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Decision Support System for IT Equipment Procurement Prioritization Using WASPAS

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ABSTRACT

Determining the priority of IT equipment procurement is a critical process in supporting organizational operational effectiveness. However, procurement decision-making at PT XYZ was previously conducted manually using spreadsheet-based recording, resulting in subjective assessments, time-consuming discussions, and inconsistent prioritization outcomes. This study proposes a web-based Decision Support System (DSS) utilizing the Weighted Aggregated Sum Product Assessment (WASPAS) method to support objective and data-driven IT procurement prioritization. The proposed system evaluates procurement alternatives based on five criteria: equipment importance, remaining stock, usage frequency, equipment age, and equipment price. The WASPAS method was selected because it combines the advantages of the Weighted Sum Model (WSM) and Weighted Product Model (WPM), improving ranking consistency and decision accuracy. System development was conducted using the Agile methodology to ensure iterative and adaptive development according to user requirements. The research results indicate that the developed system successfully generates automatic procurement priority rankings based on predefined criteria weights. In addition, the system provides reporting and analysis history features that support faster and more transparent decision-making processes. Black Box Testing results demonstrate that all system functionalities operate successfully according to user requirements. Therefore, the proposed system improves efficiency, accuracy, and objectivity in IT procurement decision-making processes.

Keywords: Decision Support System, WASPAS, IT Procurement, MCDM, Procurement Prioritization.

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1. INTRODUCTION

Information Technology (IT) equipment procurement plays an essential role in supporting organizational operational activities and maintaining the continuity of business processes. The availability of adequate IT equipment contributes significantly to operational efficiency, employee productivity, and service quality within an organization. Therefore, procurement decisions must be conducted carefully and systematically to ensure that organizational resources are allocated effectively and according to operational priorities. In many organizations, procurement activities involve multiple evaluation criteria such as equipment usage frequency, stock availability, device condition, importance level, and

procurement cost. These conditions make procurement decision-making processes increasingly complex and require objective evaluation mechanisms to support accurate prioritization [1], [2].

At PT XYZ, the process of determining IT equipment procurement priorities was previously conducted manually using Google Forms and spreadsheets as data recording tools. Although these tools were useful for storing procurement data, they were unable to provide analytical support for determining procurement priorities objectively. The decision-making process depended heavily on subjective managerial considerations and lengthy discussions, resulting in inconsistent prioritization outcomes and slower decision-making processes. Furthermore, the absence of an integrated decision support system caused difficulties in evaluating procurement alternatives based on multiple criteria simultaneously. These conditions indicate the need for a computerized system capable of assisting management in making data-driven procurement decisions more effectively. Previous studies have shown that manual evaluation and procurement processes frequently lead to inconsistent decision outcomes due to subjective assessments and limitations in processing multiple evaluation criteria simultaneously [3], [4]. Therefore, implementing a Decision Support System (DSS) integrated with a Multi-Criteria Decision Making (MCDM) method is considered necessary to improve the accuracy, consistency, and efficiency of procurement prioritization processes.

Decision Support Systems (DSS) are widely used to assist organizations in solving semi-structured and complex decision-making problems by integrating data, analytical models, and computational techniques [5]. In the context of procurement management, DSS enables organizations to evaluate alternatives objectively based on various quantitative and qualitative criteria. One of the approaches commonly applied in DSS is the Multi-Criteria Decision Making (MCDM) method, which is designed to solve decision-making problems involving multiple evaluation criteria simultaneously [6]. MCDM methods provide systematic mechanisms for ranking and selecting alternatives based on predefined criteria weights and evaluation parameters.

Among various MCDM approaches, the Weighted Aggregated Sum Product Assessment (WASPAS) method has attracted significant attention due to its ability to combine the advantages of the Weighted Sum Model (WSM) and Weighted Product Model (WPM) methods in a single calculation model. The WASPAS method is capable of producing more accurate and consistent ranking results by integrating additive and multiplicative evaluation approaches [6]. Previous studies have demonstrated the successful implementation of the WASPAS method in various Decision Support System applications, including cashier selection systems, lecturer evaluation systems, and complex operational decision-making problems [8], [7]. These studies indicate that the WASPAS method is effective in improving decision-making objectivity and generating reliable recommendation results.

Although the WASPAS method has been widely implemented in several decision-making domains, studies focusing on IT equipment procurement prioritization within organizational inventory management environments remain limited. Most previous studies primarily focused on employee evaluation, personnel selection, or general assessment systems rather than operational inventory procurement management. Therefore, this research proposes a web-based Decision Support System for determining IT equipment procurement priorities at PT XYZ using the WASPAS method. The proposed system integrates procurement analysis, inventory management, and reporting functionalities into a centralized platform to support objective, systematic, and data-driven procurement decision-making processes.

This study also adopts the Agile Software Development methodology due to its iterative and adaptive characteristics in handling changing system requirements during

development. The developed system is expected to improve procurement efficiency, reduce subjectivity in decision making, and assist management in determining procurement priorities more accurately based on organizational operational needs.

2. METHODS

This study employed a quantitative and applied research approach to develop a web-based Decision Support System (DSS) for determining IT equipment procurement priorities at PT XYZ. The research focused on solving procurement prioritization problems by implementing the Weighted Aggregated Sum Product Assessment (WASPAS) method within a Decision Support System environment. Data collection was conducted through direct observation, interviews with stakeholders, and documentation of inventory management activities at PT XYZ. The collected data included information related to stock availability, equipment condition, procurement requests, usage frequency, and operational priorities. These data were utilized as the basis for procurement analysis and system development.

The system development process adopted the Agile Software Development methodology due to its iterative and adaptive characteristics in handling changing user requirements during development [8], [9] Agile emphasizes continuous collaboration between developers and users through iterative development cycles, enabling faster feature adjustments and continuous system evaluation. The research stages consisted of problem identification, literature study, data collection, system analysis, system design, implementation, testing, and evaluation.

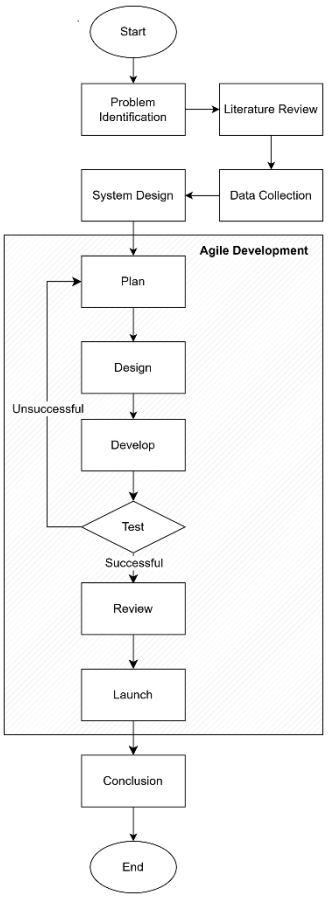


Figure 1. Research Flow Diagram

During the system design stage, Unified Modeling Language (UML) was utilized to model system functionality and user interactions. The proposed system involves several user roles including Super Admin, Manager, and Staff. The system provides functionalities such as inventory management, master criteria management, procurement analysis, report generation, and user management.

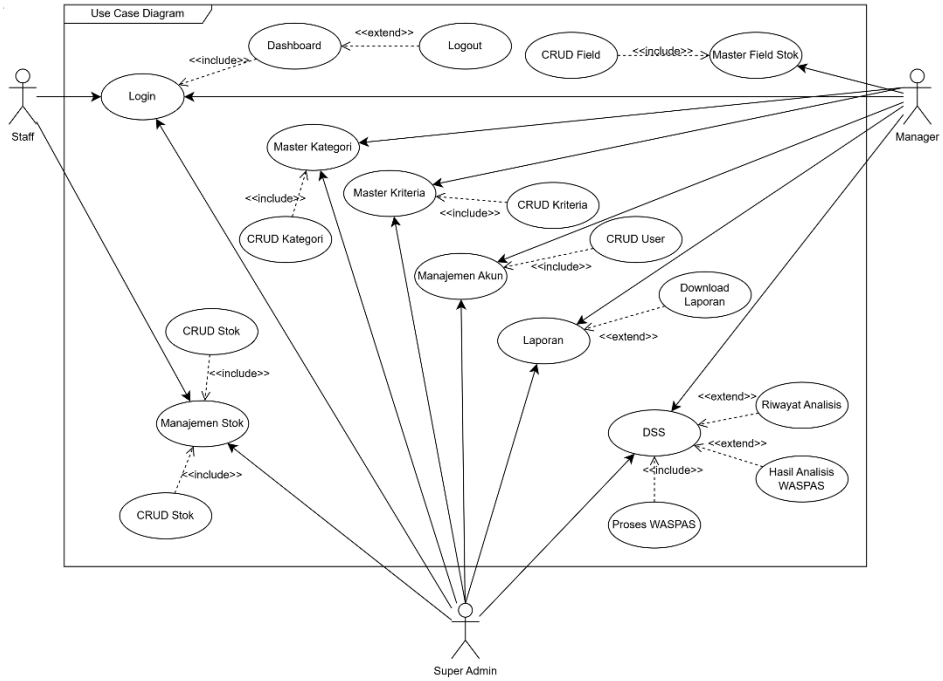


Figure 2. Use Case Diagram

The proposed application was developed as a web-based system using React.js for frontend development, Node.js for backend services, and MySQL as the database management system. The implementation of a web-based DSS enables users to access procurement analysis results more efficiently, improve centralized inventory management, and support real-time procurement evaluation processes [10].

The decision-making process in this study utilized the Weighted Aggregated Sum Product Assessment (WASPAS) method as the primary Multi-Criteria Decision Making (MCDM) approach. The WASPAS method combines the Weighted Sum Model (WSM) and Weighted Product Model (WPM) methods to improve ranking accuracy and reduce uncertainty in decision-making processes [6], [7]. The WASPAS calculation process began with constructing a decision matrix consisting of procurement alternatives and evaluation criteria. Subsequently, the decision matrix values were normalized according to the characteristics of benefit and cost criteria.

For benefit criteria, normalization was calculated using Equation (1):

$$r_{ij} = \frac{x_{ij}}{\max(x_{ij})} \tag{1}$$

For cost criteria, normalization was calculated using Equation (2):

$$r_{ij} = \frac{\min(x_{ij})}{x_{ij}} \tag{2}$$

The Weighted Sum Model (WSM) value was calculated using Equation (3):

$$Q_i^{(1)} = \sum_{j=1}^{n} w_j r_{ij} \quad (3)$$

Meanwhile, the Weighted Product Model (WPM) value was calculated using Equation (4):

$$Q_i^{(2)} = \prod_{j=1}^{n} (r_{ij})^{w_j} \quad (4)$$

The final WASPAS preference value was obtained using Equation (5):

$$Q_i = 0.5Q_i^{(1)} + 0.5Q_i^{(2)} \quad (5)$$

The alternative with the highest preference value was considered the highest procurement priority. The WASPAS method was selected because it integrates additive and multiplicative evaluation mechanisms simultaneously, resulting in more stable and accurate ranking outputs [6], [4].

System testing was conducted using the Black Box Testing method to evaluate whether all application functionalities operated according to user requirements [3]. The testing process covered authentication, inventory management, master criteria management, procurement analysis, reporting features, and user access management. The testing results were used to evaluate the reliability and functional suitability of the developed application before implementation within the organizational environment.

3. RESULTS AND DISCUSSION

3.1 Dashboard

The dashboard module provides summarized procurement and inventory information to support monitoring and decision-making activities. The system visualizes inventory conditions, procurement recommendation rankings, and transaction statistics to improve managerial evaluation efficiency.

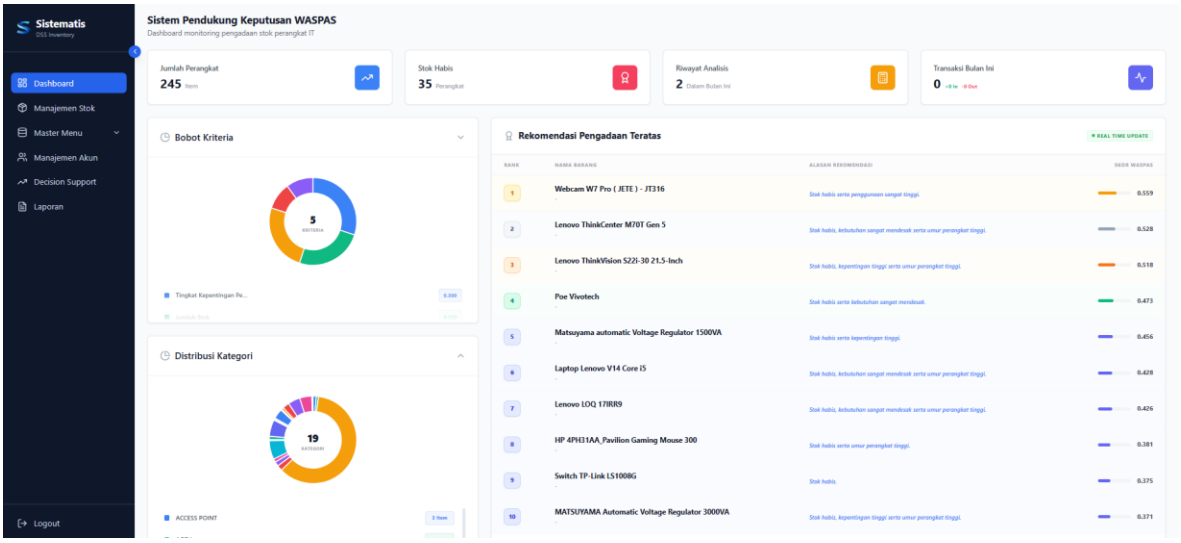


Figure 3. Dashboard Page

3.2 Stock Management

The stock management page enables users to manage inventory data including adding, editing, deleting, and searching IT equipment records. Information displayed on this page includes device name, category, stock quantity, usage frequency, and price. The system also records stock transaction history for monitoring incoming and outgoing inventory activities in real time. This functionality improves inventory monitoring efficiency and ensures that procurement analysis uses updated inventory data.

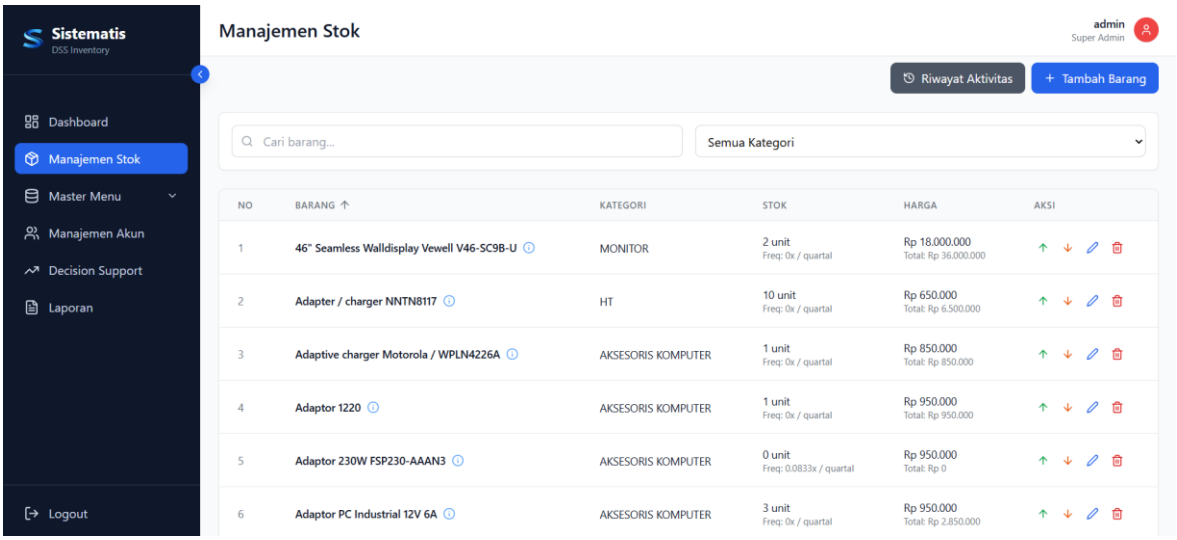


Figure 4. Stock Management Page

3.3 Master Criteria

The master criteria page provides functionality for configuring evaluation criteria, criteria types, and weight values used in the WASPAS calculation process. Users can define whether a criterion is categorized as a benefit or cost attribute and assign corresponding weight values according to organizational operational priorities. This feature supports flexibility in procurement evaluation and ensures that the total criteria weights are normalized before the ranking process is performed. Through centralized criteria management, the system enables procurement analysis to be conducted more consistently and systematically.

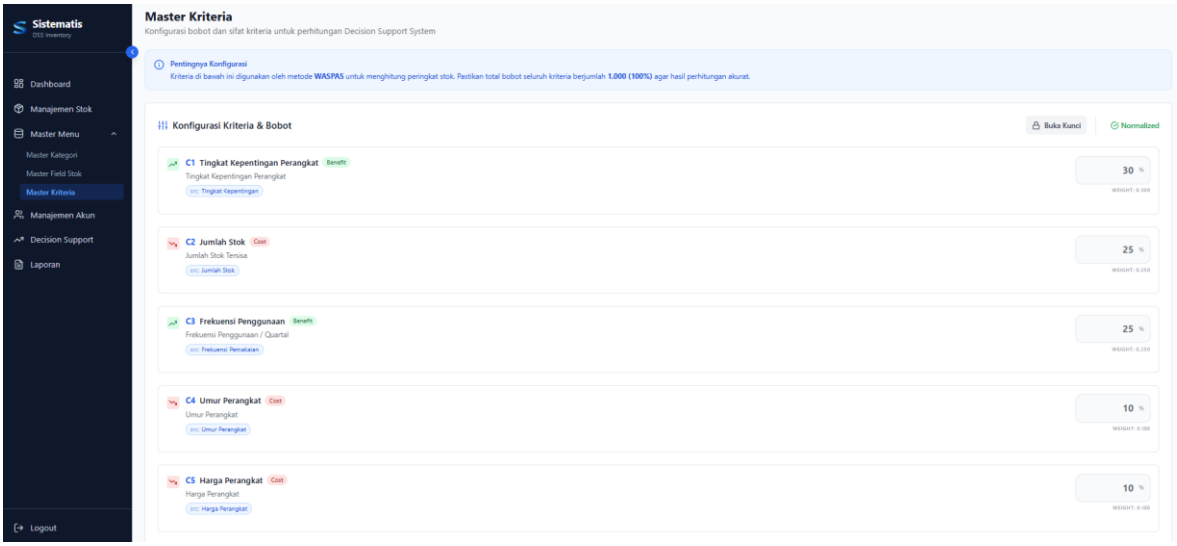


Figure 5. Master Criteria Page

3.4 WASPAS Analysis

The WASPAS analysis page displays procurement priority rankings generated automatically by the system. The analysis results include Weighted Sum Model (WSM) values, Weighted Product Model (WPM) values, final preference scores, and ranking positions for each procurement alternative. This feature enables management to determine procurement priorities objectively based on predefined criteria and weights [6], [7].

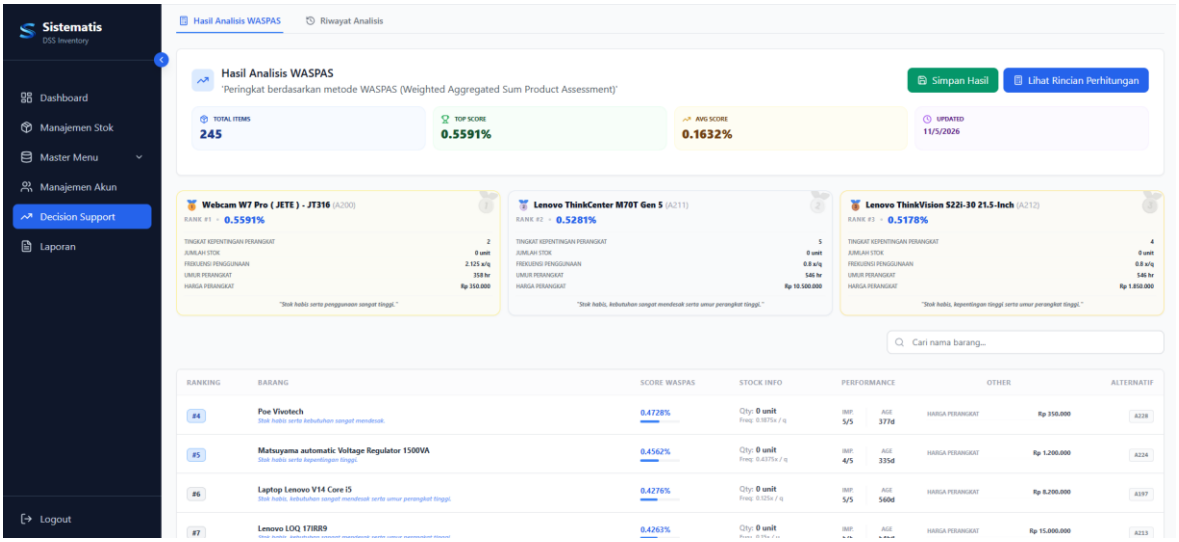


Figure 6. WASPAS Analysis Page

3.5 Report

The report page provides reporting functionality for inventory data, stock transactions, and DSS analysis results. Users can filter reports based on selected periods and export the reports into PDF or Excel formats. This feature supports documentation, monitoring, and evaluation activities related to procurement management at PT XYZ.

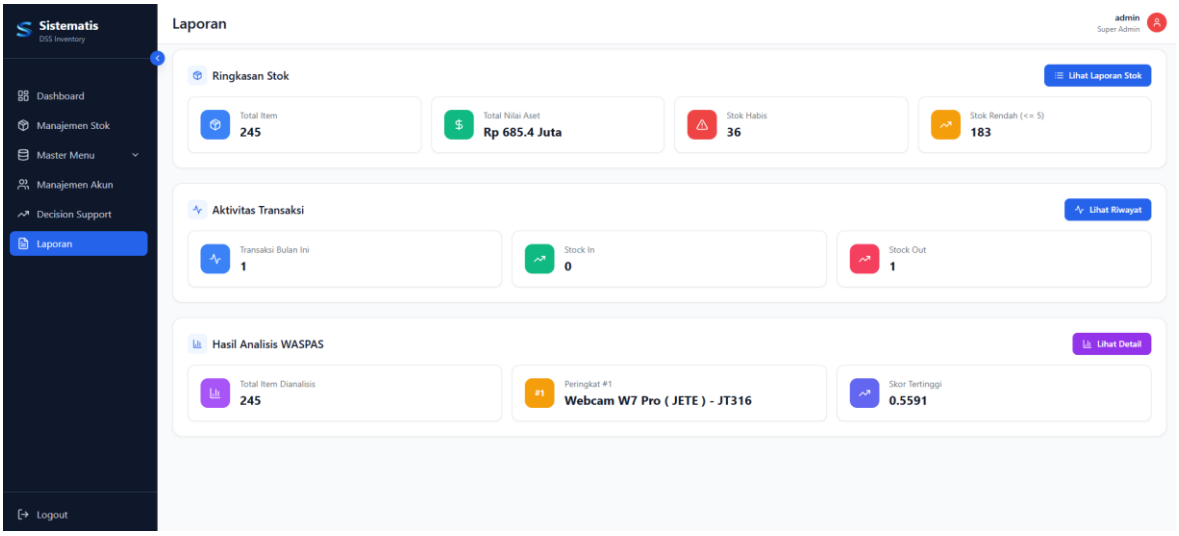


Figure 7. Report Page

3.6 WASPAS Calculation Results

The procurement priority analysis was conducted using the WASPAS method based on several evaluation criteria determined according to operational requirements at PT XYZ. The criteria used in this study include equipment importance, remaining stock, usage frequency, equipment age, and equipment price.

Table 1. Criteria and Weight Values

Code	Criteria	Type	Weight
C1	Equipment Importance	Benefit	0.30
C2	Remaining Stock	Cost	0.25
C3	Usage Frequency	Benefit	0.25
C4	Equipment Age	Benefit	0.10
C5	Equipment Price	Cost	0.10

The total criteria weight satisfies the following condition:

$$\sum_{j=1}^{n} wj = 1$$

The decision matrix used in the procurement analysis is presented in Table 2.

Table 2. Decision Matrix

Alternative	C1	C2	C3	C4	C5
A1	5	100	8	3	700000
A2	3	200	6	5	500000
A3	5	50	9	4	900000
A4	5	150	7	6	600000

The normalization process was performed to standardize all criteria values into comparable scales. Benefit and cost criteria normalization were calculated using Equations (1) and (2), respectively. The normalized matrix results are shown in Table 3.

Table 3. Normalized Decision Matrix

Alternative	C1	C2	C3	C4	C5
A1	1.00	0.50	0.89	0.50	0.71
A2	0.60	0.25	0.67	0.83	1.00
A3	1.00	1.00	1.00	0.67	0.56
A4	1.00	0.33	0.78	1.00	0.83

The Weighted Sum Model (WSM) and Weighted Product Model (WPM) values were calculated using Equations (3) and (4), respectively. The calculation results are presented in Table 4.

Table 4. WSM and WPM Calculation Results

Alternative	WSM	WPM
A1	0.769	0.737
A2	0.593	0.538
A3	0.922	0.905
A4	0.761	0.701

The final WASPAS preference values were obtained using Equation (5). The final ranking results generated by the system are presented in Table 5.

Table 5. Final WASPAS Ranking Results

Rank	Alternative	Final Score
1	A3	0.914
2	A1	0.753
3	A4	0.731
4	A2	0.565

Based on the ranking results, alternative A3 obtained the highest final preference value of 0.914 and became the highest procurement priority among all evaluated alternatives. The ranking results indicate that the WASPAS method successfully identified procurement alternatives with higher operational urgency based on the defined evaluation criteria. Alternatives with high equipment importance, low remaining stock, high usage frequency, higher equipment age, and lower procurement cost tended to obtain higher preference values. These results demonstrate that the proposed DSS is capable of generating objective procurement recommendations by considering multiple criteria simultaneously.

3.7 System Testing

System testing was conducted using the Black Box Testing method to verify whether all application functionalities operated according to user requirements. The testing process covered several main modules including authentication, stock management, master criteria management, WASPAS calculations, reporting, and account management.

Table 6. Black Box Testing Summary

Module	Expected Result	Testing Result
Login Authentication	User login and logout processes operate successfully	Successful
Dashboard Monitoring	Dashboard data displayed correctly	Successful
Stock Management	Inventory data managed properly	Successful
Master Criteria Management	Criteria data and weight configurations updated correctly	Successful
WASPAS Calculation	Ranking results generated correctly	Successful
Report Generation	Reports exported successfully	Successful
Account Management	User data managed successfully	Successful

The testing results indicate that all system functionalities operated successfully without significant errors. The developed application was able to process procurement data, generate procurement rankings, and support inventory management processes according to organizational requirements.

3.8 Discussion

The implementation results demonstrate that the developed Decision Support System (DSS) successfully supports procurement decision-making processes at PT XYZ. Compared to the previous manual procurement approach using spreadsheets and subjective discussions, the proposed system provides a more systematic and measurable evaluation mechanism for determining procurement priorities. The integration of inventory management and procurement analysis into a centralized web-based platform also improves data accessibility, monitoring efficiency, and information transparency within the organization [11].

The application of the Weighted Aggregated Sum Product Assessment (WASPAS) method enables the system to evaluate procurement alternatives objectively by combining additive and multiplicative assessment approaches through the Weighted Sum Model (WSM) and Weighted Product Model (WPM). This integration improves ranking consistency and reduces subjectivity during the decision-making process. Furthermore, the automated ranking mechanism allows procurement recommendations to be generated more efficiently based on predefined criteria and weight values.

The dashboard visualization and reporting features also contribute to improving managerial understanding of inventory conditions and procurement priorities. Through real-time monitoring and centralized reporting functionalities, management can evaluate procurement conditions more effectively and make faster operational decisions. These findings indicate that the proposed system not only supports procurement prioritization but also enhances overall inventory management processes within the organization.

The findings of this study are consistent with previous Decision Support System implementations utilizing the WASPAS method, which demonstrated improvements in ranking accuracy and decision consistency across various evaluation domains [7], [4]. However, unlike previous studies that mainly focused on personnel selection or evaluation systems, this research specifically contributes to the implementation of the WASPAS method within IT equipment procurement prioritization in an organizational inventory management environment. Therefore, the proposed system provides both practical and theoretical contributions to the application of Multi-Criteria Decision Making (MCDM) methods in operational procurement management.

CONCLUSION

This study successfully developed a web-based Decision Support System (DSS) for determining IT equipment procurement priorities at PT XYZ using the Weighted Aggregated Sum Product Assessment (WASPAS) method. The developed system was capable of integrating inventory management, procurement analysis, and reporting functionalities into a centralized platform that supports objective and data-driven decision making. Based on the implementation results, the system successfully generated procurement priority rankings automatically according to predefined criteria and weights, namely equipment importance, remaining stock, usage frequency, equipment age, and equipment price.

The application of the WASPAS method demonstrated the ability to combine the advantages of the Weighted Sum Model (WSM) and Weighted Product Model (WPM) approaches in

producing consistent and measurable ranking results. The obtained results indicate that the developed DSS improved efficiency, transparency, and consistency in procurement decision-making processes compared to previous manual methods using spreadsheets and subjective discussions. In addition, Black Box Testing results confirmed that all system functionalities operated successfully according to organizational requirements.

Theoretically, this research contributes to the implementation of Multi-Criteria Decision Making (MCDM) methods, particularly WASPAS, within the context of IT inventory procurement prioritization. Unlike previous studies that mainly focused on employee selection or general evaluation problems, this research demonstrates the applicability of the WASPAS method in supporting operational inventory procurement decisions within a real organizational environment.

Future research may further enhance the developed system by integrating forecasting methods for predicting future inventory requirements, implementing automatic stock notification features, and developing mobile-based applications to improve accessibility and operational flexibility.

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