequent process of determining the decision outcomes. The resulting decision matrix can be seen in Table 3.

Table 3. Decision Matrix Table

C1	C2	C3	C4	C5
0.237	0.5	0.394	0.287	0.4
0.237	0.5	0.394	0.383	0.5
0.593	0.4	0.525	0.287	0.5
0.356	0.3	0.263	0.479	0.3
0.593	0.4	0.525	0.479	0.3
0.237	0.3	0.263	0.479	0.4

After constructing the decision matrix, the next step in applying the MOORA method is to perform normalization on the data. The purpose of normalization is to transform the values in the decision matrix into comparable forms, allowing for a fair comparison among alternatives across each criterion. The results of this process can be seen in Table 4.

Table 4. Normalization Results Table

C1	C2	C3	C4	C5
0.063	0.106	0.063	0.076	0.042
0.063	0.106	0.063	0.102	0.053
0.157	0.085	0.084	0.076	0.053

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0.094	0.064	0.042	0.127	0.032
0.157	0.085	0.084	0.127	0.032
0.063	0.064	0.042	0.127	0.042

Table 5. Ranking Results Table

Alternatif	Maksimum	Minimum	Yi(maks-min)	Ranking
A1	0.274	0.076	0.198	3
A2	0.285	0.102	0.183	4
A3	0.379	0.076	0.302	1
A4	0.232	0.127	0.105	5
A5	0.357	0.127	0.230	2
A6	0.211	0.127	0.084	6

After the decision matrix has been normalized and weighted, the next step in applying the MOORA method is to calculate the optimization values for each alternative using the maximax and minmax approaches. The ranking results can be seen in Table 5. The analysis results show that Supplier A3 ranks highest, followed by Suppliers A5, A1, A2, A4, and A6. This process provides an overview that SNM Store can make a more objective and focused decision in selecting a supplier

CONCLUSION

The optimization using the MOORA method in supplier selection is the best alternative because this method can process data quickly and produce accurate decisions according to the needs. Among the various criteria used, price emerges as the dominant factor with the highest value, highlighting its importance in the supplier selection process. This encourages the company to be more meticulous in choosing supplier partners who offer the best value.

The analysis results show that Supplier A3= 0.302 ranks highest, followed by Suppliers A5=0.230, A1=0.198, A2=0.183, A4=0.105, and A6=0.084. This study illustrates that the company can make more objective and focused decisions in selecting suppliers, thereby supporting improvements in quality and operational efficiency.

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