



## Decision Support System For Choosing The Best Class Guardian With Simple Additive Weighting Method

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### ABSTRACT

Education is one of the most important things that can bring progress in a country. This study aims to design and build a decision system for the selection of the best supervisor class that can help the selection of supervisor class using the Simple Additive Weighting (SAW) method with pedagogic, personality, social, professionalism, education assessments. The SAW method is a method that uses the weighted sum. With this method the optimal solution is sought from alternatives and certain criteria. In this study, the researcher conducted research at SMA 1 Perbaungan so that the selection of the best supervisor class was right on target.

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## 1. Introduction

presently the use of science and technology is developing very fast and producing new innovations that must be balanced with the ability to adapt to these technologies. One such field is Supporting Decision System that can help on making decision .Supporting Decision System as an integrated computer tool that allows users to make decisions with computers, to make information useful in making unexpected semi-structured decisions. [1]

Basically SPK is a further development of a computerized management information system that is designed in such a way that is interactive with the aim of facilitating integration between various components such as processes, policies, analysis, experience and insights to make better decisions. [2]

Simple Additive Weighting (SAW) is a method that has the basic concept of finding the weighted sum of the branches of performance on each alternative of all attributes. The SAW method requires the process of normalizing the decision matrix to a scale that can be compared with existing alternative branches. The SAW method was chosen because it was able to select the best alternative from the specified alternatives based on the specified criteria. [3]

Research using the SAW method to help make decisions that have been carried out by previous studies such as SPK selection of the best teacher to assist in the process of selecting the best teacher [1]. SMA Negeri 1 Perbaungan is a public school that has a science and social studies major. Homeroom teacher has the function of being a teacher who is responsible for the supervisors or parents of students while at school and also helps students in the academic field. in determining the class of supervisor, principals often use subjective assessments of teachers who are eligible to be supervisor. Therefore we need a system that can determine the homeroom teacher quickly and objectively. To solve this problem, in this study, the reseacher chose a supporting decision system using the SAW method. This method was chosen because it is very easy and simple to use. And this method depends on the weighting value for each attribute of the class of supervisor, then continues the ordering process with the highest value used in the selection of the supervisor of the best alternative from the alternative comparison according to the criteria set by the School Principal.





## 2. Theory

### 2.1 Decision Support System

Supporting Decision System (SPK), generally defined as a system that is able to provide the ability to solve problems and the ability to communicate with semi-structured problems. Specifically, DSS is defined as a system that supports the work of managers or managers in solving semi-structured problems by providing information or supporting certain decisions.[5]

Decision making is the main function of the manager or administrator. Decision-making activities include identifying problems, evaluating these alternatives and selecting the best alternative. The manager's ability to make decisions can be improved if he knows and overcomes the theory and decision making techniques. By increasing the manager's ability to make decisions that are expected to improve the quality of decisions he makes, and this will certainly improve the work efficiency of the manager concerned.

#### a. Characteristics and Capabilities of Supporting Decision System

According to Turban there are several characteristics of the SPK, agreed as follows: [6]

- 1) supports all organizational activities.
- 2) supports several decisions that interact with each other
- 3) Can be used repeatedly and is constant.
- 4) There are two main components, namely models and data.
- 5) Using external and internal data.
- 6) Has the ability to what-if analysis and goal search analysis.
- 7) Using several quantitative models

#### b. Purpose of Supporting Decision System

According to Turban there are several objectives of the SPK:[10]

- 1) Assist managers in making decisions about semi-structured problems.
- 2) Provide support for manager's consideration and is not intended to replace the manager.
- 3) Increasing the effectiveness of decisions taken by managers more than increasing efficiency.
- 4) Computational speed, computers allow decision makers to do a lot of computing quickly at a low cost.
- 5) Increased productivity, Building decision-making groups, especially experts, can be very expensive. Computerized advocates can reduce the size of groups and allow their members to be in different locations (saving on travel costs).
- 6) Quality support, computers can improve the quality of decisions made. for example, the more data that is accessed, the more alternatives that can be evaluated.

### 2.2 Supporting Decision System (SAW) Method

The SAW (Supporting Decision System) method The SAW is often also known as the weighted sum method [2][4][7][11][12][14][15]. The basic concept of the SAW method is also known as the weighted sum method of performance branches for each alternative on all attributes. The SAW method requires a decision normalization process (X) for a scale that can be compared with all existing alternative branches [5][12][13]

The formula of the Simple Additive Weighting (SAW) Method.

$$r_{ij} = \left\{ \begin{array}{l} \frac{X_{ij}}{\text{Max } x_{ij}} \text{ If } j \text{ is an attribute} \\ i \\ \frac{\text{Min } X_{ij}}{x_{ij}} \text{ If } j \text{ is the cost attribute} \end{array} \right\}$$

Information:

- $r_{ij}$  = normalized performance branch value
- $x_{ij}$  = attribute value that is owned from criterion
- Max  $x_{ij}$  = the greatest value of each criterion
- Min  $x_{ij}$  = the smallest value of each criterion





*benefit* = if the biggest value is the best

*cost* = if the smallest value is the best

Where  $r_{ij}$  as a normalized performance rating from alternative  $A_i$  on the attribute  $C_j$ ;  $i=1,2,\dots,m$  and  $j=1,2,\dots,n$ . Preference value for each alternative ( $V_i$ ).

$V_i = n$

$$V_i = \sum_{j=1}^n w_j r_{ij} \dots\dots\dots(2)$$

Information:

$V_i$  = rank for each alternative

$W_j$  = weight value of each criterion

$r_{ij}$  =normalized performance rating value

The value of  $V_i$  which is chosen as an alternative  $A_i$  is chosen.

### a. Steps for Settlement with the SAW Method

There are several steps to completing the simple additive weighting method as follows: [2][6]

- 1) Determine alternative data ( $A_1$ ).
- 2) Determine the criteria used as a reference in decision support, namely  $C_1$ .
- 3) Determine the appropriate weight of each alternative on each criterion.
- 4) Make a decision matrix based on criteria.
- 5) Then display the matrix based on the adjusted equation for the attribute attribute (profit attribute or cost attribute) to get the normalization matrix  $R$ .
- 6) The final result obtained from the ranking process is the sum of the multiplication of the matalized matrix  $R$  with the weight vector so that the greatest value obtained will be chosen as the best alternative ( $A_1$ ) as the solution.

### b. Strengths and Weaknesses of the SAW Method

The Simple Additive Weighting (SAW) method has advantages, namely:

- 1) Determining the weight value for each attribute then begins with the ranking process which will select the best alternative from the alternative pair
- 2) the assessment will be more appropriate because it is based on the criterion value of the weighted preferences that have been determined.
- 3) There is a matrix normalization calculation according to the attribute value (between the value of benefits and costs)

Even though the SAW method is quite good, But the SAW method also has deficiency, namely:

- 1) used in total weighting
- 2) The calculation is done using crisp also fuzzy.
- 3) There is a difference in the matrix normalization calculation according to the attribute value (between the value of benefits and costs).

## 3. Research Methodology

This research was conducted by the Waterfall method, the chosen research instrument was interviews and observations because this instrument made it possible for researcher to collecting data, in Figure 1;



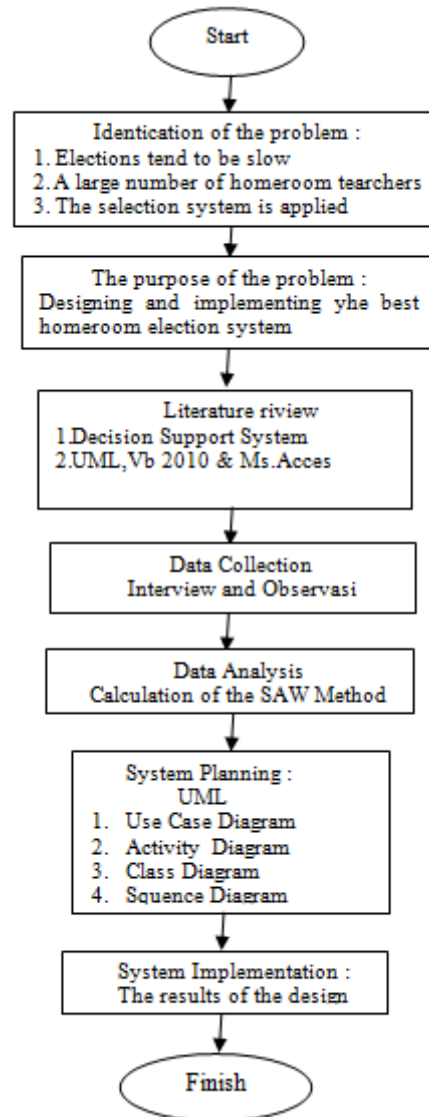


Figure 1 Research Framework

## 4. Analysis

### 4.1 Assessment Criteria

Determining Criteria for Evaluating the selection of the best class in SMA Negeri 1 Perbaungan in Table 1: Pedagogik (K1), Personality (K2), Social (K3), Professionalism (K4), Education (K5).

- 1) Determine Alternative (A1)  
Data on supervisors of SMA Negeri 1 Perbaungan class
- 2) Determine the criteria for making decision. Such as: Pedagogik, Personality, Social, Professionalisme.
- 3) Determine the Weight (W) of each criterion



Table 1.  
Weight table

Kode		Bobot
C1	Pedagogik	5
C2	Personality	5
C3	Social	5
C4	Profesionalisme	5
C5	Education	5

- 4) The next step is to make a set of each criterion with the weight of each set

Table 2.  
Table of Criteria and Weight Sets

No	Kriteria	Himpunan Kriteria	Bobot
1.	Pedagogik	(86-100) Very Good	5
		(76-85) Good	4
		(66-75) Enough	3
		(51-65) less	2
		(0-50) Very less	1
2.	Kepribadian	(86-100) Very Good	5
		(76-85) Good	4
		(66-75) Enough	3
		(51-65) less	2
		(0-50) Very less	1
3.	Sosial	(86-100) Very Good	5
		(76-85) Good	4
		(66-75) Enough	3
		(51-65) less	2
		(0-50) Very less	1
4.	Profesionalisme	(86-100) Very Good	5
		(76-85) Good	4
		(66-75) Enough	3
		(51-65) less	2
		(0-50) Very less	1
5.	Pendidikan	(86-100) Very Good	5
		(76-85) Good	4
		(66-75) Enough	3
		(51-65) less	2
		(0-50) Very less	1

- 5) Making a decision matrix based on the criteria (C1), then making a normalization matrix based on the adjusted equation so that a normalized matrix (R) is obtained.
- 6) The Final Result is the ranking process of normalized matrix multiplication (R) with the weight in order to obtain the largest value as an alternative (A1).

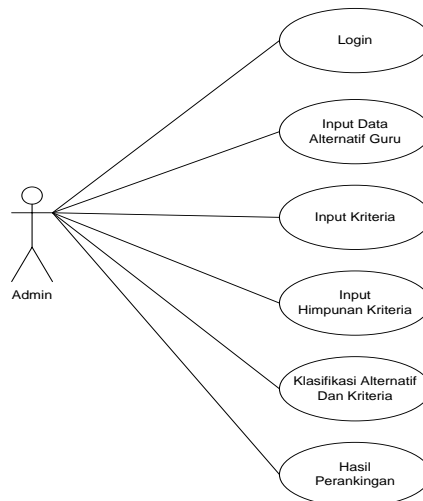


figure 2 Use Case Diagrams

- A. In determining the homeroom teacher, 4 out of 24 homeroom teachers are selected in SMA Negeri 1 Perbaungan. They are is:
1. Ir. Julina
  2. Tuti Sumiyati Sipahutar, S.Pd
  3. Asniwati, S.Pd
  4. Dedy Wida I. Simanjuntak, S.Pd

Table 3  
Initial Value Alternative Matrices

Nama Alternatif	Criteria				
	C1	C2	C3	C4	C5
Ir. Julina, M.Pd	4	1	2	3	4
Tuti Sumiyati Sipahutar, S.Pd	5	3	3	5	3
Asniwati, S.Pd. MM	2	1	4	4	4
Dedy Wida I. Simanjuntak, S.Pd	4	2	3	4	3

B. The next step is to normalize the criteria using the formula:

a. For Pedagogic Criteria (C1).

$$r_{1,1} = \frac{4}{\text{Max}\{4,5,2,4\}} = \frac{4}{5} = 0.8$$

$$r_{2,1} = \frac{5}{\text{Max}\{4,5,2,4\}} = \frac{5}{5} = 1$$

$$r_{3,1} = \frac{2}{\text{Max}\{4,5,2,4\}} = \frac{2}{5} = 0.4$$

$$r_{4,1} = \frac{4}{\text{Max}\{4,5,2,4\}} = \frac{4}{5} = 0.8$$

b. For Personality Criteria (C2).

$$r_{1,2} = \frac{1}{\text{Max}\{1,3,1,2\}} = \frac{1}{3} = 0.3333333333333333$$





$$r_{2,2} = \frac{3}{\text{Max}\{1,3,1,2\}} = \frac{3}{3} = 1$$

$$r_{3,2} = \frac{1}{\text{Max}\{1,3,1,2\}} = \frac{1}{3} = 0.3333333333333333$$

$$r_{4,2} = \frac{2}{\text{Max}\{1,3,1,2\}} = \frac{2}{3} = 0.6$$

c. For Social Criteria (C3).

$$r_{1,3} = \frac{2}{\text{Max}\{2,3,4,3\}} = \frac{2}{4} = 0.5$$

$$r_{2,3} = \frac{3}{\text{Max}\{2,3,4,3\}} = \frac{3}{4} = 0.75$$

$$r_{3,3} = \frac{4}{\text{Max}\{2,3,4,3\}} = \frac{4}{4} = 1$$

$$r_{4,3} = \frac{3}{\text{Max}\{2,3,4,3\}} = \frac{3}{4} = 0.75$$

d. For Professional Criteria (C4).

$$r_{1,4} = \frac{3}{\text{Max}\{3,5,4,4\}} = \frac{3}{5} = 0.6$$

$$r_{2,4} = \frac{5}{\text{Max}\{3,5,4,4\}} = \frac{5}{5} = 1$$

$$r_{3,4} = \frac{4}{\text{Max}\{3,5,4,4\}} = \frac{4}{5} = 0.8$$

$$r_{4,4} = \frac{4}{\text{Max}\{3,5,4,4\}} = \frac{4}{5} = 0.8$$

e. For Educational Criteria (C5).

$$r_{1,5} = \frac{4}{\text{Max}\{4,3,4,3\}} = \frac{4}{4} = 1$$

$$r_{2,5} = \frac{3}{\text{Max}\{4,3,4,3\}} = \frac{3}{7} = 0.75$$

$$r_{3,5} = \frac{4}{\text{Max}\{4,3,4,3\}} = \frac{4}{4} = 1$$

$$r_{4,5} = \frac{3}{\text{Max}\{4,3,4,3\}} = \frac{3}{7} = 0.75$$

C. To simplify further calculations

Namely ranking data, then the calculation results above are made in the matrix as follows:

D. The last step of the homeroom step with the SAW method is ranking, namely by the formula:

$$V_i = \sum_{j=i}^n w_j r_{ij}$$

E. Weight values (W) for the assessment criteria represent predetermined values, namely:

$$W = (5; 5; 5; 5; 5)$$

Then the rank calculation for each homeroom teacher is as follows:

$$A1 = (5 \times 0.8) + (5 \times 0.3333333333333333) + (5 \times 0.5) + (5 \times 0.6) + (5 \times 1)$$

$$= 4 + 1.666666666666667 + 2.5 + 5$$

$$= 16.166666666666667$$

$$A2 = (5 \times 1) + (5 \times 1) + (5 \times 0.75) + (5 \times 1) + (5 \times 0.75)$$

$$= 5 + 5 + 3.75 + 5 + 3.75$$

$$= 22.5$$

$$A3 = (5 \times 0.4) + (5 \times 0.3333333333333333) + (5 \times 1) + (5 \times 0.8) + (5 \times 1)$$





$$\begin{aligned}
&= 2 + 1.66666666667 + 5 + 4 + 5 \\
&= 17.6666666666667 \\
A4 &= (5 \times 0.8) + (5 \times 0.6) + (5 \times 0.75) + (5 \times 0.8) + (5 \times 0.75) \\
&= 4 + 3 + 3.75 + 4 + 3.75 \\
&= 18.8333333333333
\end{aligned}$$

F. Based on the above calculation, the rank of supervisor class achievement is obtained as a reference for the head master in determining the the best class supervisor.

Table 4  
Ranking table

No	Alternatif	Rangking Result
1	TutiSumiyatiSipahutar, S.Pd	22.5
2	Dedy Wida I. Simanjuntak, S.Pd	18.0833333333333
3	Asniwati, S.Pd	17.6666666666667
4	Ir. Julina	16.1666666666667

$$X = \begin{Bmatrix} 0.8 & 0.3333333 & 0.5 & 0.6 & 1 \\ 1 & 1 & 0.75 & 1 & 0.75 \\ 0.4 & 0.3333333 & 1 & 0.8 & 1 \\ 0.8 & 0.6 & 0.75 & 0.8 & 0.75 \end{Bmatrix}$$

## 5. Conclusion

Based on the research and description above, the following conclusions can be obtained:

1. Problems that occur with respect to the selection of the appropriate or not homeroom teacher can be approved by applying the Simple Additive Weighting Method (SAW).
2. By applying the Simple Additive Weighting (SAW) Method for the selection of the best homeroom teacher can be adjusted to the criteria and use weights to be used with the algorithm.
3. The system used is built with Visual studio 2010 and Microsoft Access 2010 programming language to determine the best homeroom teacher quickly and accurately.

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