DECISION SUPPORT SYSTEM FOR ELECTION SUPPLIERS OF GOODS USING THE SIMPLE METHOD ADDITIVE WEIGHTING (SAW)

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Abstract

Selection of suppliers of goods is the main key to starting a retail business. The market will find it difficult to determine suppliers because it will have a big effect on the final selling price. The Diva Shop is a medium-sized business that is still growing in the city. The system run by the store is still running on experience. As a store that is ready to compete, the store needs a supporting design system in determining the selection of suppliers of goods. The system is run using the Simple Additive Weighting (SAW) method. That The system that will be created uses the criteria that will be applied by the user based on the SAW method. The SAW design method uses a weighted summation method with the accumulation of various data, each value from the weight results obtained becomes the final decision. The Simple Additive Weighting (SAW) method can be applied properly and correctly to the decision support system at the Diva Store. The steps and results of calculations manually are the same as the steps and results of calculations performed by the system. For testing applications based on the Confusion Matrix method, the accuracy is 73.77% with an error percentage of 26.23%.

Keywords: SAW (Simple Additive Weighting) Method, Suppliers, Decision Support System

INTRODUCTION

The development of technological advances in all aspects of life can make work easier to support the progress of an organization's business. Technology can develop so that it is possible to make decisions quickly and carefully based on the foundation that has been given. The selection of suppliers of goods is the most important thing in the retail business. The goods sold are not small and consist of various types to sizes. Stores that have complete and inexpensive goods will often be visited by customers, if the goods are not complete it will hinder the store in achieving the target. In the selection of goods, price and quality play a large role in sales, therefore it is necessary to select suppliers of goods correctly. Diva's shop is located on the side of a highway that is often passed by goods supply company vehicles. Marketing officers often come to the store to offer their goods in order to become a supplier of goods in the Diva Store. The store manager always accepts every offer made to take the opportunity to get a better supplier. This offer is then considered whether it is better or worse than the previous supplier of goods. Things to consider can be in the form of purchase price, quality of goods, returns, supply schedules, to credit payments.

This consideration process takes a long time because it still uses estimates and feelings. Sometimes, before the consideration process is complete, another offer arrives. So that the consideration process starts from the beginning. The consideration process with more than one offer is more difficult to carry out. Managers often have difficulty in determining the supplier of goods to be selected. Managers may experience errors in selecting suppliers of goods to be used.

Mistakes in determining the supplier of goods can harm Diva Stores and customers. High prices can result in reduced profits. The Diva shop cannot increase the selling price because there is price competition between stores. Poor quality of goods can cause loss of customers because customers will choose other stores with better quality goods. If the customer continues to buy goods with poor quality, the customer will also experience losses, for example food or unfit goods. Irregular or too long supply schedules can make items unavailable so customers will look for items in other stores, and that greatly reduces trust and profits for Diva Stores. The short expiration time of goods can also affect the time of sale in the store. If the customer continues to buy expired goods, then the customer will experience losses, ranging from health problems and spending time only exchanging goods to the store. If the supplier does not provide warranty or return services for goods that have passed the expiration date, the store will experience a loss because it has to accommodate goods that are no longer suitable for resale.

In order to improve the quality of store services starting from the supply side of goods, the owner of the Diva Store wants to make a system to help, simplify and speed up the decision- making process based on predetermined considerations. Decision support system (DSS) is a
system that can assist decision makers in solving problems. Decision support systems can help, simplify and speed up making decisions.

METHODS
The research method that will be used in this research is as follows.
1. Data Collection Method
   The data taken are primary data taken directly and secondary data taken from documents. Primary data will be taken using the interview method by having direct conversations with the Diva Store manager. Interviews were conducted to determine the criteria and sub-criteria that will be used for the selection of suppliers of goods. Secondary data will be taken using the literature review method, carried out by reading documents for decision making on the selection of suppliers of goods at the Diva Store. A review of the document is carried out to determine the values used for the criteria and sub-criteria.
2. Software Development Method
   The software development method that will be used is the waterfall method which includes the analysis, design, coding and testing stages. Analysis is carried out to determine user needs. Design is carried out to design a system that will be made based on predetermined user needs. Coding is done to create program code according to the design that has been made. Testing is carried out to test the system that has been made whether it can meet user needs and can run properly and correctly.

RESULT AND DISCUSSIONS
1. Initial Calculation Analysis Using the SAW Method
   The following are the initial steps for calculating the SAW method using Excel.
   a. Analysis Stage
      At this stage, an analysis of what criteria will be included and the types of criteria is carried out, as well as determining the weight of these criteria. The criteria for the Decision Support System included are profit, payment due, supplier schedule, delivery time, and returns. These criteria will later become the basis for the weight values of the sub-criteria used in the SAW method in table 1.

Table.1. Criteria Weight Value

No.	Criteria	Type	Weight
1	Big profit	COST	20
2	Payment Time	BENEFIT	30
3	Supplier Schedule	COST	10
4	DeliveryTime	BENEFIT	20

| 5 | Return | BENEFIT | 20 |

The next step is to add sub-criteria attributes and their weights, which is the value of each criterion, in table 2 to table 6.

Suppliers who provide very high profits will be given according to table 2

Table 2. Value of Weight Sub Criteria Big Profit

No.	Sub Criteria	Weight	Desc.
1	Very High	20	>60%
2	High	40	50-59%
3	Medium	60	40-49%
4	Low	80	30-39%
5	Very Low	100	<29%

The supplier that gives the longest payment tempo has a high weight in the table 3.

Table 3. Value of Weight Sub Criteria Payment Tempo

No.	Sub Criteria	Weight	Desc.
1	Cash	20	Cash
2	7	40	Days
3	14	60	Days
4	21	80	Days
5	28	100	Days

Suppliers who schedule daily deliveries of goods have a high weight on the table 4.

Table 4. Value Weight Sub Criteria Supplier Schedule

No.	Sub Criteria	Weight	Desc.
1	Very Rarely	20	1 Month
2	Rare	40	10 Days
3	Medium	60	1 Week
4	Often	80	3 Days
5	Very Often	100	Every Days

Suppliers who delivery time deliveries of goods have a high weight on the table 5.

Table 5. Sub Criteria Weight Value Delivery Time

No.	Sub Criteria	Weight	Desc.
1	Very Fast	20	<3 Days
2	Fast	40	>5 Days
3	Medium	60	7 Days
4	Long	80	10 Days
5	Very Long	100	>28 Days

Suppliers who Returns Sub Criteria Weight Value of goods have a high weight on the table 6.

Table 6. Returns Sub Criteria Weight Value

No.	Sub Criteria	Weight	Desc.
1	Can not	20	Non Return

2	Can	100	Return

Add these attributes to the supplier data, which will later be useful for calculations.

b. Converstion Stage

This stage is used to change the supplier data from the analysis of each attribute to the sub- criteria attribute using a predetermined weight.

c. Normalization Stage

Normalization of Supplier Criteria Value based on weight data in table 7.

Table 7. Criteria Weight Normalization

No.	Criteria	Type	Weight	Normal Weight
1	Big profit	COST	20	0.2
2	Payment Time	BENEFIT	30	0.3
3	Supplier Schedule	COST	10	0.1
4	DeliveryTime	BENEFIT	20	0.2
5	Return	BENEFIT	20	0.2
	Count		100	1

d. Linking Stage

The ranking stage is the most important stage which multiplies all attributes by the weight of each alternative.

2. Decission Support System (DSS)

a. Use Case Diagrams

Use Case Diagram in Figure 1, The manager is the person who has access rights to the page for the system manager. The access rights owned by the manager are managing data on criteria, sub-criteria, suppliers and users and seeing suggestions.
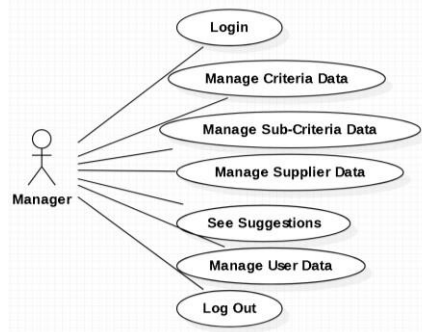

Fig.1. Use Case Diagram

b. Activity Diagram

Activity diagram in Figure 2, describes the system and managers in their system activities
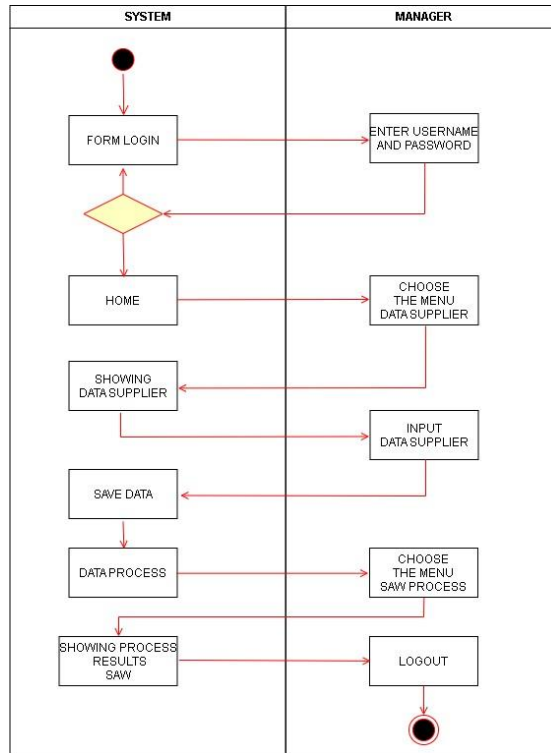
Fig.2. Activity Diagram

c. Sequence Diagram
Sequence diagram in figure 3, describe the process of input, save, delete and validate in each menu process in the system.

d. Class Diagram
Class diagram in figure 4, Shows the structure of a system clearly. Improve understanding of the general description or schema of a program.
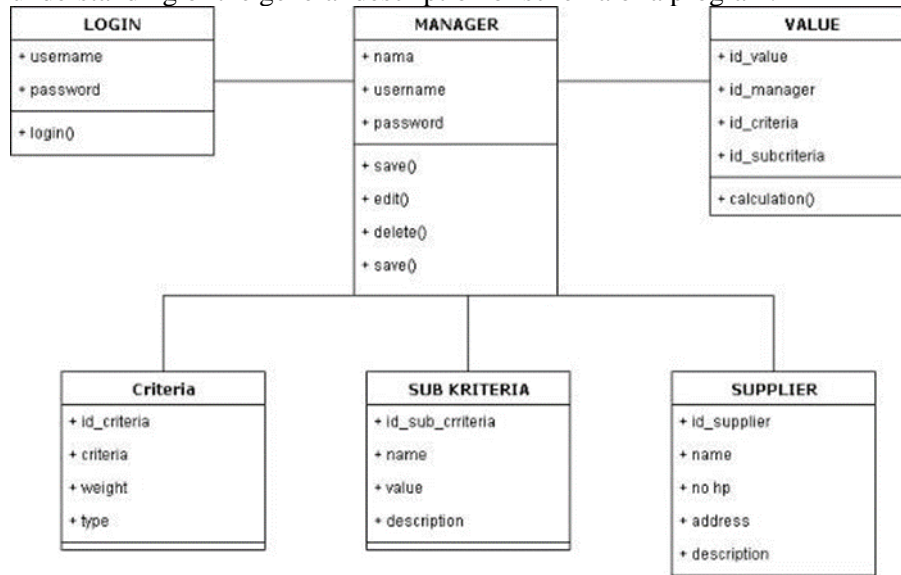

Fig.4. Class Diagram

e. System Implementation
This system successfully uses the Simple Additive Weighting (SAW) method to calculate the best supplier determination. This system has facilities to manage data on criteria, sub criteria, suppliers of goods and users as well as facilities to provide a list of suggestions for the best suppliers of goods. The criteria used in the

calculation process are the purchase price, quality of goods, supply schedule, expiration time and warranty service.

1) Login Page

The login page that has been created can be used to restrict the users who use the system. The results of making the login page are shown in Figure 5.
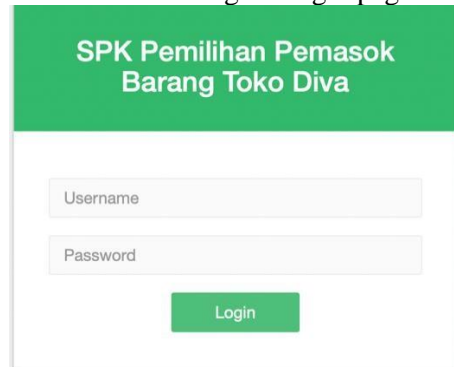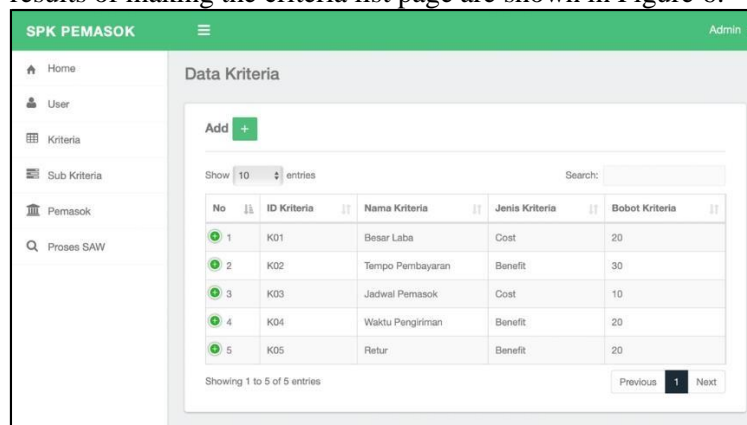

Fig.5. Login Page

2) Pages For Criteria Management

The criteria management page that has been created can be used to manage criteria data that will be used in the calculation process. The criteria management page is divided into a list page and a criteria form. The criteria list page can be used to view a list of criteria and delete criteria data. The results of making the criteria list page are shown in Figure 6.

Fig.6. Criteria Menu Page

3) Pages For Sub-Criteria Management

The sub-criteria management page that has been created can be used to manage sub-criteria data that will be used in the calculation process. The sub-criteria management page is divided into a list page and a sub-criteria form. The sub-criteria list page can be used to view a list of sub- criteria and delete sub-criteria data. The results of the sub-criteria list page are shown in Figure 7.
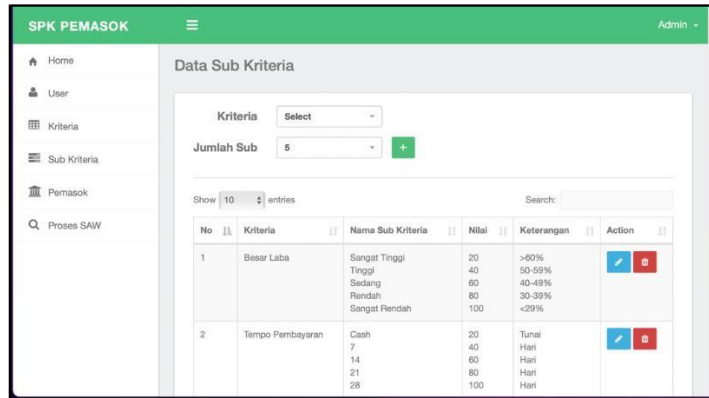
Fig.7. Sub Criteria Menu Pages

4) Pages For Supplier Management

he supplier management page that has been created can be used to manage supplier data that will be used in the calculation process. The supplier management page is divided into a list page and a supplier form. The supplier list page can be used to view the supplier list, search for supplier data and delete supplier data. The results of making a supplier list page are shown in Figure 8.
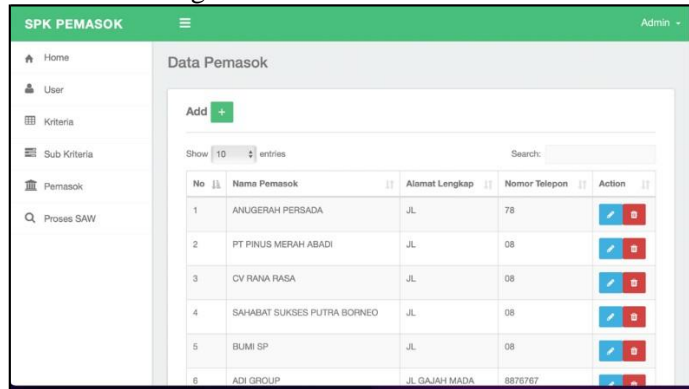

Fig.8. Supplier Menu Display

5) Pages For SAW Process

The page to display the suggestions that have been made can be used to display suggestions from the calculation process. The result of making a suggestion list page is shown in Figure 9.
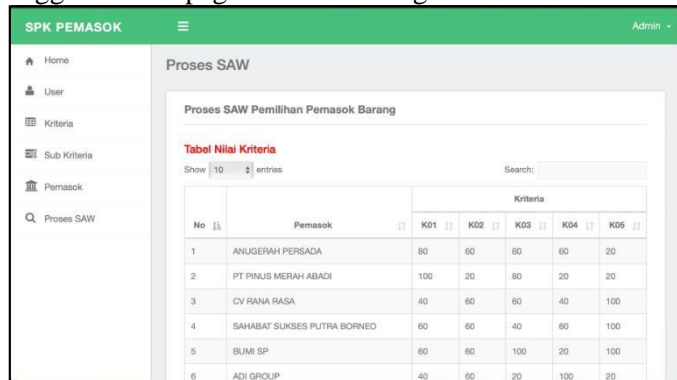

Fig. 9. SAW Process Menu Display

6) Evaluation of Accuracy Results

The testing process uses the confusion matrix method to find the level of accuracy of the system created by calculating accuracy and sensitivity.

Accuracy is the accuracy of the classification obtained, while sensitivity is a measure of the accuracy of a desired event on table 8.

Table 8. Confusion Matrix

Actual	*Predicted*	
	Positive = class 0	*Negative = class 1*
Positive = class 0	*True Positive (TP)*	*False negative (FN)*
Negative = class 1	*False Positive (FP)*	*True Negative (TN)*

Table 9. Confusion Matrix

Testing of Criteria	Total	ACCURACY TEST RESULT
TRUE POSITIVE (TP)	45	Equation = (TP+TN)/(TP+TN+FP+FN)
TRUE NEGATIVE (TN)		
FALSE POSITIVE (FP)		45/61
FALSE NEGATIVE (FN)	16	73,770492
TOTAL	61	73,77%

From the calculation results on table 9, the accuracy of the system is 73.77%, the error percentage is 26.23%.

CONCLUSIONS

Based on the research that has been done, the following conclusions can be drawn, the design of a decision support system for selecting a supplier of goods at the Diva Store has been successfully created with a system design using the Unified Modeling Language (UML) and is able to provide supplier decisions through ranking. The Simple Additive Weighting (SAW) method can be applied properly and correctly to the decision support system at the Diva Store. The steps and results of calculations manually are the same as the steps and results of calculations performed by the system. For testing applications based on the Confusion Matrix method, the accuracy is 73.77% with an error percentage of 26.23%.

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