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Decision Support System for Prioritizing Building Material Restocking Using the Simple Additive Weighting Method at Sinar Mas Putra Building Store

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Abstract

Inventory management plays a vital role in maintaining operational efficiency and customer satisfaction in building material stores.Sinar Mas Putra Building Store, Jepara, experiences difficulties in determining restocking priorities because inventory decisions are primarily based on estimation and personal experience, which may result in stock shortages or overstock conditions.This study aims to develop a web-based Decision Support System (DSS) using the Simple Additive Weighting (SAW) method to support objective restocking decisions.The system evaluates products based on five criteria: stock quantity, sales level, product price, lead time, and demand level.This study adopted the Waterfall software development model, while data were collected through observation, interviews, and documentation. The proposed system was implemented as a web-based application and validated using Black Box Testing to ensure that all functional requirements were fulfilled.The results demonstrate that the proposed DSS successfully generates systematic and objective restocking priority recommendations by integrating multiple evaluation criteria into a single decision-making process.Compared with conventional manual practices, the proposed system improves the consistency, accuracy, and efficiency of inventory decision-making.Therefore, the proposed system provides practical support for inventory management and contributes to more effective and reliable restocking decisions at Sinar Mas Putra Building Store.

Keywords:
Decision Support System; Simple Additive Weighting; Building Material Restocking; Inventory Management; Restocking Priority.

1. INTRODUCTION

Inventory is one of the most important assets in business operations, particularly in trading businesses such as building material stores. According to (Muhlis & Sw, 2023), well-managed inventory contributes significantly to maintaining operational continuity. Adequate product availability greatly influences the continuity of sales activities and customer satisfaction. Conversely, poor inventory management may result in stock shortages (stockouts) or excessive inventory (overstock), which can disrupt business operations.

Inefficient inventory management may also increase operational costs and the risk of inventory losses. (Setyadi & Nurajijah, 2024) stated that an effective logistics system can improve product distribution efficiency while reducing inventory recording errors. Therefore, effective inventory management is required to ensure that inventory levels remain aligned with market demand and operational conditions.

The rapid development of information technology has provided various solutions for data management and decision-making processes. (Kirana & Wijana, 2024) explained that web-based information systems improve the speed and accuracy of inventory data processing. Likewise, (Ewak & Pusvita, 2025) reported that web-based inventory management applications enhance operational efficiency while providing real-time access to inventory information. These findings indicate that information technology can assist organizations in managing inventory more effectively and systematically.

Sinar Mas Putra Building Store in Jepara is engaged in the sale of various building materials. (Astuti & Hamijaya, 2024) demonstrated that implementing an inventory management system in a building material store can optimize inventory control and product sales, thereby improving inventory management effectiveness. In addition, (Ilyas Asfari, 2024) reported that non-computerized inventory recording frequently results in data inaccuracies. Similar problems are experienced by Sinar Mas Putra Building Store, where restocking priorities are still determined based on estimates and personal experience. Such conditions may lead to less objective decisions, resulting in either stock shortages or excessive inventory.

Decision Support Systems (DSS) have been widely implemented to support decision-making involving multiple evaluation criteria. (W. A. Maulana et al., 2021) demonstrated that the SAW method was successfully applied to supplier selection in a building material store, producing more objective decision recommendations. Likewise, (Abdul Fattah et al., 2023) reported that a DSS utilizing the SAW method provides more objective decision results than conventional manual approaches. Furthermore, (Satyono et al., 2025a) stated that the SAW method reduces subjectivity in determining alternative priorities. Recent studies by (Nurdianti et al., 2026) have also demonstrated that the SAW method remains effective for inventory-related decision making because it produces transparent, consistent, and objective ranking results. The SAW method also employs a simple computational process and can generate alternative rankings efficiently based on predetermined criterion weights.

Although numerous studies have applied the SAW method to various decision-making problems, studies specifically focusing on determining restocking priorities in building material stores using inventory and sales data remain limited (Abdul Fattah et al., 2023; Satyono et al., 2025a). Therefore, a system capable of integrating multiple important criteria into the restocking process is required to produce more objective and measurable decisions.

Based on these issues, this study aims to design and develop a Decision Support System for determining building material restocking priorities using the SAW method. The selection of these criteria is based on previous studies conducted by (Nurdianti et al., 2026; Wibisono & Sanjaya, 2025), which demonstrated that stock quantity, sales level, product price, lead time, and demand level are significant factors in determining inventory replenishment priorities. Stock quantity represents product availability, sales level and demand level reflect product demand and sales trends, lead time indicates the procurement time required for replenishment, while product price represents inventory investment considerations. Therefore, the proposed system is expected to support more objective, systematic, and efficient restocking decisions, thereby improving inventory management at Sinar Mas Putra Building Store.

2. RESEARCH METHOD

This study employed a quantitative approach using the Waterfall system development model to design and develop a Decision Support System (DSS) for determining restocking priorities at Sinar Mas Putra Building Store, Jepara. The Waterfall model was selected because it provides a structured development process, starting from requirements analysis through system testing. According to (Afriani & Aedi, 2022), the Waterfall model follows a systematic workflow that facilitates software development. In addition, (Sutriono et al., 2023) stated that this model is widely applied in information system development because each development phase can be carried out in a planned and well-documented manner.

The object of this study was Sinar Mas Putra Building Store, Jepara, which operates in the building materials retail sector. The primary problem identified was that restocking priorities were still determined based on estimation and personal experience, increasing the risk of stock shortages and overstocking. (Muhlis & Sw, 2023) explained that non-integrated inventory management can reduce the effectiveness of inventory control. A similar condition was also reported by (Setyadi & Nurajijah, 2024), who stated that conventional inventory systems often experience delays in information processing and errors in inventory data management.

The research data were collected through observation, interviews, and documentation. Observation was conducted to understand the existing inventory management process within the store. According to (Kirana & Wijana, 2024), observation provides direct insight into business processes, enabling system requirements to be identified more accurately. Interviews were conducted with the store owner to obtain information regarding system requirements and the current restocking decision-making process. Interviews have also been employed by (Ewak & Pusvita, 2025) in the development of web-based systems to identify user requirements in greater depth.

Documentation was used to collect inventory data, including stock quantity, sales level, product price, lead time, and demand level, which served as the basis for the SAW calculation. According to (Ilyas Asfari, 2024), documentation data represent the primary source of inventory management because they reflect actual stock conditions and transaction records.

The data used in this study consisted of inventory and sales records obtained from Sinar Mas Putra Building Store, Jepara. The dataset covered one year of inventory and sales records. These data included stock quantity, sales level, product price, lead time, and demand level for each product considered as an alternative in the decision-making process. The data were selected based on the completeness of the information required by the SAW method so that all alternatives could be evaluated using the same criteria.

The inventory and sales data used in this study were obtained directly from the inventory records and transaction documents of Sinar Mas Putra Building Store covering a one-year period. These operational records were selected because they represent the actual inventory conditions and sales activities of the store, thereby providing relevant data for evaluating restocking priorities using the SAW method.

The research procedure consisted of problem identification, data collection, requirements analysis, system design, implementation, system testing, and evaluation. These stages were conducted to ensure that the developed system met user requirements and effectively addressed the identified problems. (Setiawan et al., 2025) stated that a systematic development process can improve the effectiveness of information system development and facilitate evaluation at each stage of the research. The research framework adopted in this study is illustrated in Figure 1.

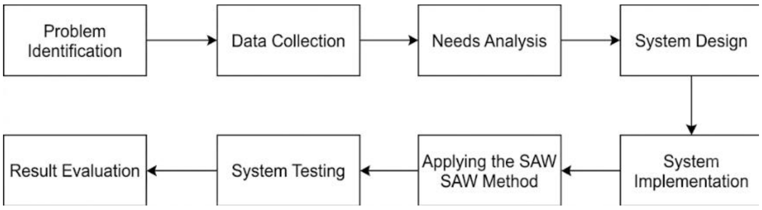

Figure 1. Research Stages

The implementation of web-based decision support systems has also been widely adopted across various fields to improve the objectivity of evaluation and decision-making processes. (Mangunsong et al., 2026) demonstrated that decision support systems can facilitate the systematic evaluation of alternatives, thereby producing more structured decision recommendations.

The system was developed using PHP with the CodeIgniter 4 framework and MySQL as the database management system. Unified Modeling Language (UML) was used to model the system requirements and visualize business process workflows. According to (Muhlis & Sw, 2023), UML is an effective approach for representing system requirements in a structured manner that is easily understood by both developers and users.

The decision-making method applied in this study was the Simple Additive Weighting (SAW) method. (Abdul Fattah et al., 2023) explained that the SAW method provides more objective decision-making than manual approaches because it simultaneously considers multiple criteria. Studies conducted by (A. Maulana & Darmanto, 2026; Satyono et al., 2025) also demonstrated that the SAW method is effective for evaluating and ranking alternatives, thereby supporting systematic decision-making. In this study, five main criteria were used: stock quantity (C1), sales level (C2), product price (C3), lead time (C4), and demand level (C5).

The weight of each criterion was determined based on its relative importance in the restocking decision process through interviews and discussions with the owner of Sinar Mas Putra Building Store, who acted as the domain expert in inventory management. The weighting process considered practical experience in daily inventory decision-making and was aligned with findings from previous studies on inventory decision support systems (Nurdianti et al., 2026; Satyono et al., 2025). The resulting criterion weights are presented in Table 1.

Table 1. Criteria and Weight of the Simple Additive Weighting (SAW) Method

Code	Criteria	Attribute	Weight
C1	Stock Quantity	Cost	0.30
C2	Sales Level	Benefit	0.25
C3	Product Price	Cost	0.15
C4	Lead Time	Cost	0.10
C5	Demand Level	Benefit	0.20

The SAW method begins by constructing a decision matrix based on the values of each alternative for all evaluation criteria. The normalization process is then performed to standardize the values of different criteria, allowing each alternative to be compared objectively. Normalization for benefit attributes is calculated using Equation (1).

$$R_{ij} = \left(\frac{X_{ij}}{Max\ (X_{ij})}\right) \tag{1}$$

In Equation (1), Rij represents the normalized value of the i-th alternative for the j-th criterion, while Xij denotes the original value of the alternative for each criterion. This equation is applied to the benefit criteria, namely Sales Level and Demand Level, because higher criterion values indicate higher restocking priority.

For cost criteria, normalization is performed using Equation (2).

$$R_{ij} = (\frac{Min\,(X_{ij})}{X_{ij}}) \tag{2}$$

Equation (2) is applied to the Stock Quantity, Product Price, and Lead Time criteria. For these criteria, lower values indicate higher restocking priority. Therefore, normalization is performed by comparing the minimum criterion value with the value of each alternative.

After all criterion values have been normalized, the next step is to calculate the preference value of each alternative using Equation (3).

$$V_i = \sum_{j=1}^{n}(W_j \times R_{ij}) \tag{3}$$

In Equation (3), Vi represents the preference value of the i-th alternative, Wj denotes the weight assigned to the j-th criterion, and Rij represents the normalized value. The preference value is obtained by summing the weighted normalized values of all criteria. A higher preference value indicates a higher priority for product restocking.

After the preference values have been calculated, all alternatives are ranked from the highest to the lowest score. The alternative with the highest preference value is considered the highest priority for restocking because it represents the most favorable combination of all evaluation criteria according to the predetermined weights. Conversely, alternatives with lower preference values receive lower priority since their overall performance is less suitable based on the established decision criteria.

The application of the SAW method provides a straightforward yet effective mechanism for evaluating multiple alternatives simultaneously. Each criterion contributes to the final preference value according to its assigned weight, allowing the decision-making process to consider several operational factors rather than relying on a single indicator. This approach ensures that the final recommendation reflects a balanced evaluation of inventory conditions.

Another advantage of the SAW method is its computational efficiency. The normalization and weighted summation processes are relatively simple to implement, making the method suitable for web-based decision support systems that require fast processing times. Because every calculation follows the same procedure, the generated ranking remains consistent even when the number of evaluated products increases.

Furthermore, the calculation process is transparent because users can trace the contribution of each criterion to the final preference value. This transparency enables decision-makers to better understand the basis of the generated recommendations and increases confidence in the resulting restocking priorities. Consequently, the proposed system is capable of supporting inventory management decisions in a systematic, objective, and efficient manner.

System testing was conducted using the Black Box Testing method to ensure that all system functions operated according to user requirements. The testing covered the system's main features, including product data management, product evaluation, the SAW calculation process, restocking priority results, and report generation. According to (Setyani & Sipayung, 2023), Black Box Testing is a testing method that focuses on verifying system functionality based on inputs and outputs without considering the internal structure of the program. Therefore, this method was employed to ensure that all system features functioned properly according to user requirements.

3. RESULTS AND DISCUSSION

This study produced a web-based Decision Support System (DSS) to determine restocking priorities at Sinar Mas Putra Building Store Jepara using the Simple Additive Weighting (SAW) method. The developed system aims to support a more objective restocking decision-making process by considering several important criteria, namely Stock Quantity, Sales Level, Product Price, Lead Time, and Demand Level. This section presents the results of system implementation, the application of the SAW method in determining restocking priorities, the ranking results of the alternatives, and the system testing results. Furthermore, the discussion analyzes the contribution of the developed system to improving inventory management effectiveness and supporting decision-making at Sinar Mas Putra Building Store Jepara.

3.1. System Implementation

The decision support system was developed as a web-based application using the CodeIgniter 4 framework and a MySQL database. The system provides several key features to support inventory management and the determination of product restocking priorities, including a dashboard, product evaluation, SAW calculation, restocking priority results, and reporting.

The main interface displayed after users successfully log into the system is shown in Figure 2. The dashboard serves as the system's central information page by presenting a summary of inventory conditions and sales activities.

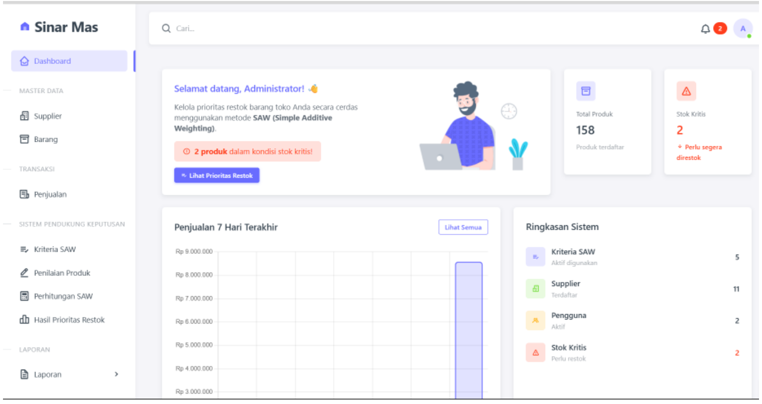

Figure 2. System Dashborad

The dashboard displays information such as the total number of products, the number of suppliers, critical stock levels, sales charts, and other summary information that enables users to monitor inventory conditions in real time. The availability of this information allows users to obtain a comprehensive overview of inventory conditions quickly, thereby supporting a more effective decision-making process.

In addition to serving as an information center, the dashboard enables users to identify inventory conditions that require immediate attention without manually reviewing transaction records. The integration of inventory data and sales information into a single interface simplifies monitoring activities and reduces the time required to obtain relevant information. Consequently, decision-makers can identify products with declining stock levels or increasing sales trends more efficiently.

The web-based architecture also provides flexibility because the system can be accessed through standard web browsers without requiring software installation on each device. This approach simplifies system maintenance and allows updates to be implemented centrally. Furthermore, storing data in a MySQL database ensures that inventory records, product information, supplier data, and transaction histories remain organized and can be retrieved efficiently whenever required.

The process of generating product evaluation data used in the SAW method is presented in Figure 3. This page is used to generate the evaluation value of each product based on the predetermined criteria.

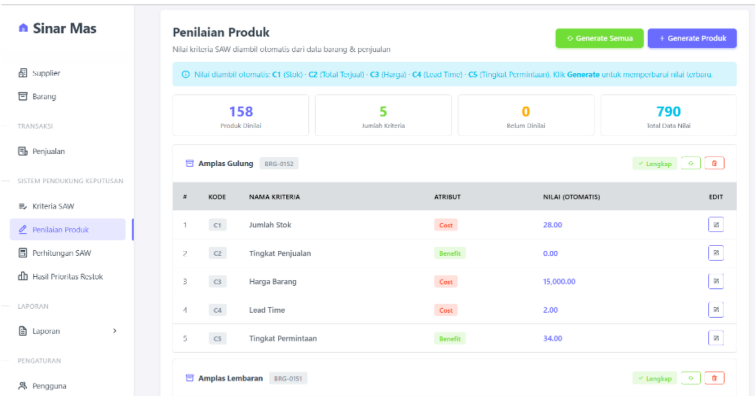

Figure 3. Product Assessment Page

Each criterion value is automatically generated from product and sales data stored in the system. The evaluation criteria consist of Stock Quantity, Sales Level, Product Price, Lead Time, and Demand Level. The system implementation demonstrates that all data required for the decision-making process can be integrated into a single platform, thereby reducing the risk of recording errors and accelerating the inventory evaluation process.

3.2. Application of the Simple Additive Weighting Method

The SAW method was applied to determine the restocking priority level of each product based on five criteria: Stock Quantity (C1), Sales Level (C2), Product Price (C3), Lead Time (C4), and Demand Level (C5). The calculation process began by constructing a decision matrix containing the value of each alternative for all evaluation criteria. The decision matrix used as the basis for the SAW calculation is presented in Table 2.

Table 2. Decision Matrix for Restocking Priority

Product Name	C1	C2	C3	C4	C5
Semen Rajawali 40 kg	7	36	63.500	3	90
Sock Pipa 1/2	43	40	3.500	2	20
Knee Pipa 1/2	19	33	5.000	2	34

Based on the data presented in Table 2, each alternative possesses different characteristics for each evaluation criterion. These values are subsequently processed through the normalization stage to standardize the measurement scale across all criteria, enabling an objective comparison among alternatives. The normalization process and the calculation of preference values using the SAW method are illustrated in Figure 4.

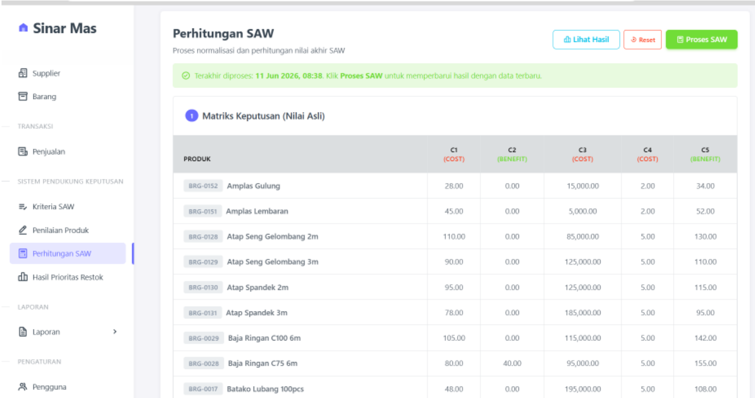

Figure 4. Calculation Process

At this stage, the system displays the decision matrix, normalization results, and the preference value obtained for each alternative. The calculation process is performed automatically, thereby minimizing calculation errors that frequently occur in manual processes. The implementation of the SAW method enables all evaluation criteria to be considered simultaneously, resulting in a more systematic and consistent evaluation process.

The normalization process plays an important role in eliminating differences in measurement scales among the evaluation criteria. Because Stock Quantity, Product Price, Lead Time, Sales Level, and Demand Level are expressed using different units and numerical ranges, direct comparison is not possible without normalization. By converting all criterion values into comparable scales, each criterion contributes proportionally according to its assigned weight.

The weighted preference calculation represents the final evaluation stage of the SAW method. Each normalized criterion value is multiplied by its respective weight before all weighted values are summed to obtain the overall preference score. This procedure enables the decision-making process to consider the relative importance of each criterion rather than relying solely on a single indicator such as stock quantity or sales level.

The implementation of the SAW method in this study demonstrates that inventory management decisions can be supported using a transparent calculation process. Every ranking result can be traced back to the values of each evaluation criterion, making the recommendation easier to understand and verify by decision-makers.

3.3. Restocking Priority Results and Discussion

The final results of the SAW method are presented in the form of a restocking priority ranking. The system automatically ranks all products according to their preference values from the highest to the lowest. The resulting restocking priority ranking is presented in Figure 5.

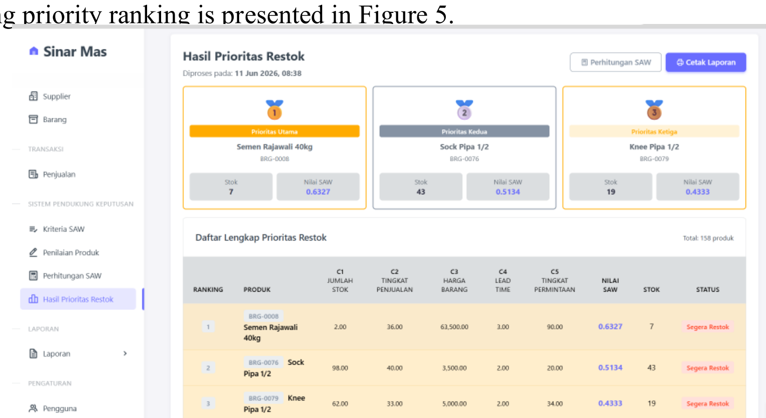

Figure 5. Restocking Priority Results

The restocking priority page displays a list of products that have been evaluated using the SAW method along with their corresponding preference values. This information assists users in identifying which products should be restocked immediately based on the evaluation of all criteria. By presenting the ranking results in a clear and structured format, the system enables users to compare product priorities efficiently and supports faster decision-making in inventory management.

Based on the SAW calculation process, the ranking results of the product alternatives are presented in Table 3.

Table 3. Restocking Priority Ranking Results

Rank	Product Name	SAW Score
1	Semen Rajawali 40 kg	0.6327
2	Sock Pipa 1/2	0.5134
3	Knee Pipa 1/2	0.4333

Based on the calculation results presented in Table 3, Semen Rajawali 40 kg obtained the highest preference value of 0.6327, placing it first in the restocking priority ranking. This result indicates that the product has the most appropriate combination of conditions according to the weighting scheme and evaluation criteria defined in this study. The product achieved the highest ranking because it exhibited a relatively low stock quantity while maintaining high sales performance and demand levels. These characteristics indicate that the product has a greater probability of experiencing stock shortages if restocking is delayed. Consequently, prioritizing this product for replenishment can help maintain product availability and minimize disruptions to sales activities.

In contrast, Sock Pipa 1/2 and Knee Pipa 1/2 obtained lower preference values because their overall criterion values produced lower weighted scores during the SAW calculation process. Although these products remain important for inventory management, their current stock conditions and demand levels indicate that their restocking urgency is lower than that of Semen Rajawali 40 kg. This demonstrates that the proposed system evaluates all products comprehensively rather than relying solely on a single criterion such as stock quantity.

The ranking results indicate that the SAW method is capable of generating restocking priorities based on the preference values of each alternative. This finding is consistent with the study conducted by (Ramadhan, 2022), which reported that the SAW method is capable of producing a systematic ranking of alternatives to support decision-making. In this study, the SAW method integrates five criteria—Stock Quantity, Sales Level, Product Price, Lead Time, and Demand Level—into a single evaluation process, ensuring that each product is assessed using the same criteria and weighting scheme. Consequently, the resulting restocking priorities are more consistent and can serve as a reliable basis for determining which products should be restocked immediately. These findings are also consistent with those of (Salsabila et al., 2026), who demonstrated that a decision support system can generate consistent alternative rankings, thereby making the prioritization process more systematic.

Another important finding is that the weighting mechanism enables the system to balance the influence of multiple criteria simultaneously. Products with low stock quantities are not automatically assigned the highest priority unless they are also supported by high demand and sales performance. Likewise, products with high demand but sufficient stock levels receive lower priority because the available inventory is still considered adequate. This demonstrates the capability of the SAW method to provide a balanced evaluation by considering all relevant decision criteria rather than emphasizing only a single factor.

The findings of this study are also consistent with those reported by (Abdul Fattah et al., 2023), who stated that the SAW method enhances objectivity in multi-criteria decision-making processes. These results indicate that implementing the SAW method not only produces alternative rankings but also supports decision-making by systematically evaluating multiple criteria. Consequently, the proposed approach reduces subjectivity and enables store managers to make inventory decisions based on measurable data rather than personal judgment.

From an inventory management perspective, the developed system provides practical benefits by assisting store owners in identifying products that should be restocked immediately, thereby reducing the risk of stock shortages and overstock conditions. Furthermore, the resulting decisions are more consistent because they are based on actual data stored within the system. The web-based implementation also allows inventory information to be updated and evaluated more efficiently, enabling users to obtain restocking recommendations whenever new sales or inventory data become available. Therefore, the proposed system can improve operational efficiency and inventory control effectiveness at Sinar Mas Putra Building Store Jepara.

3.4. System Testing

To ensure that all system functions operated according to user requirements, system testing was conducted using the Black Box Testing method on the system's main functional features. The results of the functional testing using the Black Box Testing method are presented in Table 4.

Table 4. Black Box Testing Results

No	Test Scenario	Hasil
1	Entering a valid username and password	Successful
2	Adding, editing, and deleting product data	Successful
3	Generating product criterion values	Successful
4	Executing the SAW calculation process	Successful
5	Displaying the restocking priority ranking	Successful
6	Printing restocking priority and inventory reports	Successful

Based on the testing results presented in Table 4, all major system functions operated successfully without any functional errors. The system was able to manage product data, generate product evaluations, perform SAW calculations, display restocking priority results, and produce reports according to user requirements.

The testing results indicate that the developed system fulfills the operational requirements for supporting the determination of restocking priorities at Sinar Mas Putra Building Store Jepara. Overall, the implementation of the SAW method within the decision support system successfully generates objective, structured, and easily understandable restocking recommendations, thereby improving inventory management effectiveness and supporting better decision-making.

4. CONCLUSION

This study aimed to design and develop a Decision Support System (DSS) for determining restocking priorities at Sinar Mas Putra Building Store, Jepara, using the Simple Additive Weighting (SAW) method. The system was developed as a web-based application using the CodeIgniter 4 framework and the MySQL database by incorporating five evaluation criteria: stock quantity, sales level, product price, lead time, and demand level. The SAW method was employed to evaluate and rank products, thereby generating objective restocking priority recommendations based on the predetermined criteria and their respective weights.

The results demonstrate that the developed system effectively supports decision-making in inventory management. The SAW calculation process generates a prioritized restocking list that can serve as a more structured basis for procurement decisions compared with conventional manual approaches that rely on estimation and personal experience. These findings are consistent with the study conducted by (Hanin & Adi, 2023), which demonstrated that the SAW method is capable of providing systematic decision recommendations based on multiple evaluation criteria. Furthermore, the Black Box Testing results indicate that all major system functions operated according to user requirements, including product data management, product evaluation, the SAW calculation process, the presentation of restocking priority results, and report generation.

This study contributes to the application of the SAW method in inventory management for building material stores by improving the objectivity of restocking priority determination. However, the study is limited by the use of criterion weights determined solely through user judgment and has not incorporated a more systematic weighting approach. Therefore, future research may integrate methods such as the Analytical Hierarchy Process (AHP) to determine criterion weights more objectively and incorporate inventory demand forecasting based on historical sales data to further improve the quality of the generated recommendations.

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