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Applying SAW To Choose A Supplier Charcoal Shell Best In Business Dm. Muliady

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ABSTRACT

Supplier selection is a crucial factor in maintaining quality, supply continuity, and production cost efficiency for the DM. Muliady business, which specializes in the production and sale of coconut shell charcoal. The challenges faced include the availability of numerous supplier alternatives with varying characteristics and the absence of an objective, structured, and measurable evaluation system to identify the best supplier. This study aims to determine relevant criteria, assign weights to each criterion, apply the Simple Additive Weighting (SAW) method, and provide a recommendation for the best coconut shell charcoal supplier for DM. Muliady. A quantitative approach was employed, involving the processing of supplier data based on measurable values for each criterion. The criteria used include charcoal quality, price, delivery punctuality, supply continuity, and distance or ease of distribution. The SAW method was implemented by determining criterion weights, assigning ratings to each alternative, normalizing the decision matrix according to criterion types, and calculating preference values by summing the products of normalized values and their respective weights. The resulting preference values were used to rank the suppliers, with the highest-scoring supplier identified as the recommended choice. The application of the SAW method is expected to assist DM. Muliady in making supplier selection decisions that are more objective, systematic, and measurable, while aligning with the business's specific needs.

INTRODUCTION

Micro, Small, and Medium Enterprises (MSMEs) are business entities that play a crucial role in supporting and boosting both local and national economic growth (Rani et al., 2021). Coconut shell charcoal is a commodity with high economic value because it is widely used in various sectors, such as the food industry, metal processing, briquette production, household fuel, and for export. High-quality coconut shell charcoal is characterized by low moisture content, high fixed carbon content, low ash content, and uniform particle size. Therefore, the availability of high-quality raw materials heavily depends on selecting the right suppliers. In the context of DM. Muliady's business which specializes in the production and sale of coconut shell charcoal and was established in Silo Bonto Pekan Kamis in 2011 selecting the best suppliers is a crucial factor for maintaining product quality consistency, supply continuity, and production cost efficiency.

Common challenges encountered in the field include the large number of potential suppliers with varying characteristics, as well as the lack of an objective, structured, and measurable evaluation system for selecting the best supplier. Each supplier offers different prices, quality levels, distribution distances, delivery timeliness, and supply capacities. If the selection is made subjectively or based solely on experience, the risk of making the wrong decision increases—for example, unstable supply, charcoal quality that does not meet standards, or high logistics costs. These conditions can impact the production process, customer satisfaction, and even the business's competitiveness. Therefore, a structured, objective, and scientifically accountable decision-making approach is necessary.

Decision Support Systems are primarily designed to assist management in performing analytical tasks in less structured situations with less clear criteria (Kania et al., 2021). One widely used approach for selecting the best alternative based on various criteria is the Simple Additive Weighting (SAW) method (Ferdian, 2021). Simple Additive Weighting (SAW) is a method in decision support systems characterized by weighted summation (Akbar, 2023). SAW performs a weighted summation of the performance ratings for each alternative across all attributes (Wahyudhi Amin & Hilman, 2023). This method is part of Decision Support System (DSS) techniques that work by assigning weights to each criterion deemed important, then performing a normalization process and calculating preference values for each alternative (Sutoyo & Iin, 2024). he alternative with the highest preference value is considered the most suitable choice (Wijaya & Wulandari, 2024). The advantage of the SAW method lies in its simple, logical, and easily interpretable calculations, making it highly suitable for supplier selection cases (Rizky Firdaus et al., 2024).

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In the context of DM. Muliady's business, the selection of the best coconut shell charcoal supplier can be broken down into several key criteria, such as charcoal quality, price, distance or ease of distribution, on-time delivery, and supply continuity. Using the SAW method, each criterion can be weighted according to its level of importance. For example, product quality might be the primary criterion, while price and supply reliability serve as supporting criteria. In this way, the supplier evaluation process no longer relies solely on the business owner's intuition but is based on systematic calculations that consider all aspects simultaneously.

The application of the SAW method also offers another benefit: it helps business owners conduct regular documentation and evaluations (Rindang Subekti & Prasetya, 2024). Data regarding suppliers can be stored and reanalyzed when market conditions change, raw material prices fluctuate, or production needs shift. As a result, the decisions made become more adaptive and relevant to the current situation. Using this method can also reduce decision-making biases that may arise from personal relationships with suppliers or outdated practices that are no longer efficient (Supardi & Lianda, 2025).

In addition, competition in the coconut shell charcoal business is intensifying as market demand both domestic and international continues to rise. Business operators are required to maintain product quality on a sustainable basis. One strategic step to achieve this is ensuring that raw materials are sourced from suppliers who truly meet the required standards (Yusuf & Soediantono, 2022). Mistakes in selecting suppliers not only affect product quality but can also lead to financial losses, delays in order fulfillment, and a decline in the business's reputatio (Rohman & Bhakti, 2023). Therefore, the selection of suppliers must be managed professionally using multi-criteria decision-making methods.

Based on the above discussion, the application of the Simple Additive Weighting (SAW) method to determine the best coconut shell charcoal supplier for Muliady's business is highly relevant. This method is expected to provide objective and measurable evaluation results, enabling the business owner to select the supplier that best meets the established needs and standards (Petronela Kurniati Kondang et al., 2025). The results of this study can also serve as a basis for the development of a sustainable computer-based decision support system (Ruwllah et al., 2025). Thus, the application of the SAW method not only aids in the selection of suppliers today but also serves as a foundation for strategic decision-making in the future (Alvi et al., 2025).

METHOD

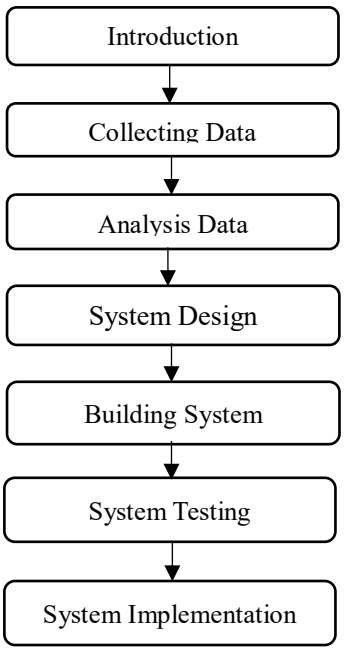


Figure 1. Research Stages

Introduction

The initial stage of this research is a preliminary study aimed at gathering input and suggestions regarding the research subject. Through this study, the researcher can obtain information about the issues addressed in the research. In this study, the issue addressed is the large number of supplier alternatives with varying characteristics. There is currently no objective, structured, and measurable evaluation system available for determining the best supplier. Each supplier offers different prices, quality, distribution distances, delivery timeliness, and supply capacity. If the selection is made subjectively or based solely on experience, the risk of making the wrong decision increases—for example, unstable

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supply, charcoal quality that does not meet standards, or high logistics costs. These conditions can impact the production process, customer satisfaction, and even the business's competitiveness.

Collecting Data

The next stage is data collection, which was conducted as part of the study to gather data related to the research problem, namely the application of SAW to determine the best coconut shell charcoal supplier for Muliady's business. This was carried out through direct observation in accordance with the established criteria.

Analysis Data

In this stage, data analysis is conducted to transform the data into useful information. This ensures that the data can be easily understood and is beneficial to researchers in conducting their studies. Following the analysis, it is believed that this problem can be addressed using the SAW method, which can serve as a reference for decision-making.

System Design

After the data analysis phase is complete, the next step is system design, which involves model design using UML, database design, and the definition of inputs and outputs to be generated in accordance with the established objectives.

Building System

This phase involves developing a system using the PHP programming language and a MySQL database to achieve a specific objective based on the requirements for a decision support system designed to identify top-selling products based on sales data.

System Testing

In this phase, system testing is conducted to determine whether the developed system is capable of solving the problem as intended. Here, the developed system is tested using the black-box testing method. The black-box testing method is used to identify errors and demonstrate the application's functionality during operation, verifying whether inputs are accepted correctly and whether the resulting outputs match expectations.

System Implementation

After system testing is complete, the next step is system implementation. This phase is carried out to create and finalize the results of the design. During this phase, program code is written to solve the problems identified in the design using the PHP and MySQL programming languages.

RESULT

Analysis Data

Data analysis for a decision support system in selecting charcoal suppliers using the SAW method at DM. Muliady refers to questionnaire data acquisition. Questionnaire data acquisition involves collecting responses to questions completed by the public regarding the services they have received at DM. Muliady, this data contains the five basic criteria for selecting charcoal suppliers using the SAW method at DM. Muliady, as shown in Table 1 below.

Table 1. Criteria

No	Criteria	Criteria Code	Weight
1	Charcoal Quality	C1	0.35
2	Price	C2	0.25
3	On-Time Delivery	C3	0.15
4	Supply Continuity	C4	0.15
5	Distribution Distance	C5	0.10

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Design System

The use case diagram describes the administrator. The proposed use case diagram is shown in Figure 2.

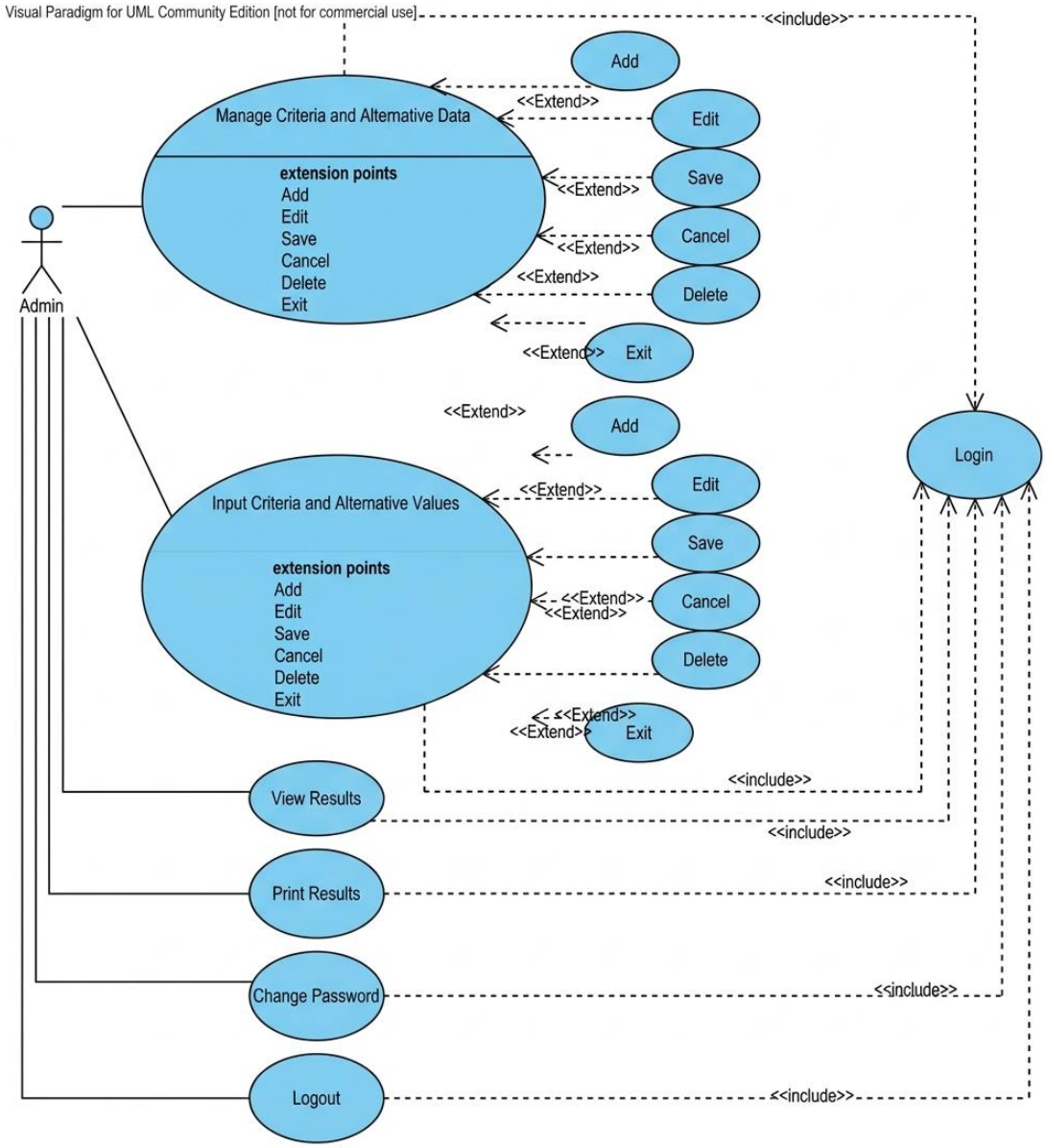


Figure 2. Design System

The use case diagram illustrates the interaction between the administrator and the decision support system for selecting the best coconut shell charcoal supplier. The administrator is responsible for managing the main data required by the system, including criteria and supplier alternatives. The administrator can enter, edit, cancel, and delete criteria and alternative data before the calculation process is performed. The system then processes the entered data using the Simple Additive Weighting (SAW) method, including the normalization and preference value calculation stages. The calculation results are presented as a supplier ranking that can be used to support the selection of the most suitable supplier. Thus, the use case diagram represents the functional flow from data management to the generation of supplier selection results.

Implementation System

Program implementation is the stage at which a system—whose design has been finalized and approved—is put into use. The implementation stage also covers the deployment of the developed application.

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Login Page

The login page is the initial interface used to authenticate users before accessing the decision support system. On this page, the administrator is required to enter a registered username and password and then select the login button. If the entered credentials are valid, the system grants access to the main administrator page. This authentication process is intended to restrict access to authorized users and maintain the security of the data managed by the system.

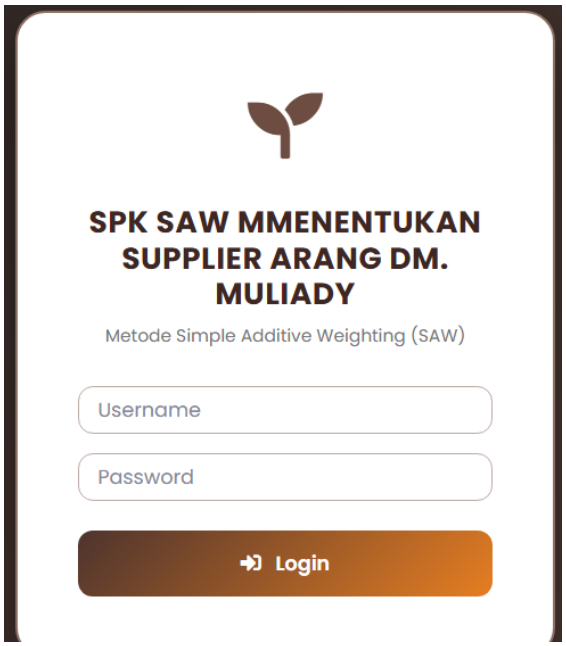


Figure 3. Login Page

Home Admin

The Home Admin page serves as the main interface for the administrator after successfully logging into the system. This page provides access to the menus and submenus required to manage the decision support system. Through the available menu options, the administrator can access the criteria management, alternative management, calculation, and report functions. The page therefore serves as the central navigation interface that connects the administrator with the main functions of the supplier selection system.

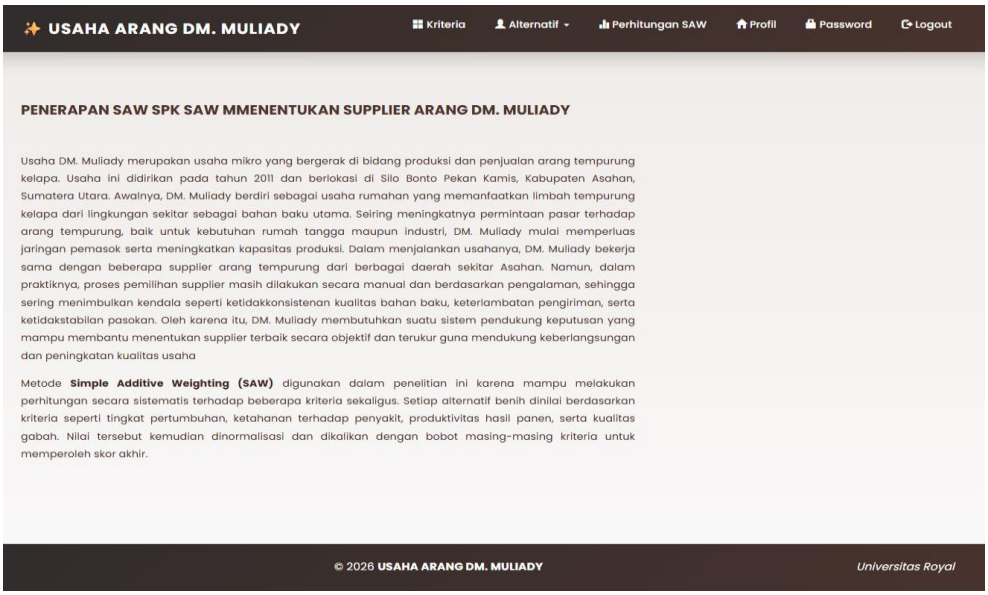


Figure 4. Home Admin

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Criteria Page

The Criteria Page is used by the administrator to manage the criteria used in the supplier selection process. Through this page, the administrator can enter, edit, cancel, and delete criterion data according to the requirements of the decision-making process. The criteria managed on this page correspond to the evaluation criteria used in the SAW calculation, namely charcoal quality, price, on-time delivery, supply continuity, and distribution distance. Therefore, this page provides the basic data required before the supplier alternatives are evaluated using the SAW method.

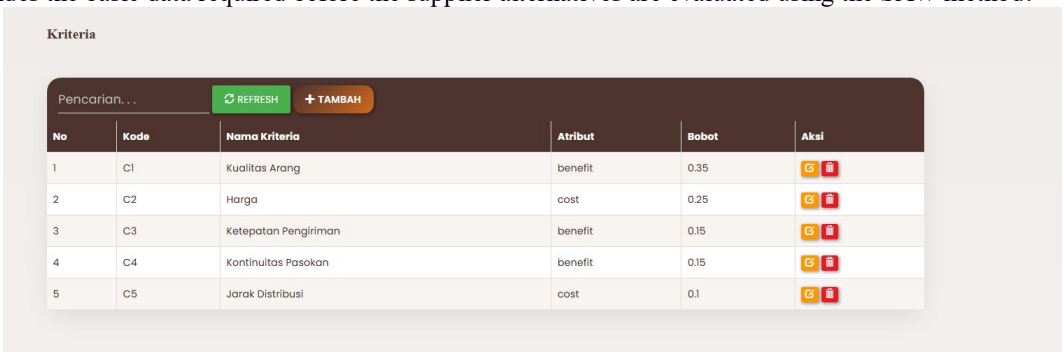


Figure 5. Criteria Page

Alternative Page

The Alternative Page is used to manage the supplier alternatives that will be evaluated in the decision support system. The administrator can enter new alternative data and perform editing, cancellation, or deletion of existing alternative data. The alternatives entered through this page become the objects of evaluation in the SAW calculation process. After the alternative data have been entered, each supplier can be evaluated based on the established criteria before the normalization and preference value calculation stages are performed.

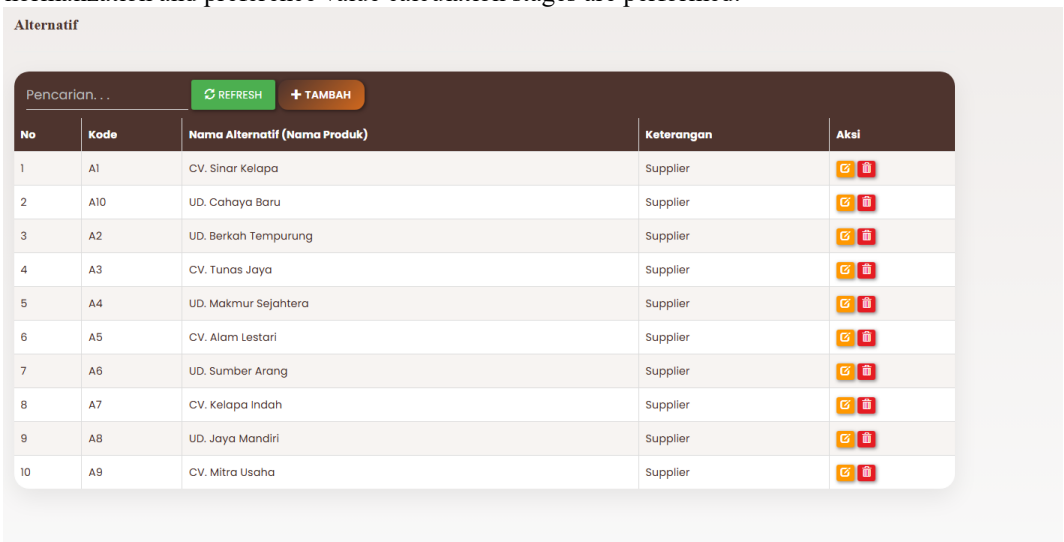


Figure 6. Alternative Page

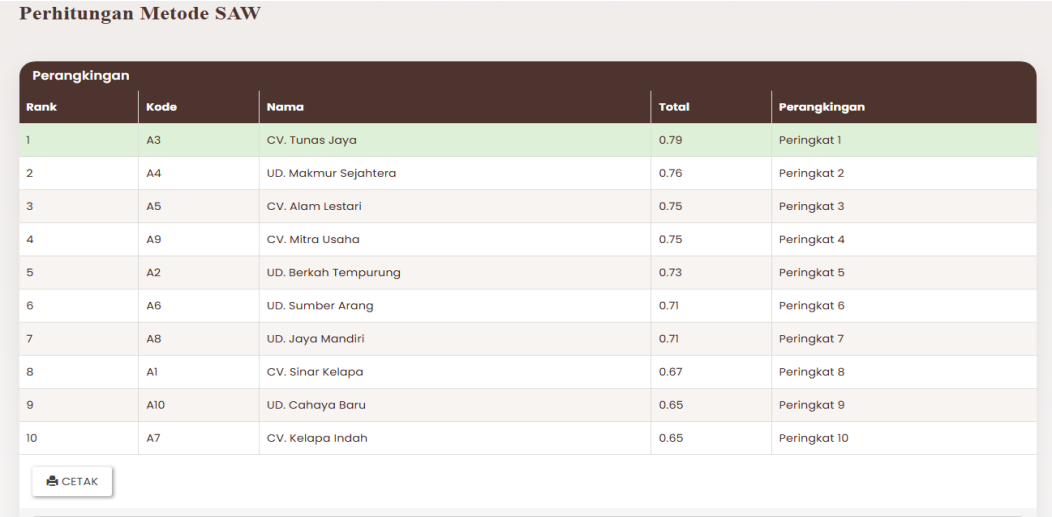
Calculation Page

The Calculation Page displays the processing of supplier data based on the criteria and alternatives previously entered into the system. At this stage, the system applies the SAW method to process the evaluation data through the required calculation stages. The criteria weights and alternative values are used as the basis for normalization and preference value calculation. The resulting preference values are then used to establish the ranking of supplier alternatives. Thus, this page represents the main computational stage of the decision support system.

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Perhitungan Metode SAW

Perangkingan

Rank	Kode	Nama	Total	Perangkingan
1	A3	CV. Tunas Jaya	0.79	Peringkat 1
2	A4	UD. Makmur Sejahtera	0.76	Peringkat 2
3	A5	CV. Alam Lestari	0.75	Peringkat 3
4	A9	CV. Mitra Usaha	0.75	Peringkat 4
5	A2	UD. Berkah Tempurung	0.73	Peringkat 5
6	A6	UD. Sumber Arang	0.71	Peringkat 6
7	A8	UD. Jaya Mandiri	0.71	Peringkat 7
8	A1	CV. Sinar Kelapa	0.67	Peringkat 8
9	A10	UD. Cahaya Baru	0.65	Peringkat 9
10	A7	CV. Kelapa Indah	0.65	Peringkat 10

CETAK

Figure 7. Calculation Page

Report Page

The Report Page presents the output generated from the supplier selection calculation. The information displayed on this page represents the results of the SAW processing and provides the supplier ranking based on the established criteria and weights. This page enables the administrator to review the final calculation results in a more organized form. The resulting ranking can subsequently be used as supporting information in the supplier selection process at DM. Muliady.



USAHA ARANG DM. MULIADY

Silo Bonto Pekan Kamis, Kabupaten Asahan, Sumatera Utara

Laporan Hasil Perhitungan Menentukan Supplier Arang DM. MULIADY

Ranking	Kode	Nama Perserta	Total	Keterangan
1	**A3**	**CV. Tunas Jaya**	**0.79**	Supplier Arang
2	A4	UD. Makmur Sejahtera	0.76	Peringkat 2
3	A5	CV. Alam Lestari	0.75	Peringkat 3
4	A9	CV. Mitra Usaha	0.75	Peringkat 4
5	A2	UD. Berkah Tempurung	0.73	Peringkat 5
6	A6	UD. Sumber Arang	0.71	Peringkat 6
7	A8	UD. Jaya Mandiri	0.71	Peringkat 7
8	A1	CV. Sinar Kelapa	0.67	Peringkat 8
9	A10	UD. Cahaya Baru	0.65	Peringkat 9
10	A7	CV. Kelapa Indah	0.65	Peringkat 10

Berdasarkan hasil perhitungan menggunakan metode **Simple Additive Weighting (SAW)**, Supplier Arang dengan nilai tertinggi adalah dengan total skor .

Batubara 08-July-2026
Pimpinan DM. MULIADY,

DM. MULIADY

Figure 8. Calculation Page

DISCUSSION

The results demonstrate that the application of the Simple Additive Weighting (SAW) method can provide a more structured approach to selecting coconut shell charcoal suppliers at DM. Muliady. The evaluation considers five criteria, namely charcoal quality, price, delivery punctuality, supply continuity, and distribution distance, with different weights according to their importance. By combining these criteria into a single preference score, the system enables supplier

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alternatives to be compared using consistent and measurable parameters rather than relying solely on subjective judgment.

The implementation of the system also improves the supplier selection process compared with the previous practice. Before the system was implemented, supplier selection was primarily dependent on the business owner's experience and consideration of individual supplier characteristics. This approach could make comparisons between suppliers less consistent. After implementation, the criteria, weights, alternative values, normalization process, and final preference values are managed systematically through the application. The resulting ranking therefore provides a more transparent basis for determining the supplier that best meets the business requirements.

These findings are consistent with previous studies showing that SAW can be applied to multi-criteria decision-making because it uses a relatively simple weighted-summation process to rank alternatives (Akbar, 2023; Rani et al., 2021). Previous research has also demonstrated the use of SAW for supplier selection and other decision-support problems involving multiple evaluation criteria (Wahyudhi Amin & Hilman, 2023; Alvi et al., 2025). The present study extends these applications to the selection of coconut shell charcoal suppliers, where product quality, supply continuity, delivery performance, price, and distribution distance must be considered simultaneously.

From a practical perspective, the developed system helps DM. Muliady document supplier evaluations and obtain ranking results more systematically. The stored evaluation data can also be reused for subsequent supplier assessments when business requirements or supplier conditions change. Thus, the integration of the SAW method into a computer-based decision support system provides a practical mechanism for supporting more objective supplier selection and reducing dependence on subjective assessment.

However, the results should be interpreted within the scope of the study. The evaluation focuses on the criteria and supplier data available at DM. Muliady, so the findings may not be directly generalizable to other businesses with different supplier characteristics or procurement requirements. Future research could incorporate a larger supplier dataset, additional criteria such as payment terms and product capacity, and comparative analysis with other multi-criteria decision-making methods to evaluate whether the resulting rankings remain consistent.

CONCLUSION

This study developed a web-based Decision Support System for selecting the best coconut shell charcoal supplier at DM. Muliady using the Simple Additive Weighting (SAW) method. The results show that supplier evaluation can be structured using five criteria: charcoal quality, price, delivery punctuality, supply continuity, and distribution distance, with respective weights of 0.35, 0.25, 0.15, 0.15, and 0.10. The SAW method processes the supplier alternatives through rating, normalization, and weighted preference calculation to produce a supplier ranking, in which the alternative with the highest preference value is considered the most suitable supplier based on the established criteria.

The developed system provides functionality for managing criteria and supplier alternatives, performing SAW calculations, and displaying the resulting ranking. These functions provide DM. Muliady with a more structured and measurable basis for supplier evaluation compared with selection based primarily on subjective considerations. The findings therefore indicate that the implementation of SAW can support supplier selection by integrating multiple criteria into a single decision-making process.

The contribution of this study is the application of a SAW-based decision support system specifically for coconut shell charcoal supplier selection at DM. Muliady. Nevertheless, the findings are limited to the criteria, weights, and supplier data used in this study. Future research could evaluate additional criteria and supplier data and compare SAW with other multi-criteria decision-making methods to assess the consistency of supplier rankings.

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