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Design of a Web-Based Decision Support System for Laptop Vendor Search for Resellers using the Simple Addtive Weighting (SAW) Method

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Abstract

This study aims to design a web-based Decision Support System (DSS) to assist resellers in determining the most suitable used laptop vendors to meet their criteria at the Loyal Laptop store. The main problem faced is the vendor selection process and stock management, which are still done manually, often resulting in data inaccuracies, recording errors, and delays in obtaining important information regarding stock and vendor quality. To overcome this, this study developed a system using the Simple Additive Weighting (SAW) method as a calculation technique in determining the best vendor based on several criteria, namely delivery speed, discount level, service, warranty, product authenticity, and payment terms. Each criterion is given a weight according to its level of importance in the vendor selection process, then a normalization and ranking process is carried out to obtain the best alternative. The system is built web-based using PHP, HTML, CSS, and MySQL as a database. The implementation results show that the system can help admins in managing vendor data more effectively, improve the accuracy of vendor selection, and speed up the decision-making process. With this application, the process of processing stock data and searching for vendors becomes more efficient, precise, and structured.

Keywords: *Laptop; DSS; SAW*

1. Introduction

The continuous advancement of technology allows human work to be completed more quickly. Technology is a tool frequently used in various daily activities. Technology simplifies information processing, as it is crucial for the results to be useful to users. Speed, accuracy, and efficiency in data and information processing are crucial for every company or institution, increasing productivity, time, and costs. In the world of trade, specifically in the sales of goods, obstacles often arise in processing data, such as incoming and outgoing goods. Many companies still use manual systems and have not yet computerized them. Therefore, data processing systems in the business world are currently a significant challenge, especially in businesses engaged in public services. Computers as a tool for various activities are not new; they have become commonplace. With their various advantages, computers play a crucial role in companies processing data and producing maximum output. The data processing process in this store is still manual, making it prone to errors in recording information. With the use of manual methods, sales services to consumers and purchasing procedures from suppliers are inefficient. This creates obstacles in obtaining information regarding sales, purchases, and inventory. Therefore, a system is needed to assist the selection process and make the supplier search more focused. A Decision Support System (DSS) is a computer-based system designed to solve problems and act as a tool to support the decision-making process. Several methods are applied in Decision Support Systems (DSS), such as the Analytic Hierarchy Process (AHP), TOPSIS, and Simple Additive Weighting (SAW).

Simple Additive Weighting (SAW) is also often referred to as the weighted sum method. The essence of the SAW method is to find a weighted sum of the performance assessments of various alternatives across all attributes (Fisburn & MacCrimmon, 2021). The SAW method requires a normalization of the decision matrix (X) to a scale that can be compared across all available alternative assessments. The advantage of the SAW method is its rapid computation. However, the drawback of this method is that it uses local weighting and its calculations are performed using crisp or fuzzy numbers. The approach applied in this study to determine the search for a laptop vendor is one of the Fuzzy Multi-Attribute Decision Making methods, namely the Simple Additive Weighting (SAW) method. The SAW method is also known as the weighted sum method. The basic concept of the SAW method is to add up the performance value of each alternative based on the weight of each attribute. This method requires a normalization process for the decision matrix (X) to a scale that can be compared with all alternatives. In its implementation, the application will be created web-based using the Java programming language.

2. Literature Review

This research is based on various references from previous studies related to the problem discussed. The review of these studies provides a theoretical foundation and important insights that support the process of writing this thesis. Therefore, several relevant literature studies served as the primary references in this research:

1.Gaia Boutique is a small and medium enterprise (SME) operating in the fashion and accessories sector. Sales data processing at Gaia Boutique is still manual; consumers must visit the store in person to purchase products and make cash payments. This makes it difficult to generate reports, including recapitulating purchases from suppliers and sales to consumers. This is due to the need to recap all transactions occurring during the reporting period. Therefore, this study aims to provide a solution by designing a web-based sales system using the PHP programming language and a MySQL database. The author developed the system using the waterfall method and used use case diagrams, activity diagrams, and class diagrams. This research resulted in a solution in the form of a web-based sales system at Gaia Boutique that can provide detailed product information to customers and enable purchase transactions to be made anywhere and at any time. (Dwi Ayu Gusriyanti, 2023).
2.Selecting the right vendor is crucial in running business processes. Companies need to consider important factors when selecting the right vendor. Offering low prices is no longer efficient in today's vendor selection process. In this study, a combination of Fuzzy AHP and TOPSIS will be used in vendor selection at a sales and distribution company in Jakarta. In this study, TOPSIS is used to rank alternatives based on the established criteria whose weight values have been calculated using the Fuzzy AHP method. The preference weights of each criterion generated by Fuzzy AHP are 0.453718 for price, 0.01616 for the number of professional technicians, 0.144174 for the work implementation methodology and 0.385948 for the company experience. The rankings generated by TOPSIS are PT. Nusa Network Prakarsa in first place, PT. Mitra Integrasi Informatika in second place and PT. Iproteksi Telematika in third place. After the ranking results are known, an evaluation is carried out on the relationship of each criterion with the final TOPSIS results by calculating the Pearson correlation value. After that, the final TOPSIS results and ranking results are calculated for their correlation to determine how strong the relationship is between all attributes or criteria and the ranking results. (Khoirun Nisa, 2022).
3.In manufacturing companies, the supply chain is a key factor in determining the company's success. Selecting quality raw materials will ensure product quality. Furthermore, the availability of raw materials required for the production process is absolutely crucial. If suppliers are late in delivering required raw materials, production can be halted, resulting in production targets not being met. These missed targets must be met through overtime. The company must incur additional production costs to achieve the required production volume. This is a loss for the company. The research method used in developing this Vendor Performance Analysis Application is based on the concept of information system analysis and design. The initial stage involves investigating problems and current procedures, including problem analysis. The next stage is system design, which involves designing the proposed system using supporting diagrams, and implementing it. The expected outcome of this research is the design of an application for a vendor performance analysis system to obtain an overview of vendor performance audits in a manufacturing company and provide an overview of the concept of product quality maintenance or quality assurance from a vendor selection perspective. This is a case study of PT. Suzuki Indomobil Motor. (Ifan Junaedi, 2021).

3. Reasearch Methods

This study uses a Decision Support System with the Simple Additive Weighting (SAW) method to search for laptop vendors. The research object is Loyal Laptop, with data used in the form of data obtained from the owner's location.

3.1. Simple Addtive Weighting Methodology

The SAW method is one of the methods used to solve Fuzzy Multiple Attribute Decision Making (FMADM) problems. Simple Additive Weighting (SAW) is a method used to find the optimal alternative from a number of alternatives with certain criteria. The definition of the Simple Additive Weighting (SAW) method is often also known as the weighted sum method. The Simple Additive Weighting (SAW) method was used in this study by distributing questionnaires to obtain primary data (Gunawan et al., 2023). In this study, designing a hierarchical tree structure means arranging the criteria in a tree form, where each element (node) is connected to a parent and can have several children (sub-criteria) that have structured relationships. This approach facilitates understanding the levels and priorities of sub-criteria and helps in determining the order (Heryati & Afriyani, 2024).

$$r_{ij} = \begin{cases} \dfrac{x_{ij}}{Max_i\ x_{ij}} & \text{If J is the benefit attribute} \\ \dfrac{Min_i\ x_{ij}}{x_{ij}} & \text{If J is the cost attribute} \end{cases}$$

Where:
rij = normalized performance rating of alternative Ai (i=,2,…,m)
Maxi = maximum value of each row and column.
Mini = minimum value of each row and column.
xij = row and column of the matrix.
Vi = final value of the alternative
Wi = predetermined weight.
Rij = normalized matrix.

A larger Vi value indicates that alternative Ai is more preferred.

a. Laptop Asus

Normalisasi:

Kriteria C1
A1 = 0,5/1 = 0,5
A2 = 0,75/1 = 0,75
A3 = 1/1 = 1
A4 = 0,5/1 = 0,5
A5 = 0,25/1 = 0,25
Kriteria C2
A1 = 0,25/0,75 = 0,333
A2 = 0,5/0,75 = 0,667
A3 = 0,5/0,75 = 0,667
A4 = 0,25/0,75 = 0,333
A5 = 0,75/0,75 = 1
Kriteria C3
A1 = 0,5/0,5 = 1
A2 = 0,25/0,5 = 0,5
A3 = 0,5/0,5 = 1
A4 = 0,25/0,5 = 0,5
A5 = 0,25/0,5 = 0,5
Kriteria C4
A1 = 0,5/1 = 0,5
A2 = 0,75/1 = 0,75
A3 = 1/1 = 1
A4 = 0,5/1 = 0,5
A5 = 0,25/1 = 0,25
Kriteria C5
A1 = 1/1 = 1
A2 = 1/1 = 1
A3 = 1/1 = 1
A4 = 1/1 = 1
A5 = 1/1 = 1
Kriteria C6
A1 = 0,75/0,75 = 1
A2 = 0,75/0,75 = 1
A3 = 0,75/0,75 = 1
A4 = 0,75/0,75 = 1
A5 = 0,25/0,75 = 0,333

Tabel 1 : Calculation Stage (Asus)

Name Alternatif	**Kriteria**						**Results**
	C1	**C2**	**C3**	**C4**	**C5**	**C6**	
PT. Data Teknologi Terbaru	0.25	0.08325	0.5	0.375	1	0.75	2.95825
PT. Unibless indo Multi	0.375	0.16675	0.25	0.5625	1	0.75	3.10425
CV. Amanah Anugerah Karya	0.5	0.16675	0.5	0.75	1	0.75	3.6675
PT. Mitra Andalan Systemindo	0.25	0.08325	0.25	0.375	1	0.75	2.70825
PT. Bangun Selaras Solusindo	0.125	0.25	0.25	0.1875	1	0.24975	2.06225

Therefore, the recommended supplier for Asus laptops is CV. Amanah Anugerah Karya, with a score of **3,667**.

b. Laptop Hp

Normalisasi:

Kriteria C1
A1 = 0,5 / 0,75 = 0,667
A2 = 0,5 / 0,5 = 1
Kriteria C2
A1 = 0,75 / 0,75 = 1
A2 = 0,25 / 0,75 = 1
Kriteria C3
A1 = 0,5 / 0,75 = 0,667
A2 = 0,75 / 0,75 = 1
Kriteria C4
A1 = 0,75 / 1 = 0,75
A2 = 1 / 1 = 1
Kriteria C5
A1 = 1 / 1 = 1
A2 = 1 / 1 = 1
Kriteria C6
A1 = 0,75 / 0,75 = 1
A2 = 0,5 / 0,75 = 0,667

Tabel 2: Calculation Stage (Hp)

Name Alternatif	Kriteria						Results
	C1	C2	C3	C4	C5	C6	
PT. Citra Sari Kencana	0.50025	0.5	0.16675	0.75	1	0.5	3.417
Cv. Gadhiza Raisalindo	0.75	0.1665	0.25	1	1	0.3335	3.5

So, the recommended supplier for HP laptops is CV. Gadhiza Raisalindo, with a score of **3.5**.

c. Laptop Lenovo

Normalisasi:

Kriteria C1
A1 = 0,25/1 = 0,25
A2 = 1/1 = 1
A3 = 1/1 = 1
A4 = 0,25/1 = 0,25
A5 = 0,5/1 = 0,5
A6 = 0,75/1 = 0,75
A7 = 0,75/1 = 0,75
Kriteria C2
A1 = 0,75/1 = 0,75
A2 = 1/1 = 1
A3 = 0,25/1 = 0,25
A4 = 0,5/1 = 0,5
A5 = 0,75/1 = 0,75
A6 = 0,75/1 = 0,75
A7 = 0,5/1 = 0,5
Kriteria C3
A1 = 0,5/1 = 0,5
A2 = 0,75/1 = 0,75
A3 = 0,75/1 = 0,75
A4 = 0,25/1 = 0,25
A5 = 0,5/1 = 1
A6 = 1/1 = 1
A7 = 1/1 = 1
Kriteria C4
A1 = 0,75/1 = 0,75
A2 = 0,5/ = 0,5
A3 = 1/1 = 1
A4 = 0,5/1 = 0,5
A5 = 0,5/1 = 0,5
A6 = 0,5/1 = 0,5
A7 = 0,75/1 = 0,75
Kriteria C5
A1 = 1/1 = 1
A2 = 1/1 = 1
A3 = 1/1 = 1

A4 = 1/1 = 1
A5 = 1/1 = 1
A6 = 1/1 = 1
A7 = 1/1 = 1
Kriteria C6
A1 = 0,75/0,75 = 1
A2 = 0,75/0,75 = 1
A3 = 0,25/0,75 = 0,333
A4 = 0,5/0,75 = 0,667
A5 = 0,5/0,75 = 0,667
A6 = 0,5/0,75 = 0,667
A7 = 0,75/0,75 = 1

Tabel 3: Calculation Stage (Lenovo)

Name Alternatif	Kriteria						Results
	C1	C2	C3	C4	C5	C6	
Cv. Delona Indah Jaya	0.125	0.5625	0.25	0.375	1	0.75	3.0625
Cv. ihsan Cemerlang	0.5	0.75	0.375	0.25	1	0.75	3.625
PT. Akasha Persada Indonesia	0.5	0.1875	0.375	0.5	1	0.24975	2.81225
PT. Belpin Blessin Indonesia	0.125	0.375	0.125	0.25	1	0.50025	2.37525
PT. Mutiara Bhinneka Jaya	0.25	0.5625	0.25	0.25	1	0.50025	2.81275
PT. Satu Anugrah Solusindo	0.375	0.5625	0.5	0.25	1	0.50025	3.18775
PT. Anugrah Ratri Sentosa	0.375	0.375	0.5	0.375	1	0.75	3.375

So, the recommendation for selecting a Lenovo laptop supplier falls on CV. Ihsan Cemerlang with a score of **3,625.**

d. Laptop Acer

Normalisasi:

Kriteria C1
A1 = 0,75/1 = 0,75
A2 = 0,75/1 = 0,75
A3 = 1/1 = 1
A4 = 1/1 = 1
A5 = 0,5/1 = 0,5
A6 = 0,5/1 = 0,5
A7 = 0,25/1 = 0,25
Kriteria C2
A1 = 0,25/1 = 0,25
A2 = 0,75/1 = 0,75
A3 = 0,75/1 = 0,75
A4 = 0,75/1 = 0,75
A5 = 0,5/1 = 0,5
A6 = 0,25/1 = 0,25
A7 = 1/1 = 1
Kriteria C3
A1 = 1/1 = 1
A2 = 0,25/1 = 0,25
A3 = 0,75/1 = 0,75
A4 = 0,75/1 = 0,75
A5 = 0,50/1 = 0,50
A6 = 0,25/1 = 0,25
A7 = 0,25/1 = 0,25
Kriteria C4
A1 = 0,75/0,75 = 1
A2 = 0,25/0,75 = 0,333
A3 = 0,75/0,75 = 1
A4 = 0,25/0,75 = 0,333
A5 = 0,50/0,75 = 0,667
A6 = 0,75/0,75 = 1
A7 = 0,75/0,75 = 1
Kriteria C5
A1 = 1/1 = 1
A2 = 1/1 = 1
A3 = 1/1 = 1
A4 = 1/1 = 1
A5 = 1/1 = 1
A6 = 1/1 = 1

A7 = 1/1 = 1
Kriteria C6
A1 = 0,75/0,75 = 1
A2 = 0,5/0,75 = 0,667
A3 = 0,25/0,75 = 0,333
A4 = 0,5/0,75 = 0,667
A5 = 0,75/0,75 = 1
A6 = 0,75/0,75 = 1
A7 = 0,25/0,75 = 0,333

Tabel 4: Calculation Stage (Acer)

Name Alternatif	Kriteria						Results
	C1	C2	C3	C4	C5	C6	
PT. Mitraco Wirajaya Perdana	0.375	0.125	0.75	0.25	1	0.5	3
PT. Access Lintas Solusi	0.375	0.375	0.1875	0.08325	1	0.3335	2.35425
PT. Mazelindo Utama Raya	0.5	0.375	0.5625	0.25	1	0.1665	2.854
CV. Barito Solusindo	0.5	0.375	0.5625	0.08325	1	0.3335	2.85425
PT.Enternals Globalindo Sukses	0.25	0.25	0.375	0.16675	1	0.5	2.54175
CV. Indo Haromain Jaya	0.25	0.125	0.1875	0.25	1	0.5	2.3125
PT. Delta Teknologi Indonesia	0.125	0.5	0.1875	0.25	1	0.1665	2.229

So, the recommendation for selecting an Acer laptop supplier falls on PT. Mitraco Wirajaya Perdana with a score of **3.**

4. Result and Discussion

This Laptop Vendor Search System was successfully implemented as a web-based application using the PHP programming language and a MySQL database. The system interface is designed to facilitate analysis calculations by owners and employees using the SAW method.

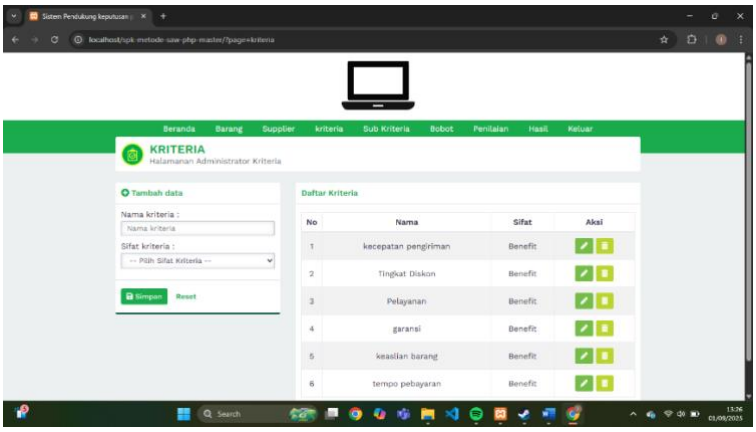

Fig.1: Kriteria

This criteria data contains the criteria name along with the weight value with two options, namely benefit and cost.

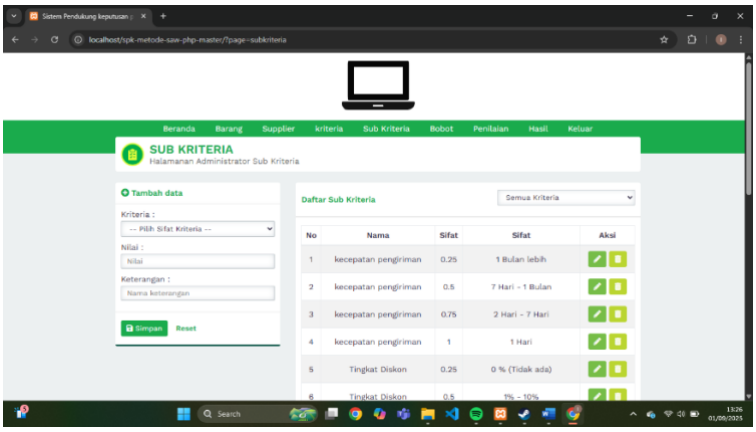

Fig.2: Sub Kriteria

The Sub-Criteria Form displays a menu of options for entering criteria data for selecting suppliers. This criteria data contains the names of criteria such as Delivery Speed, Discount Level, Service, Warranty, Product Authenticity, and Payment Terms.

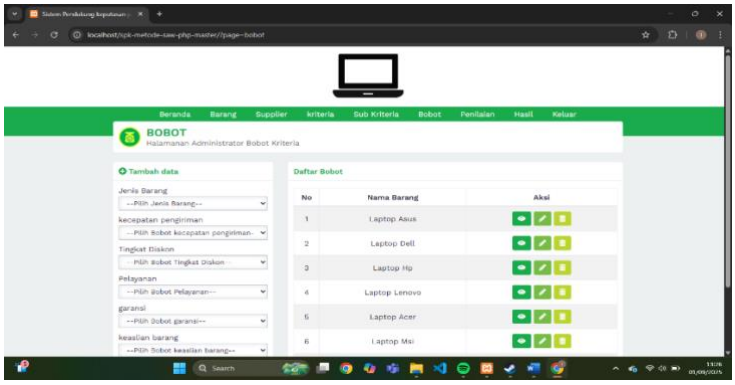

Fig.3: Bobot

The Weights page displays the importance level of the criteria, with the value representing the weight of the selected item type. If there are any errors, you can click edit or delete.

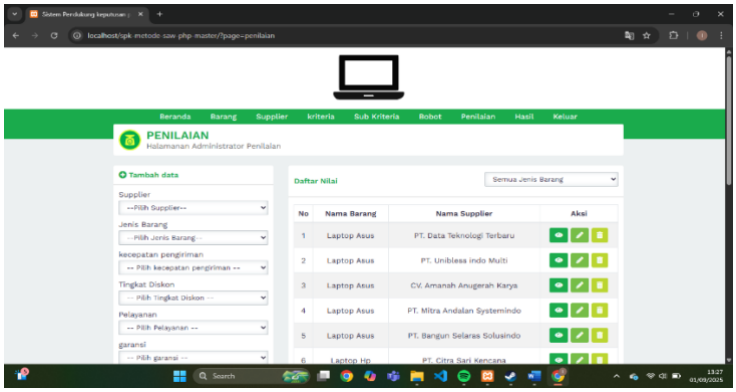

Fig.4: Penilaian

The Rating page contains the importance of the criteria and the rating of the supplier you wish to select. Here, you'll need to select the type of item, shipping speed, discount level, service, warranty, authenticity, and payment term.

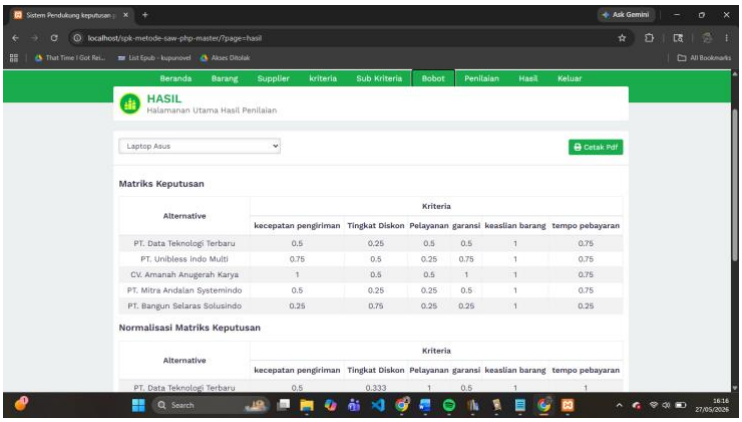

Fig.5: Hasil

The results form is a form that contains the results of the processed data. In this form, the system will calculate the data using the SAW method, then the classification results will be displayed, as well as the normalization results until the final result, namely the ranking results.

5. Conclusion

Based on the explanation presented in the previous results and analysis regarding the Vendor Search Decision Support System using the Simple Additive Weighting (SAW) method for Loyal Laptop, several points can be concluded to achieve the desired objectives. The following conclusions can be drawn:

1. Accurate stock control and an effective vendor selection process. To ensure data accuracy and product availability, a structured stock control method is required, including routine physical inventory procedures, the use of an integrated inventory management system, and adequate human resource training.
2. The Simple Additive Weighting (SAW) method can be used as an alternative in the Vendor Search Decision Support System, helping to expedite the laptop vendor selection process. This SAW procedure is carried out based on criteria and weights determined by the school, with calculations performed by matrix normalization of all criteria.
3.

The final result of this study is the choice with the highest ranking value. With the Vendor Search Decision Support System, the store can make more informed and accurate decisions.

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