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Decision Support System for Supplier Selection on Time Concept with AHP and SAW Method

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Abstract

Seeing the rapid development of global business causes companies to compete as the best to meet global market demands. In the current era of globalization, technological development is beneficial for human life. All human activities today can be done quickly and easily using a computer. Decision Support System is a computer-based system that assists decision-making in utilizing specific data and models to solve various unstructured problems. Decision makers in selecting the best supplier for Time Concept are still having difficulties, and this is because there are no appropriate criteria and weights. Making a decision support system is expected to help solve the problems in Time Concept. Moreover, it can provide benefits or convenience for Time Concept when selecting the best supplier. The author uses the method of Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW). According to the system test results, the Consistency Ratio (CR) calculation value is 0.0752. The comparison assessment is considered CONSISTENT if the Consistency Ratio (CR) value is not greater than 0.1000. So that the comparison of the criteria does not need to be recalculated because it is CONSISTENT.

Keywords: AHP Method; SAW Method; Supplier Selection; Decision Support System.

Abstrak

Melihat perkembangan global bisnis yang sedemikian cepatnya menyebabkan perusahaan berlomba-lomba sebagai yang terbaik untuk memenuhi permintaan pasar global. Di era globalisasi seperti saat ini teknologi yang sudah berkembang sangat bermanfaat bagi kehidupan manusia. Segala macam kegiatan manusia saat ini dapat dikerjakan dengan cepat dan mudah menggunakan komputer. Sistem Penunjang Keputusan adalah suatu sistem berbasis komputer yang ditujukan untuk membantu pengambilan keputusan dalam memanfaatkan data dan model tertentu untuk memecahkan berbagai persoalan yang tidak terstruktur. Pengambil keputusan dalam pemilihan supplier terbaik pada Time Concept masih mengalami kesulitan, hal ini disebabkan karena belum adanya kriteria dan bobot yang tepat. Dengan dibuatnya sebuah sistem penunjang keputusan ini diharapkan dapat membantu memecahkan masalah yang ada pada Time Concept. Serta dapat memberikan manfaat atau kemudahan bagi Time Concept pada saat melakukan pemilihan supplier terbaik. Penulis menggunakan metode Analytical Hierarchy Process (AHP) dan Simple Additive Weighting (SAW).Hasil dari pengujian sistem maka didapatlah nilai perhitungan Consistency Ratio (CR) yaitu sebesar 0,0752. Penilaian perbandingan dikatakan KONSISTEN jika nilai Consistency Ratio (CR) tidak lebih besar dari 0,1000. Sehingga penilaian perbandingan Kriteria tidak perlu dilakukan perhitungan ulang karena SUDAH KONSISTEN

Kata kunci: Metode AHP; Metode SAW; Pemilihan Supplier; Sistem Penunjang Keputusan.

INTRODUCTION

Seeing the rapid development of global business causes companies to compete as the best to meet global market demands. In the current era of globalization, technological development benefits human life. All human activities today can be done quickly and easily using a computer. According to Hati and Fitri in 2017, supplier selection is one of a company's essential activities because purchasing raw material components represents 40 to 80 percent of the total product cost and impacts

company performance. Companies have different criteria for choosing suppliers as business partners(Hati & Fitri, 2017) (Purwitasari & Pribadi, 2015). Depending on the company's goals for smooth production and operations. Many companies make fatal mistakes in choosing suppliers, resulting in company losses. Assessment of suppliers requires various criteria that can describe the supplier's overall performance—the number of suppliers engaged in the sale of watches. The Time Concept company has several alternative suppliers, each with advantages and disadvantages.

This requires foresight from Time Concept to analyze which supplier is suitable and worthy to be prioritized as a business partner. Supplier selection is a long process. First, to evaluate suppliers based on several criteria, such as service, discount, payment duration, delivery time, and delivery amount. At the time of evaluation of supplier selection, trade-offs often occur, such as suppliers who provide fast service but late delivery, which can result in empty watch stocks. The more criteria Time Concept wants in the supplier selection, the more complicated the problem. Therefore, it needs a decision-making technique. So the research can use the AHP method and the SAW method to complete the decision support system that will be made, where the value of the weighting of the criteria for the AHP method will be the input for the Simple Additive Weight (SAW) method in ranking the best supplier selection alternatives.

Researchers also attach previous research (Bagaspati & Irawan, 2020). The decision support system uses the AHP and SMART methods to select the best supplier. The results of research at PT. Muria Karya Sentosa produces a weight of each criterion, namely quality criteria with a weight of 36.67%, delivery time criteria with a weight of 25.94%, price criteria with a weight of 7.61%, service criteria with a weight of 20.53%, and conformity criteria with weight 9.25%. The results of calculating the weight of the criteria have been tested with a Consistency Index (CI) value of 0.0945 and a Consistency Ratio (CR) value of 0.0844. The CR value is consistent because it is less than or equal to 0.1. Calculations with the SMART method ranked suppliers with the best value owned by PT. Mighty Lightning Bow of 0.7627 (Auddie & Mahdiana, 2019). Martoyo, Anang, and Fajar Mahardika.

"The Effect of Promotion and Distribution on Customer Satisfaction at PT Tiga Serangkai Internasional Bandung Branch." The method used is the promotion effect method with variable three obtained. Satisfactory promotion and distribution for consumers can increase company improvement(Martoyo & Mahardika, 2020). Setiyawan, Siswanti and Hasbi, 2020. Analytical Hierarchy Process Method and Simple Multi-Attribute Rating Technique as Support for Supplier Selection Decisions. AHP and SMART methods. Based on the analysis of validity testing using ten samples and determining the performance of DSS, there is a similarity level of 20% or a difference of 80%. It is due to the difference in calculating the weight of each criterion between the manual process and the application. Where the calculation of the application is not only calculated from the value of each criterion but also multiplied by the weight of the criteria. (Setiyawan et al., 2020). Putra, Habibie and Handayani, 2020. Decision Support System for Supplier Selection in Tb.Nameene with the Simple Additive Weighting Method. The results of this test are done by comparing the output or output of the system with the results of manual calculations against several formulas in the SAW method. Application testing is done by looking at the overall output given as a result of the analysis of the application with the actual conditions. Moreover, after the coding is complete, a testing process will be carried out on the resulting application to find out whether the resulting application is to find out whether designed application is running correctly and by design carried out (Putra et al., 2020).

Implementation of the Waterfall Method in the Analog Image Digitization Process. With the image processing method of negative images in Matlab. With the results of the research and discussion, it can be concluded that this application can take pictures using a laptop or notebook webcam and can be used for digital image processing that comes from negative images (photo clichés) with inverted images to accurate color images. The results of the application image processing can be stored in JPG/JPEG (Joint Photographic Expert Group) format. The testing results show that this application is easy to use and is likely to be developed in a better and more complex direction (Mahardika et al., 2017).

Mahardika, F., Setiawan, E., & Saputra, D. I. S. (2019). Application of Color Segmentation to Images on Social Media with the Fuzzy K-Means Cluster Algorithm. This is the basis for conducting this research to find image segmentation in social media images. Researchers conducted research by combining image segmentation using the fuzzy k-means cluster algorithm. The existence of this merger is expected to get maximum results. The research results on social media show the distribution of images for each area that has similarities and also find out the grouping of pixels

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based on the proximity of the distance between pixels (Mahardika et al., 2019).

Implementation Segmentation of Color Image with Detection of Color to Detect Object (Mahardika et al., 2017). With the image segmentation method in Matlab. The results of object detection in 2-dimensional images are a somewhat complex process to do. Object detection requires a computer vision approach for the desired part of the object to be accurately recognized by the computer (Mahardika & Saputra, 2017).

Apriastika, Prima, and Lusi Fajarita. "Decision Support System for Determining the Best Teacher at SD Strada Santa Maria Using the AHP (Analytical Hierarchy Process) and SAW (Simple Additive Weighting) Methods. This study discusses the decision support system in determining the best teacher at Strada Santa Maria Elementary School. Strada Santa Maria Elementary School is a superior, caring educational community with a spirit of service. Currently, the school has conducted assessment activities to determine the best teacher, but this assessment has not produced maximum results because at Strada Santa Maria Elementary School, all teachers are said to be good, all are equal, and no one distinguishes degrees. Strada Santa Maria Elementary School requires an objective and structured decision support system so that the results obtained are by expectations and can improve the quality and quality of teachers so that they are well achieved. The system that will be created uses the AHP (Analytical Hierarchy Process) method to determine the weight of the existing criteria, namely spiritualism, professionalism, leadership, and solidarity, which will later be compared with other criteria. Moreover, the SAW (Simple Additive Weighting) method is used in selecting alternative rankings (Apriastika & Fajarita, 2019).

Setiyawan, Bayu Aji, Sri Siswanti, and Muhammad Hasbi. "Analytical Hierarchy Process Method and Simple Multi-Attribute Rating Technique as Supporting Supplier Selection Decisions."The process of choosing a supplier in Sukoharjo has not used the application program in making the decision but still uses the manual way of writing. In addition, in conducting the selection of suppliers conducted by the HRD section is still subjective, so the results obtained in the selection of suppliers are less valid because in selecting HRD suppliers only choose based on price criteria, where If there is a supplier that offers the lowest price then the supplier will be chosen as a supplier in Sukoharjo. The research aims to build and implement a decision support system helpful in selecting suppliers in Sukoharjo using the Analytical Hierarchy Process (AHP) and Simple Multi-Attribute Rating Technique (SMART). The AHP method calculates the weight of the criteria, and the SMART method calculates the supplier's alignment. With testing, the black box system is already running according to the function, and for the results of the validity, test get, the test value results in the category very good with a percentage of 80% (Setiyawan et al., 2020).

Gholamian, K., Vakilifard, H., Talebnia, G., & Hejazi, R. (2020). Conceptual design of sustainable outsourcing with balanced scorecard using analytic hierarchy process: A case study for Fajr jam gas refining company. Our findings indicated that a sustainable outsourcing model was successfully designed using a balanced scorecard. Economic, social, and environmental sustainability was considered in each of the balanced scorecard faces used in the model. This work's primary objectives were a sustainable domestic business, customer satisfaction, and sustainable learning and growth. Finally, a balanced scorecard with 26 strategic objectives was designed and implemented. To this end, paired comparisons were performed to compute the importance of each strategic goal in every phase and make prioritization accordingly (Gholamian et al., 2020).

Gholamian, K., Vakilifard, H., Talebnia, G., & Hejazi, R. (2019). Identification and Prioritization of Environmental Criteria of Sustainable Outsourcing Model in Fajr Jam Gas Refining Company with Analytic Hierarchy Process Method. The findings indicated that designing a sustainable outsourcing model using a balanced scorecard. Seven strategic objectives in the environmental dimension had to be considered. Two objectives in the learning and growth aspect, two in the internal business processes aspect, two in the customer satisfaction aspect, and a strategic environmental objective in the financial performance aspect were identified. Finally, using a paired comparisons questionnaire, the importance of each strategic objective was calculated and prioritized (Gholamian et al., 2019).

Yahya, S., & Kingsman, B. (2017). Vendor rating for an entrepreneur development program: a case study using the analytic hierarchy process method. This paper describes a case study into vendor rating for a government-sponsored Entrepreneur Development program in Malaysia. The paper reviews current methods for vendor rating and finds them wanting. It illustrates a new approach based on Saaty's Analytic Hierarchy process method, developed to assist in multi-criteria decision problems. The new method overcomes the difficulties associated with the categorical and simple linear weighted average

criteria ranking methods. It provides a more systematic way of deriving the weights to be used and scoring vendor performance (Yahya & Kingsman, 2017).

GAP or gap analysis is defined as comparing actual performance with potential or expected performance. GAP analysis evaluates the business by comparing the company's current performance with previously targeted performance and determining what steps need to be taken to reduce the gap and achieve the desired state in the future. This analysis model is based on consumer assumptions by comparing company performance with specific standards or consumer expectations (Stolzer & Goglia, 2016).

GAP Analysis is used as a business evaluation tool focused on performance gaps. This analysis is used to determine the gap between consumer perceptions and expectations and identify the actions needed to enable them to reduce the gap and achieve the expected performance in the future. Therefore, the company wants to know the gap between consumers' perceptions and expectations of quality service, price, and quality of watch products at Time Concept.

Supplier selection is a long process. First, the supplier is evaluated based on several criteria: service, price discounts, payment duration, delivery time, and the number of shipments. When evaluating supplier selection, there is often a trade-off, such as a supplier who provides fast service but delivers late, which can result in an empty watch stock. The more criteria Time Concept wants to select suppliers, the more complicated the problem is. Therefore, a decision-making technique is needed. This research aims to create a decision support system to help the supplier selection process correctly and accurately.

RESEARCH METHODS

1. Research Methods

Research methodology is a scientific process or method to obtain data for research purposes, such as data collection methods and research methodologies used as research guidelines so that the results achieved do not deviate from their objectives. This study examines the selection of the best suppliers using the Analytical Hierarchy Process (AHP) and Simple Additive Weight (SAW) methods on the Time Concept(laurentinus & Rinaldi, 2019).

2. Sample Selection Method

The sample selected or used in this study is supplier data on Time Concept and the criteria that have been determined, among others:

a. Service This criterion relates to supplier services to company requests with a fast response. The assessment of these criteria uses an ordinal scale based on the following table 1:

Table 1. Ordinal Service Scale

target value	Information
1	Very bad
2	Bad
3	Normal
4	Very nice
5	Very good

b. Discounts

This criterion relates to the discount given by the supplier to Time Concept. Discounts are obtained from questions asked by the purchasing department when they want to order or from supplier invoices received by Time Concept. The assessment of this criterion is seen from the amount of discount given by the supplier.

c. Payment duration

This criterion relates to the repayment period of the watch. These criteria are obtained from questions asked by the purchasing department when they want to order or from supplier invoices received by Time Concept. The assessment of this criterion is seen from the length of time for repayment. The longer the payment period, the better.

d. Delivery time

This criterion relates to the delivery time of the watch. These criteria are obtained from questions the purchasing department asks when they want to order or from supplier invoices that Time Concept has received. 27 Assessment of this criterion is seen from the time the order arrives. The sooner it comes, the better.

e. Number of Send

This criterion relates to the number of watch orders received. These criteria are obtained from questions the purchasing department asks when they want to order or from supplier invoices that Time Concept has received. The assessment of these criteria uses an ordinal scale based on table 2.

Table 2. Ordinal Scale Number of Sends

target value	Information
1	Tidak Sesuai
2	Sesuai

In addition to the criteria, there are several alternative suppliers, as seen in table 3.

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Table 3. Alternative

No	Alternative	Alternative Code
1	PT. Radiance	SP001
2	PT. Time Line	SP002
3	PT. VIP Watch	SP003
4	PT. Luminoux	SP004
5	PT. Alva Jaya Mandiri	SP005
6	PT. Swiss Watch	SP006
7	PT. Central Watch	SP007

3. Data Collection Method

In this study, to collect data. The author uses observation, interviews, document analysis, questionnaires, and literature studies.

4. Research Instruments

Research instruments are tools that are needed or used to collect data. The instrument used in collecting data in this study is to provide questionnaires to respondents. The respondent of this research is the General Manager of Brand Activation, which can be seen in Appendix-A of the questionnaire based on the following table 4.

Table 4. Alternatives

Respondents	Amount
Alternative	1

5. Data Analysis Techniques

Data analysis techniques used to analyze the data in this study are descriptive analysis, Analytical Hierarchy Process (AHP), and Simple Additive Weighting (SAW). Descriptive analysis aims to draw conclusions and provide an overview of current business processes. at the same time, the Analytical Hierarchy Process (AHP) is used to determine the weight of each predetermined criterion. Because Time Concept has not given weighting criteria. Simple Additive Weighting (SAW) is used to sort the alternatives after the criteria are processed and to determine the supplier rankings sorted from the most significant value to the smallest value to obtain results to determine the best supplier candidate(Hati & Fitri, 2017).

6. Research Stages

The following are the stages of the research which can be seen in Figure 1:

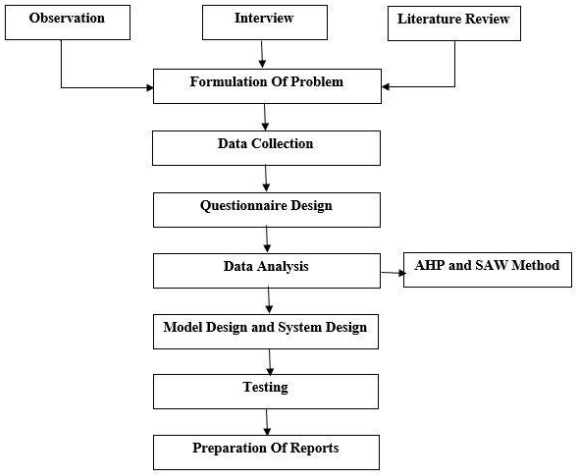

Figure 1. Research Stages

1. Formulation

Problems At this research stage, the problems to be discussed are formulated based on the observations' results.

2. Interview

The interview is the process of collecting data on the Time Concept by asking questions directly to assist in making a decision support system. The questions asked included issues related to supplier selection and the criteria for supplier selection.

3. Library Studies

Library Studies are carried out by looking for journals, books, and information from the internet related to the problem under study.

4. Observation

Then observations are made by visiting Time Concept to conduct interviews with Time Concept decision-makers to obtain information regarding problems and the ongoing process of selecting suppliers.

5. Data Collection

Then carry out the data collection stage by collecting documents from Time Concept.

6. Questionnaire Design

On the Time Concept side, the criteria used in the supplier selection process are determined so that the writer can directly design a questionnaire based on the specified criteria and, at the same time, carry it back to the data collection stage when filling out the questionnaire by the Brand Activation General Manager as an expert respondent.

7. Data Analysis

After the data collection process and questionnaire design, the next step is to analyze the data using the Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW) methods which will then obtain the level of importance of

each criterion, and the General Manager Brand Activation makes the decision maker.

8. Model Design and System Design

Then the next stage is designing the model and system design as a description, planning, and sketching or arrangement of several separate elements into a unified whole and function.

9. Testing

The Decision Support System application for supplier selection is tested to determine whether the system built is correct and uses the black box testing method.

10. report preparation

After the test runs according to the required system, then there will be a report preparation process

2. AHP Method

a. Calculation Process AHP

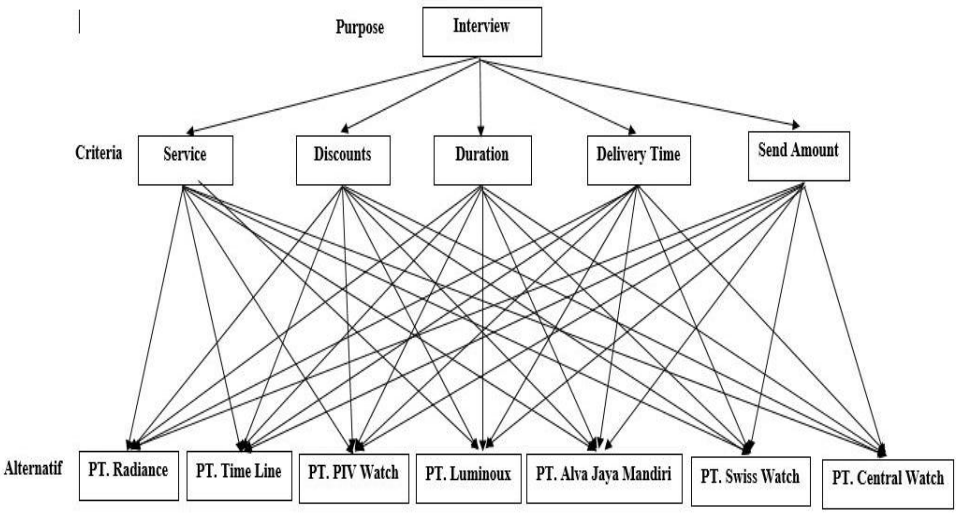

Figure 2. Hierarchical criteria

b. Criteria used

First, in this study, the General Manager Brand Activation will give the importance and attributes of each criterion. Criteria data is data regarding the criteria of decision-making. The following criteria table example contains several columns, namely the criteria name and attributes for the weight calculation using AHP weighting. The weight of the criteria determines how critical the criteria are. The criteria attribute consists of benefits or costs, where benefit means that the greater the value, the better, while the smaller the cost, the better the value. The following is the level of importance used in table 5:

Table 5 Criteria Level

Criteria Name	Attribute
Service	Benefit
Potongan Harga	Benefit
Durasi Pembayaran	Benefit
Waktu Pengiriman	Cost
Jumlah Kirim	Benefit

c. Weighting Stage AHP

In this study, the Head of Brand Activation will first be given a questionnaire to find the level of importance of the existing criteria, then the AHP method of comparison of criteria will be used to determine the weight of each criterion that will be

RESULTS AND DISCUSSION

1. System analysis

In analyzing the problems in Time Concept, namely determining the best supplier, the researchers in this chapter discuss the data analysis process. The data analysis technique is based on data collected through interviews, observations, questionnaires, and literature studies to determine the system requirements for solving the right problem. The data is processed in detail and precisely. Then the data collected in detail will be developed with the selected methods to help design the desired system.

used as a benchmark for the assessment as follows table 6:

1) Value of Interest Comparison Between Criteria

Table 6. Pairwise comparison matrix

Criteria	Service	Discounts	Payment Duration	Delivery time	Send Amount
Service	1	2	1/2	1/3	2
Discounts	½	1	1	½	3
Payment Duration	2	1/1	1	½	3
Delivery time	3	2	2	1	2
Send Amount	½	1/3	1/3	½	1

2) Convert Fraction Matrix To Decimal

Table 7. Pairwise Comparison Matrix

Criteria	Service	Discounts	Payment Duration	Delivery time	Send Amount
Service	1,0000	2,0000	0,5000	0,3333	2,0000
Discounts	0,5000	1,0000	1,0000	0,5000	3,0000
Payment Duration	2,0000	1,0000	1,0000	0,5000	3,0000
Delivery time	3,0000	2,0000	2,0000	1,0000	2,0000
Send Amount	0,5000	0,3333	0,3333	0,5000	1,0000

3) Multiplying Paired Matrices (Square of Paired Matrices)

$$\begin{bmatrix} 1,0000 & 2,0000 & 0,5000 & 0,3333 & 2,0000 \\ 0,5000 & 1,0000 & 1,0000 & 0,5000 & 3,0000 \\ 2,0000 & 1,0000 & 1,0000 & 0,5000 & 3,0000 \\ 3,0000 & 2,0000 & 2,0000 & 1,0000 & 2,0000 \\ 0,5000 & 0,3333 & 0,3333 & 0,5000 & 1,0000 \end{bmatrix} x \begin{bmatrix} 1,0000 & 2,0000 & 0,5000 & 0,3333 & 2,0000 \\ 0,5000 & 1,0000 & 1,0000 & 0,5000 & 3,0000 \\ 2,0000 & 1,0000 & 1,0000 & 0,5000 & 3,0000 \\ 3,0000 & 2,0000 & 2,0000 & 1,0000 & 2,0000 \\ 0,5000 & 0,3333 & 0,3333 & 0,5000 & 1,0000 \end{bmatrix}$$

4) Matrix Multiplication Results

$$\begin{bmatrix} 4,9999 & 5,8332 & 4,3332 & 2,9166 & 12,1666 \\ 6,0000 & 4,9999 & 4,2499 & 3,1667 & 11,0000 \\ 7,5000 & 7,9999 & 4,9999 & 3,6666 & 14,0000 \\ 12,0000 & 12,6666 & 8,1666 & 4,9999 & 22,0000 \\ 3,3333 & 2,9999 & 2,2499 & 1,5000 & 4,9998 \end{bmatrix}$$

This result is obtained from = ((1,000*1,0000)+(2,0000*0,5000)+(0,5000*2,0000)+(0,3333*3,0000)+(2,0000*0,5000)
=(1,0000+1,0000+1,00000+0,9999+1,0000)
=4,9999

5) Add up each row of the result of matrix multiplication

$$\begin{bmatrix} 4,9999 & 5,8332 & 4,3332 & 2,9166 & 12,1666 \\ 6,0000 & 4,9999 & 4,2499 & 3,1667 & 11,0000 \\ 7,5000 & 7,9999 & 4,9999 & 3,6666 & 14,0000 \\ 12,0000 & 12,6666 & 8,1666 & 4,9999 & 22,0000 \\ 3,3333 & 2,9999 & 2,2499 & 1,5000 & 4,9998 \end{bmatrix} = \begin{matrix} 30,2495 \\ 29,4165 \\ 38,1664 \\ 59,8331 \\ 15,0829 \\ 172,7484 \end{matrix}$$

6) Normalize each number of rows in the matrix with the total rows, which will produce an eigenvector

$$\begin{matrix} 30,2495 \\ 29,4165 \\ 38,1664 \\ 59,8331 \\ 15,0829 \\ 172,7484 \end{matrix} \xrightarrow{Eigen\ Vector} \begin{matrix} 0,1751 \\ 0,1703 \\ 0,2209 \\ 0,3464 \\ 0,0873 \\ 1 \end{matrix}$$

The EigenVector results are obtained from = 30,2495/172,7484 =0,1751

7) Determine the weight of each criterion taken from the eigenvector

Table 8 Criteria and Weights

Criteria Name	Weight
Service	0,1751
Discounts	0,1703
Payment Duration	0,2209
Delivery time	0,3464
Send Amount	0,0873

8) Multiply the decimal number value of each criterion matrix by the weight/eigenvector.

Table 9 Vector Counting Table

Criteria	Service	Discounts	Payment Duration	Delivery time	Send Amount	Vector
Service	1,0000	2,0000	0,5000	0,3333	2,0000	0,9162
Discounts	0,5000	1,0000	1,0000	0,5000	3,0000	0,9139
Payment Duration	2,0000	1,0000	1,0000	0,5000	3,0000	1,1765
Delivery time	3,0000	2,0000	2,0000	1,0000	2,0000	1,8287
Send Amount	0,5000	0,3333	0,3333	0,5000	1,0000	0,4784
Weight	0,1751	0,1703	0,2209	0,3464	0,0873	

This result is obtained from: = (1,0000*0,1751)+(2,0000*0,1703)+(0,5000∗0,2209)+(0,3333∗0,3464) +(2,0000*0,0873) = 0,1751+0,3406+0,1105+0,1154+0,1746 = 0,9162

9) The result of the vector is divided by the weight or eigenvector in table 10.

Table 10 Results Tableλ

Criteria	Vector	Weight	Results
Service	0,9162	0,1751	5,2324
Discounts	0,9139	0,1703	5,3664
Payment Duration	1,1765	0,2209	5,3259
Delivery time	1,8287	0,3464	5,2792
Send Amount	0,4784	0,0873	5,4800

This result is obtained from λ = 0,9162/ 0,1751= 5,2324

10) Calculate the sum of each result (λ) from each criterion and then divide by the number of elements as in the equation below:
$\lambda Maks = \sum \lambda / n$
λMaks = (5,2324+ 5,3664+ 5,3259+ 5,2792+ 5,4800)/5 λMaks = 26,6839 / 5 = 5,3368

11) Calculate the Consistency Index (CI) shown like this equation:
CI = (5,3368– 5) / (5-1)
CI = 0,3368 / 4 = 0,0842

12) Calculating Consistency Ratio(CR)

The Consistency Ratio (CR) value is obtained by dividing Consistency Index (CI) and Ratio Index (RI). For the Consistency Ratio test, if the CR result is < 0.1, then the data is considered consistent and does not need to be recalculated, but if the CR value is > 0.1, then a recount is required.

CR = 0.0842/1.12 = 0.0752 CR value < 0.1, then the data is declared consistent. With consistent testing, the weighting is no longer needed for re-calculation.

3. Simple Additive Weighting (SAW) Method

The Simple Additive Weighting (SAW) method is used to determine the final alternative value in selecting the best supplier, which will produce the output as the best supplier based on the highest ranking value.

a. SAW Calculation Process

Based on the number of suppliers in the Time Concept, the Simple Additive Weighting (SAW) method is applied in determining suppliers. The supplier has the following data in table 11:

Table 11 SAW Calculation Process

Alternative name	Criteria				
	Service	**Discounts**	**Payment Duration**	Delivery time	**Send Amount**
PT. Radiance	3	250000	64	14	2
PT. Time Line	4	400000	64	14	1
PT. VIP Watch	5	500000	32	14	2
PT. Luminoux	4	300000	32	14	2
PT. Alva Jaya Mandiri	3	400000	64	14	1
PT. Swiss Watch	4	300000	32	14	1
PT. Central Watch	4	300000	32	14	1

1) First, normalization is carried out into an R matrix to calculate the value of each criterion, calculating based on the profit criteria or the cost criteria with the following equation in table 12:

Table 12 Classification of Criteria

Criteria Name	Attribute
Service	Benefit
Discounts	Benefit
Payment Duration	Benefit
Delivery time	Cost
Service	Benefit

a) PT. Radiance
$r1 = 0{,}6; r2 = 0{,}5; r3 = 1; r4 = 1; r5 = 1$
b) PT. Time Line
$r1 = 0{,}8; r2 = 0{,}8; r3 = 1; r4 = 1; r5 = 0{,}5$
c) PT. VIP Watch
$r1 = 1; r2 = 1; r3 = 0{,}5; r4 = 1; r5 = 1$
d) PT. Luminoux
$r1 = 0{,}8; r2 = 0{,}6; r3 = 1; r4 = 1; r5 = 1$
e) PT.Alva Jaya Mandiri
$r1 = 0{,}6; r2 = 0{,}8; r3 = 1; r4 = 1; r5 = 0{,}5$
f) PT. Swiss Watch
$r1 = 0{,}8; r2 = 0{,}6; r3 = 1; r4 = 1; r5 = 0{,}5$
g) PT. Central Watch
$r1 = 0{,}8\ ; r2 = 0{,}6\ ; r3 = 1; r4 = 1; r5 = 0{,}5$

From the results of the calculation matrix above, get the value of the matrix R:

$$R = \begin{bmatrix} 0{,}6000 & 0{,}5000 & 1{,}0000 & 1{,}0000 & 1{,}0000 \\ 0{,}8000 & 0{,}8000 & 1{,}0000 & 1{,}0000 & 11{,}0000 \\ 1{,}0000 & 1{,}0000 & 0{,}5000 & 1{,}0000 & 1{,}0000 \\ 0{,}8000 & 0{,}6000 & 0{,}5000 & 1{,}0000 & 1{,}0000 \\ 0{,}6000 & 0{,}8000 & 1{,}0000 & 1{,}0000 & 0{,}5000 \\ 0{,}8000 & 0{,}6000 & 0{,}5000 & 1{,}0000 & 0{,}5000 \\ 0{,}8000 & 0{,}6000 & 1{,}0000 & 1{,}0000 & 0{,}5000 \end{bmatrix}$$

2) Alternate Ranking

After getting the r-value from the R matrix and the weight value (W), the next step is the preferred process (Vi) using the formula:

$$R = \begin{bmatrix} 0{,}6000 & 0{,}5000 & 1{,}0000 & 1{,}0000 & 1{,}0000 \\ 0{,}8000 & 0{,}8000 & 1{,}0000 & 1{,}0000 & 11{,}0000 \\ 1{,}0000 & 1{,}0000 & 0{,}5000 & 1{,}0000 & 1{,}0000 \\ 0{,}8000 & 0{,}6000 & 0{,}5000 & 1{,}0000 & 1{,}0000 \\ 0{,}6000 & 0{,}8000 & 1{,}0000 & 1{,}0000 & 0{,}5000 \\ 0{,}8000 & 0{,}6000 & 0{,}5000 & 1{,}0000 & 0{,}5000 \\ 0{,}8000 & 0{,}6000 & 1{,}0000 & 1{,}0000 & 0{,}5000 \end{bmatrix}$$

a) PT. Radiance get a score of 0,8448
b) PT. Time Line gets a score of 0,8873
c) PT. VIp Watch get a score of 0,84896
d) PT. Luminoux get a score of 0,7862
e) PT. Alva jaya Mandiri get a score of 0,8523
f) PT. Swiss Watch get a score of 0,7428
g) PT. Central Watch get a score of 0,8532

After doing the above calculations, that PT. VIP Watch is the best supplier, with a value of 0.8896.

CONCLUSIONS AND SUGGESTIONS

Conclusion

Based on the research results, several conclusions were drawn, including decision support systems with the AHP and SAW methods can be used to assess and select the best supplier, so there is no doubt in the selection. Of course, several criteria and weights play a significant role in determining the ranking results. The results of the system test by inputting data from the questionnaire, the value of the Consistency Ratio (CR) calculation is 0.0752. Suppose the Consistency Ratio (CR) value is less than or equal to 0.1000. In that case, the comparison evaluation is considered CONSISTENT to avoid the necessity of doing a new calculation in the comparative assessment of the criteria since it is CONSISTENT.

Suggestion

The following is a suggestion for future system development: companies to train users who will use this decision support system to operate properly and correctly. Subsequent research uses other variables to support changes in decision

support systems according to future company needs.

REFERENCES

Apriastika, P., & Fajarita, L. (2019). Sistem Penunjang Keputusan Penentuan Guru Terbaik Pada SD Strada Santa Maria Dengan Metode AHP (Analytical Hierarchy Process) Dan SAW (Simple Additive Weighting). *IDEALIS : InDonEsiA JournaL Information System*, *2*(3), 138–145. https://jom.fti.budiluhur.ac.id/index.php/IDEALIS/article/view/462

Auddie, M., & Mahdiana, D. (2019). Sistem Penunjang Keputusan Pemilihan Supplier Terbaik Dengan Metode Analytical Hierarchy Process Pada Klinik AMC. *IDEALIS: InDonEsiA JournaL Information System*, *2*(6), 182–186.

Bagaspati, R. A., & Irawan, H. (2020). Sistem Penunjang Keputusan: Pemilihan Supplier Terbaik Menggunakan Metode Analytical Hierarchy Process (AHP) Dan Simple Multi Attribute Rating Technique (SMART) Studi Kasus PT. Muria Karya Sentosa. *Proceeding SENDI_U*, 200–207. https://www.unisbank.ac.id/ojs/index.php/sendi_u/article/view/7982

Gholamian, K., Vakilifard, H., Talebnia, G., & Hejazi, R. (2019). Identification and Prioritization of Environmental Criteria of Sustainable Outsourcing Model in Fajr Jam Gas Refining Company with Analytic Hierarchy Process Method. *Iranian (Iranica) Journal of Energy & Environment*, *10*(3), 204–210. https://doi.org/10.5829/IJEE.2019.10.03.07

Gholamian, K., Vakilifard, H., Talebnia, G., & Hejazi, R. (2020). Conceptual Design of Sustainable Outsourcing with Balanced Scorecard Using Analytic Hierarchy Process: A Case Study for Fajr Jam Gas Refining Company. *International Journal of Engineering*, *33*(1), 112–123. https://doi.org/10.5829/IJE.2020.33.01A.13

Hati, S. W., & Fitri, N. S. (2017). Analisis Pemilihan Supplier Pupuk Npk Dengan Metode Analytical Hierarchy Process (AHP). *Inovbiz: Jurnal Inovasi Bisnis*, *5*(2), 122–132. https://doi.org/10.35314/INOVBIZ.V5I2.249

laurentinus, L., & Rinaldi, S. (2019). Implementasi Metode Analytical Hierarchy Process dan Simple Additive Weighting untuk Pemilihan Dosen Terbaik Studi Kasus STMIK Atma Luhur. *Jurnal Teknologi Informasi Dan Ilmu Komputer*, *6*(6), 655–664. https://doi.org/10.25126/JTIIK.2019661636

Mahardika, F., Purwanto, K. A., & Saputra, D. I. S. (2017). Implementasi Metode Waterfall pada Proses Digitalisasi Citra Analog. *VOLT : Jurnal Ilmiah Pendidikan Teknik Elektro*, *2*(1), 63–72. https://doi.org/10.30870/VOLT.V2I1.948

Mahardika, F., & Saputra, D. I. S. (2017). Implementation Segmentation of Color Image with Detection of Color to Detect Object. *VOLT : Jurnal Ilmiah Pendidikan Teknik Elektro*, *2*(2), 157–166. https://doi.org/10.30870/VOLT.V2I2.1095

Mahardika, F., Setiawan, E., Intan, D., & Saputra, S. (2019). Penerapan Segmentasi Warna Pada Gambar Di Media Sosial Dengan Algoritma Fuzzy K-Means Cluster. *Simetris: Jurnal Teknik Mesin, Elektro Dan Ilmu Komputer*, *10*(2), 631–638. https://doi.org/10.24176/SIMET.V10I2.3381

Martoyo, A., & Mahardika, F. (2020). Pengaruh Promosi dan Distribusi Terhadap Kepuasan Pelanggan Pada PT Tiga Serangkai Internasional Cabang Bandung. *Jurnal Pemasaran Kompetitif*, *3*(2), 1–11. http://openjournal.unpam.ac.id/index.php/JPK/article/view/3612

Purwitasari, K. D., & Pribadi, F. S. (2015). Implementasi Sistem Pendukung Keputusan Peminatan Peserta Didik SMA menggunakan Metode AHP (Analytic Hierarchy Process) dan SAW (Simple Additive Weighting). *Jurnal Teknik Elektro*, *7*(2), 57–61. https://doi.org/10.15294/JTE.V7I2.8583

Putra, N., Habibie, D. R., & Handayani, I. F. (2020). Sistem Pendukung Keputusan Pemilihan Supplier Pada Tb.Nameene Dengan Metode Simple Additive Weighting (Saw). *Jursima*, *8*(1), 45. https://doi.org/10.47024/js.v8i1.194

Setiyawan, B. A., Siswanti, S., & Hasbi., M. (2020). Metode Analitychal Hierarchy Process Dan Simple Multi Attribute Rating Technique Sebagai Penunjang Keputusan Pemilihan Supplier. *Jurnal Ilmiah SINUS*, *18*(2), 63–73. https://doi.org/10.30646/sinus.v18i2.475

Stolzer, A., & Goglia, J. (2016). *Safety management systems in aviation*.

Yahya, S., & Kingsman, B. (2017). Vendor rating for an entrepreneur development programme: a case study using the analytic hierarchy process method. *Https://Doi.Org/10.1057/Palgrave.Jors.2600797*, *50*(9), 916–930. https://doi.org/10.1057/PALGRAVE.JORS.2600797