Journal of Artificial Intelligence and Engineering Applications

Website: https://ioinformatic.org/

15 yrs October 202 3 . Vol. 3 . No. 1; e-ISSN : 2808-4519

Employee Selection Decision Support System The Best Marketing at SMK Dwiwarna Medan Using the Simple Additive Weighting Method

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Abstract

Medan Dwiwarna Private Vocational School is a private school that has the main advantage of being a center of excellence (PK) school. Medan Dwiwarna Vocational School has 8 (eight) school departments. Currently, the best marketing selection system at Dwiwarna Private Vocational School in Medan still uses manual selection methods, because there is no system that can automatically select the best employees based on criteria and assessment of marketing performance using an application system. The criteria determined to be able to select one of the best marketing employees to work at Dwiwarna Private Vocational School in Medan require that every marketing employee must have high discipline and royalty at Dwiwarna Private Vocational School in Medan. To find the right solution in this research, a decision support system was created that can select one of the best marketing employees to be given a bonus for their performance using a simple additive weighting method which functions to provide an assessment of each marketing employee with the final result of ranking the best performance in the marketing sector.

Keywords: *Medan Dwiwarna Private Vocational School, Marketing Employees, Performance, Simple Additive Weighting, Ranking.*

1. Introduction

Medan Dwiwarna Private Vocational School is a private school that has the main advantage of being a center of excellence (PK) school. Dwiwarna Medan Vocational School has 8 (eight) departments for vocational high schools (SMK) with laboratory facilities in each department that meet national standards. The marketing task for the Dwiwarna Vocational School is to recruit prospective students by visiting a junior high school (junior high school) which aims to introduce the Dwiwarna Medan Vocational School to junior high school students so they are interested in entering the Dwiwarna Medan Vocational School. The current problem occurs in the best marketing selection system at the Dwiwarna Medan Private Vocational School, which still uses the manual selection method, because there is no system that can automatically select the best employees based on criteria and an assessment of marketing performance using an application system [1].

Therefore, the right solution to determine the selection of the best marketing employees, Dwiwarna Medan Private Vocational School has a policy in selecting and assessing the performance of marketing employees based on the results of marketing employee performance. It will be seen who is better at recruiting new students to join SMK Dwiwarna Medan .

The criteria determined to be able to select one of the best marketing employees to work at the Medan Dwiwarna Private Vocational School require every marketing employee to have high discipline and royalty at the Medan Dwiwarna Private Vocational School. To find the right solution in this research, a decision support system was created that can select one of the best marketing employees to be given a bonus for their performance using a simple additive weighting method which functions to provide an assessment of each marketing employee with the final result of ranking the best performance in the marketing sector.

The right decision support system to be able to make a decision more quickly and precisely, in accordance with the criteria that will be determined to determine the best marketing employees are assessed based on performance which will be given a bonus by the Dwiwarna Medan Private Vocational School. To be able to solve this problem using the simple additive weighting method which functions to determine the weight value of each attribute, then proceed with a ranking process which will select the best alternative from a number of alternatives and the assessment will be more precise because it is based on predetermined criteria values and preference weights.

This decision support system has the advantage of expanding the decision maker's ability to process information to make calculated final results because the data is analyzed first. Research data regarding the assessment of the selection of marketing employees at the Medan

Dwiwarna Private Vocational School, the assessment is in the form of a questionnaire filled in by the principal and administrator of the Medan Dwiwarna Private Vocational School. The criteria data used by the simple additive weighting method has a weight of 5 criteria which is in accordance with the policies made by the school.

Completion using the simple additive weighting (SAW) method of multi-criteria decision making which is used to select the best alternative from a number of predetermined criteria. This method involves attributes or criteria that are measured in numerical form and takes into account the relative weight of each criterion for selecting the best marketing person to work at Dwiwarna Private Vocational School in Medan.

2. Research Methodology

There are several problem solving methods that will be discussed in this research which will be described as below.

2.1. Decision Support Systems

Decision Support Systems are information systems that provide information, modeling and data manipulation. The system is used to assist decision making in semi-structured situations, where no one knows for sure how decisions should be made [2].

Decision support systems provide alternatives in determining who the best employee will be selected. Because the nature of the decision support system is objective, fast, accurate and computer-based, it will make it easier to select the best employees. A decision support system is a computer-based system, which can support decision making to resolve semi-structured problems, by utilizing existing data and then processing it into information in the form of suggestions towards a particular decision. According to Kusrini, a decision support system (DSS) is an information system that provides information, modeling and data manipulation [3].

2.2. Simple Additive Weighting (SAW) Method

The problem solving method related to the title taken by the author is the Simple Additive Weighting method, often known as the weighted addition method. The basic concept of the Simple Additive Weighting method is to find the weighted sum of the performance ratings for each alternative on all attributes. The Simple Additive Weighting method can help in decision making in a case, however, calculations using the Simple Additive Weighting method only produce the largest value which will be selected as the best alternative. Calculations will be in accordance with this method if the selected alternative meets the specified criteria. The Simple Additive Weighting method is more efficient because the time required for calculations is shorter. The Simple Additive Weighting method requires a process of normalizing the decision matrix (X) to a scale that can be compared with all existing alternative ratings [4].

2.3. Employee

Employee performance is generally a benchmark used by companies in assessing their employees. Employees who perform according to standards or even exceed them can be given awards or vice versa, those who have not been able to reach the specified standards can be subject to consequences. Forms of reward and consequences can be in the form of promotions, increases in compensation, transfers, and termination of employment. Through the performance assessment process, companies can also find out to what extent their goals have been achieved [5].

3. Application of the Simple Additive Weighting (SAW) Method

So employee data is obtained which can be used as research data and as analytical data that will be carried out in the application of the method. The following supporting data for this research can be seen in table 3.1 as follows:

Table 1: Criteria used

Code	Criteria	Type Criteria	Mark	Attribute
C1	Presence	Very well	5	Benefits
		Good	4	
		Enough	3	
		Bad	1	
C2	Work result	Very satisfactory	5	Benefits
		Satisfying	4	
		Good enough	3	
C3	Performance	Very good	5	Benefits
		Good	3	
		Enough	1	
C4	Work attitude	Very well	5	Benefits
		Good	4	
		Pretty good	3	
		Enough	2	
		Bad	1	
C5	Honesty	Very good	4	Benefits
		Good	3	
		Pretty good	2	

After determining the type of attribute criteria included in the type of attribute Benefit or Cost. Benefit if the largest value of a criterion is the best alternative. Cost if the smallest value of a criterion is the best alternative. Determine the weight value per criterion (Wij), which is the value that determines the minimum value that must be achieved for each existing criterion. The criterion weight value is determined by the system user. Determination of weight seen in the following table:

Table 2: Criteria weighting

Criteria Name	Code	Weight	
Presence	C1	40	0.4
Work result	C2	20	0.2
Performance	C3	20	0.2
Work attitude	C4	10	0.1
Honesty	C5	10	0.1
Total		100	1

From the value of the criteria weighting table then converted into a matrix form, it can be seen as follows:
W = [0.4, 0.2, 0.2, 0.1, 0.1]
The next stage is to determine alternative values for each criterion for each alternative and create a decision matrix. Alternative values are inputted by the user, we can see in the following table:

Table 3: Assessment of Alternatives According to Criteria

Alternative	Criteria				
	C1	C2	C3	C4	C5
	Presence	Work result	Performance	Work attitude	Honesty
A1	3	4	3	2	5
A2	4	3	3	4	3
A3	5	2	1	4	1
A4	1	2	5	5	1
A5	5	3	1	5	3

Then the assessment table for alternatives is converted into a matrix form, as below:

Xij =

$$\begin{pmatrix} 3 & 4 & 3 & 2 & 5 \\ 4 & 3 & 3 & 4 & 3 \\ 5 & 2 & 1 & 4 & 1 \\ 1 & 2 & 5 & 5 & 1 \\ 5 & 3 & 1 & 5 & 3 \\ 4 & 4 & 3 & 2 & 2 \\ 3 & 4 & 3 & 3 & 2 \\ 4 & 5 & 3 & 5 & 3 \\ 3 & 4 & 5 & 3 & 3 \\ 5 & 3 & 1 & 3 & 2 \\ 5 & 5 & 3 & 4 & 3 \\ 4 & 4 & 3 & 3 & 2 \\ 3 & 4 & 3 & 3 & 4 \\ 4 & 5 & 5 & 3 & 3 \\ 5 & 3 & 3 & 2 & 3 \\ 3 & 3 & 3 & 3 & 2 \end{pmatrix}$$

Then normalize matrix X to become Matrix R. Normalize matrix

Rij = (Xij / max{Xij})
Rij = (min{Xij} /Xij)

Where :
Ri j = normalized performance rating value
Xij = attribute value for each criterion
Max Xi = the greatest value of each criterion i
Min Xij = the smallest value of each criterion i
Benefit = if the greatest value is the best
Cost = if the smallest value is the best

From the normalization equation for matrix X, the matrix R is obtained as follows:

R =

$$\begin{pmatrix} 0.6 & 0.8 & 0.6 & 0.4 & 1 \\ 0.8 & 0.6 & 0.6 & 0.8 & 0,6 \\ 1 & 0.4 & 0.2 & 0.8 & 0.2 \\ 0.2 & 0.4 & 1 & 1 & 0.2 \\ 1 & 0.6 & 0.2 & 1 & 0.6 \\ 0.8 & 0.8 & 0.6 & 0.4 & 0.4 \\ 0.6 & 0.8 & 0.6 & 0.6 & 0.4 \\ 0.8 & 1 & 0.6 & 1 & 0.6 \\ 0.6 & 0.8 & 1 & 0.6 & 0.6 \\ 1 & 0.6 & 0.2 & 0.6 & 0.4 \\ 1 & 1 & 0.6 & 0.8 & 0.6 \\ 0.6 & 0.8 & 0.6 & 0.6 & 0.4 \\ 0.6 & 0.8 & 0.6 & 0.6 & 0.8 \\ 0.8 & 1 & 1 & 0.6 & 0.6 \\ 1 & 0.6 & 0.6 & 0.4 & 0.6 \\ 0.6 & 0.6 & 0.6 & 0.6 & 0.4 \end{pmatrix}$$

Finally, carry out the ranking process, carry out the ranking process using the following equation.

$$V_i = \sum_{j=1}^{n} w_j \, r_{ij}$$

Where :
Vi = ranking for each alternative
wj = weight value of each criterion
rij = normalized performance rating value

A larger Vi indicates that alternative Ai is more selected. The weight w that has been given is W = [0.25, 0.2, 0.15, 0.25, 0.15]
V1 = (0.4*0.6) +(0.2*0.8) +(0.2*0.6) + (0.1*0.4) +(0.1 *1)
V1 = 0.24+0.16+0.12+0.04+0.1
V1 = 0.66

V2 = (0.4*0.8) +(0.2*0.6) +(0.2*0.6) + (0.1*0.8) +(0.1 *0.6)
V2 = 0.32+0.12+0.12+0.8+0.06
V2 = 0.7

V3 = (0.4*1) +(0.2*0.4) +(0.2*0.2) + (0.1*0.8) +(0.1 *0.2)
V3 = 0.4+0.08+0.04+0.08+0.02
V3 = 0.62

V4 = (0.4*0.2) +(0.2*0.4) +(0.2*1) + (0.1*1) +(0.1 *0.2)
V4 = 0.08+0.08+0.2+0.1+0.02
V4 = 0.48

V5 = (0.4*1) +(0.2*0.6) +(0.2*0.2) + (0.1*1) +(0.1 *0.2)
V5 = 0.4+0.12+0.04+0.1+0.06
V5 = 0.72

V6 = (0.4*0.8) +(0.2*0.8) +(0.2*0.6) + (0.1*0.4) +(0.1 *0.4)
V6 = 0.32+0.16+0.12+0.04+0.04
V6 = 0.68

V7 = (0.4*0.6) +(0.2*0.8) +(0.2*0.6) + (0.1*0.4) +(0.1 *0.4)
V7 = 0.24+0.16+0.12+0.06+0.04
V7 = 0.62

V8 = (0.4*0.8) +(0.2*1) +(0.2*0.6) + (0.1*1) +(0.1 *0.6)
V8 = 0.32+0.2+0.12+0.1+0.06
V8 = 0.8

V9 = (0.4*0.6) +(0.2*0.8) +(0.2*1) + (0.1*0.6) +(0.1*0.6)
V9 = 0.24+0.16+0.12+0.06+0.06
V9 = 0.64

V10 = (0.4*1) +(0.2*0.6) +(0.2*0.2) + (0.1*0.6) +(0.1*0.4)
V10 = 0.4+0.12+0.04+0.06+0.04
V10 = 0.66

V11 = (0.4*1) +(0.2*1) +(0.2*0.6) + (0.1*0.8) +(0.1*0.6)
V11 = 0.4+0.12+0.04+0.08+0.06
V11 = 0.86

V12 = (0.4*0.6) +(0.2*0.8) +(0.2*0.6) + (0.1*0.6) +(0.1*0.4)
V12 = 0.24+0.16+0.12+0.06+0.04
V12 = 0.62

V13 = (0.4*0.6) +(0.2*0.8) +(0.2*0.6) + (0.1*0.6) +(0.1*0.8)
V13 = 0.24+0.16+0.12+0.06+0.08
V13 = 0.66

V14 = (0.4*0.8) +(0.2*1) +(0.2*1) + (0.1*0.6) +(0.1*0.6)
V14 = 0.32+0.2+0.2+0.06+0.06
V14= 0.84

V15 = (0.4*1) +(0.2*0.6) +(0.2*0.6) + (0.1*0.4) +(0.1*0.6)
V15 = 0.4+0.12+0.12+0.04+0.06
V15= 0.74

V16 = (0.4*0.6) +(0.2*0.6) +(0.2*0.6) + (0.1*0.6) +(0.1*0.4)
V16 = 0.24+0.12+0.12+0.06+0.04
V16= 0.58

From the final value calculation stage process, results are obtained as in the table below:

Table 4: Results of Alternative Ranking Tables

Alternative	Subcriteria Name	Mark	Rank
A11	Putri Aprianti, S.Pd	0.86	1
A14	Nasmita Lubis, SE	0.84	2
A8	Husni Amri, ST	0.8	3
A15	Fahtoni Hidayat, S.Pd	0.74	4
A5	Joko Suprianto, S.Kom	0.72	5
A2	Devi Oktaviani, S.Pd	0.7	6
A6	Kirno, S.Pd	0.68	7
A1	Dewi Amaliea, SE	0.66	8
A10	Eka Dwi Yanto, S.Pd	0.66	8
A13	Mhd. Yunus, S.Pd	0.66	8
A9	Ridwan Sitorus, S.Pd	0.64	9
A7	Ella Dwinta, S, Kom	0.62	10
A12	Abdul Halim, S.Pd	0.62	10
A3	Juwita Harahap, SS	0.62	10
A16	Sono Zebua, S.Pd	0.58	11
A4	Indriani Hafsah, S.Pd	0.48	12

Then the alternative that has the highest score is A11 with the sub-criteria name Putri Aprinati, S.Pd with a value of 0.86 as the best marketing at the Dwiwarna Private Vocational School in Medan.

3.1. Interface Page Display

The appearance of the seminar application testing that will be displayed in chapter 4 is in the form of an image that already has a mobile web-based system application test, namely as follows.

1. Home page

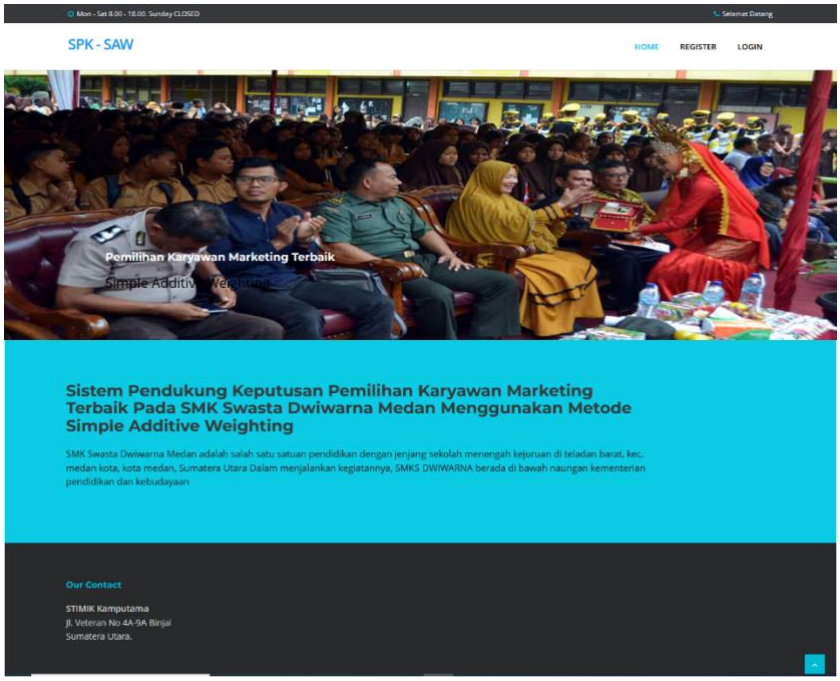

Figure 1: Home Page

2. Registration page

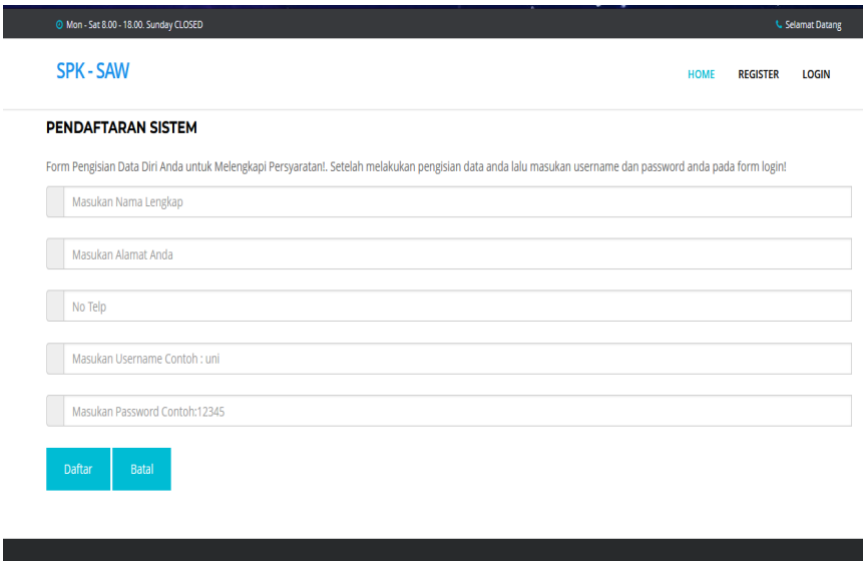

Figure 2: Register page

3. Login Page

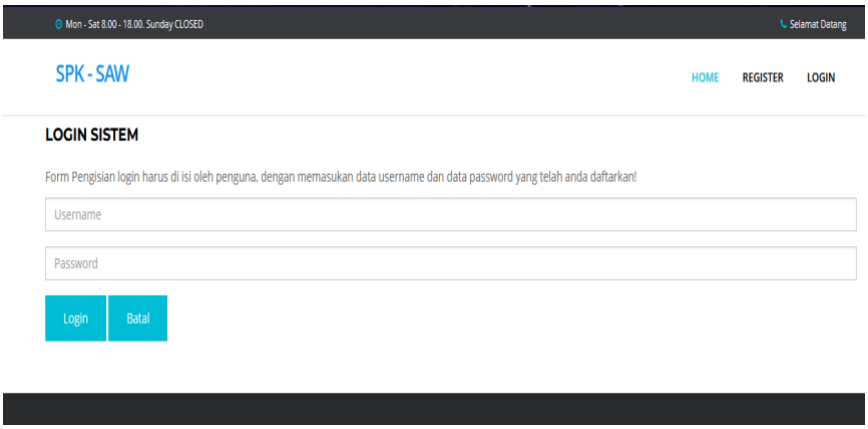

Figure 3 : Login Page

4. Criteria page

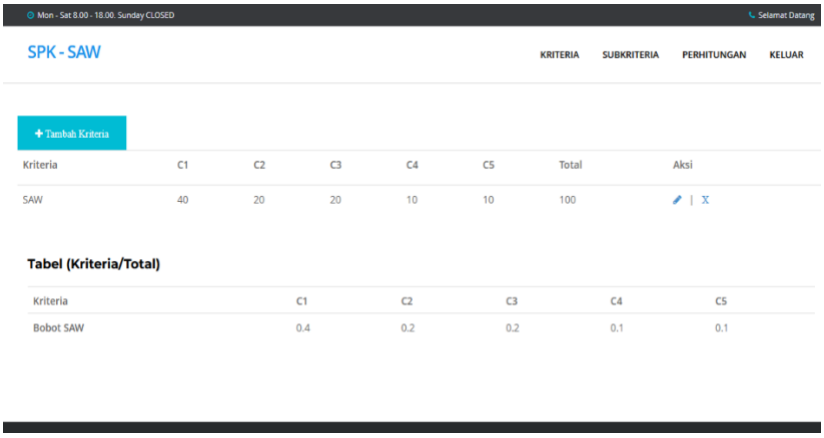

Figure 4: Algorithm Page

5. Alternative Pages

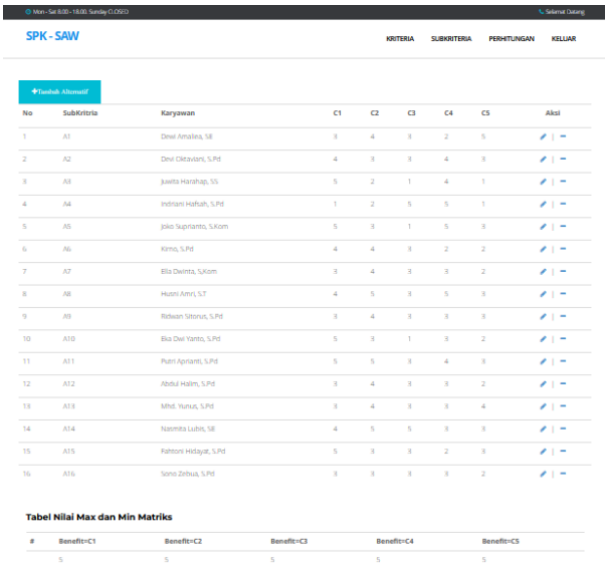

Figure 5: Alternative Pages

6. Calculation Page

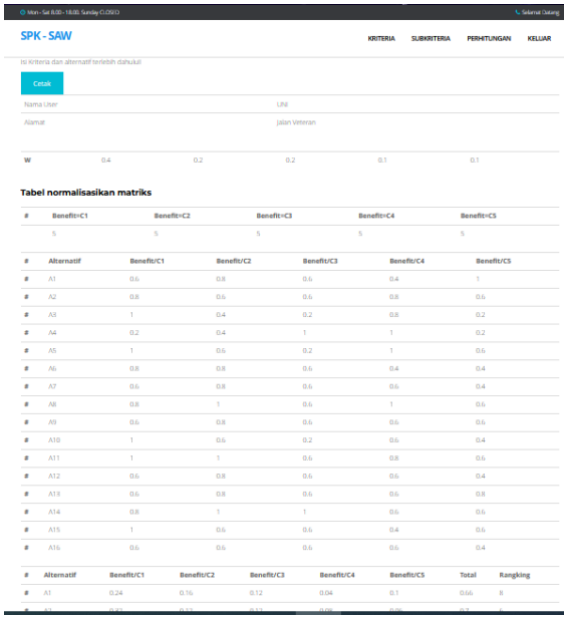

Figure 6: Calculation Page

4. Conclusion

Based on the results of creating a decision support system for selecting the best marketing employees at Dwiwarna Private Vocational School using the Simple Additive Weighting method, several conclusions were obtained as follows:

1. Produced the best marketing selection with the highest score of 0.86 alternative code A11 with the employee name Putri Aprianti, S.Pd.
2. Using data from 16 marketing employees and data assessment made by Dwiwarna Private Vocational School using the SAW method.
3. Produce a website-based decision support system application using the PHP programming language, database and MySQL.

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