

IMPLEMENTATION OF SIMPLE ADDITIVE WEIGHTING (SAW) ALGORITHM IN DECISION SUPPORT SYSTEM FOR DETERMINING WORKING AREA FOR COOPERATIVE

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Abstract

Today, the cooperative in Medan has difficulty in determining the work area for employees. The difficulty in determining the work area of employees is because the number of employees does not meet the needs. In addition, the employees' lack of knowledge about the work area will be a problem. This has resulted in obstruction of the performance of employees at the Medan Cooperative. To overcome this problem, a decision support system is needed that can assist in making decisions to determine the employee's work area. Using the Simple Additive Weighting (SAW) method is expected to help companies to be able to assess and determine employees who meet the criteria and can work for a long time. The Decision Support System for selecting the work area that is currently being designed is the Decision Support System for Determining Work Areas in Cooperatives in Medan Using the Simple Additive Weighting (SAW) Method. Where with this system it can make it easier for companies to place employee work areas based on the area where the employee lives. The system designed can be used for all employees because it is very easy to use, no special computer skills are needed. So that employees can use this system to generate reports about their work area based on residence. Decision support system application designed using the Simple Additive Weighting (SAW) method at the Cooperative in Medan, can determine the work area of employees.

Keyword : Saw, Decission, Cooperative

1. Introduction

Decision support systems are information-producing systems aimed at a particular problem that must be solved by managers and can assist managers in making decisions. Decision support system is a systematic approach to the essence of a problem, gathering mature determinants of the alternatives faced and taking the most appropriate action. A decision support system is a computer-based system that produces various alternative decisions to assist management in dealing with various structured or unstructured problems using data and models. SAW method Is a weighted addition method. The basic concept of the SAW method is to find the weighted sum of the performance ratings for each alternative on all criteria. The SAW method requires a decision matrix normalization process (X) to a scale that can be compared with all available alternative ratings. The SAW method recognizes 2 (two) attributes, namely the benefit criteria and the cost criteria. The fundamental difference between these two criteria is in the selection criteria when making decisions. [1]–[5]

A problem in life can be solved by various methods which may be given direct problem solving or provide some alternative solutions for problem solving. An agency will of course be very careful in selecting and placing employees who work in the agency concerned. Mistakes in choosing and determining work placements will certainly have a negative impact on the performance of the agency. Therefore we need a systematic method and appropriate selection in determining the work area of employees. In addition to assessing technical abilities / skills, agencies usually also assess employees' physical and psychological health. Due to the large number of participants and the criteria for recruitment and placement of employees, the agency sometimes encountered difficulties. Therefore, an agency needs a system that can help analyze the assessment of employees with the criteria desired by the agency for the placement of these employees. [6]–[11]

3. Results and Discussion

In this research, the writer tries to apply the Simple Additive Weighting (SAW) method in determining the work area. The cooperative in Medan will determine the employee's work area. The criteria used to take measurements can be seen in table 1.

Table 1. Criteria Table

CRITERIA	SUB CRITERIA	SCORE
EDUCATIONAL QUALIFICATIONS (C1)	SMA/SMK/MA	60
	D1	70
	D3	80
	D4/S1	90
	S2	100
WORK DISCIPLINE (C2)	Very less	60
	Less	70
	Enough	80
	Good	90
	Very good	100
WORK QUALITY (C3)	Very less	60
	Less	70
	Enough	80
	Good	90
	Very good	100
RESPONSIBLE (C4)	Very less	60
	Less	70
	Enough	80
	Good	90
	Very good	100
ETHICS (C5)	Very less	60
	Less	70
	Cukup	80
	Enough	90
	Very good	100

The weight for each assessment criterion can be seen in table 2

Table 2. Criteria Weights

CRITERIA	QUALITY
EDUCATIONAL QUALIFICATIONS (W1)	65
WORK DISCIPLINE (W2)	60
WORK QUALITY (W3)	75
RESPONSIBLE (W4)	60
ETHICS (W5)	70

Furthermore, the criterion weights are normalized. The normalization of the criteria weights are as follows:

$$w_1 = \frac{65}{65 + 60 + 75 + 60 + 70} = 0.20$$

$$w_2 = \frac{60}{65 + 60 + 75 + 60 + 70} = 0.18$$

$$w_3 = \frac{75}{65 + 60 + 75 + 60 + 70} = 0.23$$

$$w_4 = \frac{60}{65 + 60 + 75 + 60 + 70} = 0.18$$

$$w_5 = \frac{70}{65 + 60 + 75 + 60 + 70} = 0.21$$



There are five employees who become candidates (alternatives) whose work area placement will be determined, as can be seen in table 3.

Table 3. Table of Alternative Values in Each Criterion

Alternative	Criteria				
	C1	C2	C3	C4	C5
Epipanias Gulo	60	70	80	90	100
Edi Susanto Lombu	70	80	90	100	60
Toni Gea	80	70	90	90	80
Burhan	80	90	90	80	80
Joko	70	70	80	70	70

The next step is normalization:

$$r_{11} = \frac{60}{\max \{60; 70; 80; 80; 70\}} = \frac{60}{80} = 0.75$$

$$r_{21} = \frac{70}{\max \{60; 70; 80; 80; 70\}} = \frac{70}{80} = 0.88$$

$$r_{31} = \frac{80}{\max \{60; 70; 80; 80; 70\}} = \frac{80}{80} = 1$$

$$r_{41} = \frac{80}{\max \{60; 70; 80; 80; 70\}} = \frac{80}{80} = 1$$

$$r_{51} = \frac{70}{\max \{60; 70; 80; 80; 70\}} = \frac{70}{80} = 0.88$$

$$r_{12} = \frac{70}{\max \{70; 80; 70; 90; 70\}} = \frac{70}{90} = 0.78$$

$$r_{22} = \frac{80}{\max \{70; 80; 70; 90; 70\}} = \frac{80}{90} = 0.89$$

$$r_{32} = \frac{70}{\max \{70; 80; 70; 90; 70\}} = \frac{70}{90} = 0.78$$

$$r_{42} = \frac{90}{\max \{70; 80; 70; 90; 70\}} = \frac{90}{90} = 1$$

$$r_{52} = \frac{70}{\max \{70; 80; 70; 90; 70\}} = \frac{70}{90} = 0.78$$

$$r_{42} = \frac{90}{\max \{70; 80; 70; 90; 70\}} = \frac{90}{90} = 1$$

$$r_{52} = \frac{70}{\max \{70; 80; 70; 90; 70\}} = \frac{70}{90} = 0.78$$

$$r_{13} = \frac{80}{\max \{80; 90; 90; 90; 80\}} = \frac{80}{90} = 0.89$$

$$r_{23} = \frac{90}{\max \{80; 90; 90; 90; 80\}} = \frac{90}{90} = 1$$

$$r_{33} = \frac{90}{\max \{80; 90; 90; 90; 80\}} = \frac{90}{90} = 1$$

$$r_{43} = \frac{90}{\max \{80; 90; 90; 90; 80\}} = \frac{90}{90} = 1$$

$$r_{53} = \frac{80}{\max \{80; 90; 90; 90; 80\}} = \frac{80}{90} = 0.89$$

$$r_{14} = \frac{90}{\max \{90; 100; 90; 80; 70\}} = \frac{90}{100} = 0.9$$

$$r_{24} = \frac{100}{\max \{90; 100; 90; 80; 70\}} = \frac{100}{100} = 1$$

$$r_{34} = \frac{90}{\max \{90; 100; 90; 80; 70\}} = \frac{90}{100} = 0.9$$

$$r_{44} = \frac{80}{\max \{90; 100; 90; 80; 70\}} = \frac{80}{100} = 0.8$$

$$r_{54} = \frac{70}{\max \{90; 100; 90; 80; 70\}} = \frac{70}{100} = 0.7$$

$$r_{15} = \frac{100}{\max \{100; 60; 80; 80; 70\}} = \frac{100}{100} = 1$$

$$r_{25} = \frac{60}{\max \{100; 60; 80; 80; 70\}} = \frac{60}{100} = 0.6$$

$$r_{35} = \frac{80}{\max \{100; 60; 80; 80; 70\}} = \frac{80}{100} = 0.8$$

$$r_{45} = \frac{80}{\max \{100; 60; 80; 80; 70\}} = \frac{80}{100} = 0.8$$

$$r_{55} = \frac{70}{\max \{100; 60; 80; 80; 70\}} = \frac{70}{100} = 0.7$$

The results of normalization can be seen in the following matrix:

$$R = \begin{bmatrix} 0.75 & 0.78 & 0.89 & 0.9 & 1 \\ 0.88 & 0.89 & 1 & 1 & 0.6 \\ 1 & 0.78 & 1 & 0.9 & 0.8 \\ 1 & 1 & 1 & 0.8 & 0.8 \\ 0.88 & 0.78 & 0.89 & 0.7 & 0.7 \end{bmatrix}$$

$$V_1 = 0.20 \cdot 0.75 + 0.18 \cdot 0.78 + 0.23 \cdot 0.89 + 0.18 \cdot 0.9 + (0.21 \cdot 1) = 0.15 + 0.14 + 0.21 + 0.16 + 0.21 = 0.87$$

$$V_2 = 0.20 \cdot 0.88 + 0.18 \cdot 0.89 + 0.23 \cdot 1 + 0.18 \cdot 1 + (0.21 \cdot 0.6) = 0.18 + 0.16 + 0.23 + 0.18 + 0.12 = 0.87$$

$$V_3 = 0.20 \cdot 1 + 0.18 \cdot 0.78 + 0.23 \cdot 1 + 0.18 \cdot 0.9 + (0.21 \cdot 0.8) = 0.20 + 0.14 + 0.23 + 0.16 + 0.17 = 0.9$$

$$V_4 = 0.20 \cdot 1 + 0.18 \cdot 1 + 0.23 \cdot 1 + 0.18 \cdot 0.8 + (0.21 \cdot 0.8) = 0.20 + 0.18 + 0.23 + 0.14 + 0.17 = 0.92$$

$$V_5 = 0.20 \cdot 0.88 + 0.18 \cdot 0.78 + 0.23 \cdot 0.89 + 0.18 \cdot 0.7 + (0.21 \cdot 0.7) = 0.18 + 0.14 + 0.20 + 0.12 + 0.15 = 0.79$$

The next step is to calculate the final grade

Table 4. Decision Table

Value	Working area
0.1 – 0.199	Wilayah <u>Purwosari</u>
0.2 – 0.299	Wilayah <u>Bilal</u>
0.3 – 0.399	Wilayah <u>Pancing</u>
0.4 – 0.499	Wilayah <u>Brayan</u>
0.5 – 0.599	Wilayah <u>Marelan</u>
0.6 – 0.699	Wilayah <u>Belawan</u>
0.7 – 0.799	Wilayah <u>Martubung</u>
0.8 – 0.899	Wilayah <u>Tj. Selamat</u>
0.9 - 1	Wilayah <u>Saintis</u>

Based on the decision table above, the employee alternative work area placement that is assessed can be seen in table 5.

Table 5. Work Area Placement Table

Alternative	Final score	Working area
<u>Epipanias Gulo</u>	0.87	Wilayah <u>Tj. Selamat</u>
<u>Edi Susanto Lombu</u>	0.87	Wilayah <u>Tj. Selamat</u>
<u>Toni Gea</u>	0.90	Wilayah <u>Saintis</u>
<u>Burhan</u>	0.92	Wilayah <u>Saintis</u>
<u>Joko</u>	0.79	Wilayah <u>Martubung</u>

The results of manual testing and testing carried out through the system will be compared to see what percentage (%) the accuracy of the system being built is. It can be seen in the following table:

No.	Baby Name	Manual Calculation	System Calculation	(T/F)
1.	<u>Epipanias Gulo</u>	0.87	0.87	T
2.	<u>Edi Susanto</u>	0.87	0.87	T
3.	<u>Toni Gea</u>	0.90	0.90	T
4.	<u>Burhan</u>	0.92	0.92	T
5.	<u>Joko</u>	0.79	0.79	T

Information:

T = True.

Occurs when the system calculation result is the same as manual calculation.

F = False.

Occurs when the system calculation results are different from the manual calculation results.

Based on the tests that have been done, it is obtained:

Accuracy Level = (number of accurate data / total samples) * 100%

= (5/5) * 100%

= 100%

4. Conclusions

Decision Support System for working area selection that is currently being designed is the Decision Support System for Determining Work Areas in Cooperatives in Medan Using the Simple Additive Weighting (SAW) Method. Wherewith this system it can make it easier for companies to place employee work areas based on the area where the employee lives. The system is designed to be used for all employees because it is very easy to use, no need to have special skills in computers. So that employees can use this system to generate reports about their work area based on residence.

Reference

- [1] A. Pendiagnosa, K. Warna, M. Pemrograman, B. Delphi, and S. Eniyati, "Perancangan Sistem Pendukung Pengambilan Keputusan untuk Penerimaan Beasiswa dengan Metode SAW (Simple Additive Weighting)," *J. Teknol. Inf. Din.*, 2011.
- [2] A. Afshari, M. Mojahed, and R. Yusuff, "Simple additive weighting approach to personnel selection problem," *Int. J. Innov. Manag. Technol.*, 2010.
- [3] J.-J. Huang, "Simple Additive Weighting Method," in *Multiple Attribute Decision Making*, 2011.
- [4] I. Kaliszewski and D. Podkopaev, "Simple additive weighting - A metamodel for multiple criteria decision analysis methods," *Expert Syst. Appl.*, 2016.
- [5] S. Pendukung Keputusan Menentukan Kelayakan Penerimaan Bantuan Pengusaha Ayam Petelur Oleh Dinas Peternakan Kabupaten Pesawaran Menggunakan *et al.*, "METODE SIMPLE ADDITIVE WEIGHTING," *J. Pendidik. Teknol. dan Kejur.*, 2017.
- [6] N. C. Shaner, P. A. Steinbach, and R. Y. Tsien, "A guide to choosing fluorescent proteins," *Nat. Methods*, 2005.
- [7] M. B. Kennel, R. Brown, and H. D. I. Abarbanel, "Determining embedding dimension for phase-space reconstruction using a geometrical construction," *Phys. Rev. A*, 1992.
- [8] Y. Wu and V. N. Vapnik, "Statistical Learning Theory," *Technometrics*, 1999.
- [9] C. Fraley and A. E. Raftery, "How many clusters? Which clustering method? Answers via model-based cluster analysis," *Comput. J.*, 1998.
- [10] B. Mirkin, "Choosing the number of clusters," *Wiley Interdiscip. Rev. Data Min. Knowl. Discov.*, 2011.
- [11] K. A. Moloney, "A generalized algorithm for determining category size," *Oecologia*, 1986.