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Analysis of Simple Additive Weighting (SAW) Method for The Selection of The Best Teachers in SMK Siti Banun

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ABSTRACT

Solution and problem-solving processes may have decisions. Decision management services are designed to assist and support the decision-makers decision-making. They can be used in the decision-making process and assess the processes used in digital elections. Another method is the Simple Additive Weighting (SAW) method, often used in decision support systems. This SAW strategy was selected because it determines each attribute's weight before moving on to the ranking process and then selects the alternative with the highest weight from the alternatives list. This instance, instead, is to use the PEW (proportional weighted) method to determine the best teacher at SMK Siti Banun. using this scheme, you can assume that the rankings would be more reliable since it is based on pre-defined criteria and weights to provide the best results.

1. Introduction

Science and technology are in a fast-moving phase, resulting in developments that must be measured for adaptation. Decision support systems, for example, assist in making decisions. Decision support systems are interconnected computational resources that enable individuals to connect with computers to produce semi-structured and semi-unpredictable knowledge to make decisions. It is hoped that decisions are not be made arbitrarily, allowing continuity to be found by applied criteria to be measured. Teacher performance is commonly used several different metrics to decide whether it exceeds standards. To help teachers assess performance in motivating other teachers and becoming exemplary educators, a decision support system (DSS) is needed. The DSS assists in the implementation of a model-based approach.[1].

2. Method

a decision support systems that provide information, details, and assistance with analyses and reporting (DSS). This infrastructure aids the decision-making process in a semi-structured and unstructured world where no one knows exactly how to decide.[2]. A teacher's status or job holds you current with your profession. This job would be challenging for anyone with no prior teaching experience. Becoming a teacher entails more than just joining the teaching profession. Furthermore, if you wish to lecture, you must have a thorough understanding of education and other topics.[3]. The teacher is the key Fig responsible for ensuring that each student's ability realized. As a mentor, the instructor is there. A teacher's position is crucial in developing the best possible students from a variety of educational backgrounds.

2.1 Simple Additive Weighting Method (SAW)

The weighted addition system is another name for the SAW technique. The SAW approach's basic concept is to determine the total weight of all choice production scores. The SAW method needs to normalise the decision matrix (X) to a size that is equal to all feasible ranking alternatives.[4]. The following is the formula for the Simple Additive Weighting process:

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$$r_{ij} = \begin{cases} \frac{x_{ij}}{\underset{i}{Max}\, x_{ij}} \; Jika\ j\ adalah\ attribut\ keuntungan\ (benefit) \\ \frac{\underset{i}{Min}\, x_{ij}}{x_{ij}} \; jika\ j\ adalah\ attribut\ biaya\ (cost) \end{cases} \quad \text{..................[4]}$$

Fig 1. The formula for the Simple Additive Weighting

Description :
rij = normalized performance rating value
xij = attribute value owned by each criterion
Max xij = the greatest value of each criterion
Min xij = the smallest value of each criterion
benefit = if the greatest value is the best
cost = if the smallest value is best

Dimana r_{ij} sebagai rating kinerja ternormalisasi dari Alternative A_i pada atribut C_j; i=1,2,…,m dan j=1,2,…,n . Nilai preferensi untuk setiap Alternative (Vi) dapat dilihat pada Gambar 3.2 berikut ini.

$$V_i = \sum_{j=1}^{n} W_j \; r_{ij} \dots\dots\dots\dots \quad [4]$$

Fig 2. Preference values for each alternative (Vi)

Description:
Vi = ranking for each alternative
Wj = weight value of each criterion
rij = normalized performance rating value
A larger Vi value indicates that the alternative Ai is preferred.
The steps to solve problems with the SAW method are as follows [5]:

a. Determine the criteria that will use as a reference in making decisions, namely Ci.
b. Determine the suitability rating of each alternative on each criterion.
c. Make a decision matrix based on the criteria (Ci), then normalize the matrix based on the equation that adjusted to the type of attribute (profit attribute or cost attribute) to obtain a normalized matrix R.
d. The final result is obtained from the ranking process, namely the multiplication of the normalized matrix R with the weight vector so that the most significant value chosen as the best alternative (Ai) as a solution.

3. Results and Discussion

3.1 Problem Analysis

SMK Siti Banun also has difficulty counting and evaluating these teachers. Measurements are sometimes done incorrectly and take a lot of time. SMK Siti Banun has difficulty positioning and teachers with good results due to errors in measuring teacher evaluations. Based on these problems, an assessment system was created to help SMK Siti Banun in solving the problems and avoiding mistakes in the process of selecting the best teachers.

3.2 Application of the simple additive weighting method (SAW)

Assess the best teachers at SMK Siti Banun using the Simple Additive Weighting (SAW) method. Calculations necessitate the use of parameters and weights. Example of a completed assignment for ten teachers whose work evaluated using predetermined parameters. The ten candidates (alternative) teachers are

A1 = Dwi Srinawati Rambe, S.Pd, M.M;
A2 = Helmi Imelda Ritonga, S.Pd;
A3 = Aini Afrida, M.Pd;
A4 = Wahyu Azhar Ritonga, M.Si;
A5 = Lukiy pipit asniah, S.Si;
A6 = Zahara Nasution. S.Pd;
A7 = Icha Rivaldi S.Pd;
A8 = Asmita Hartati, S.P.d;
A9 = Zufri Aman Sani Tambunan, ST;
A10 = Sormawati Sinaga, S.Pd;

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There are criteria used to make measurements:

B1= Discipline : Very Good
B2= Initiative : Good
B3= Achievement : Good
B4= Responsibility : Enough
B5= Keeping a Good Name As An Educator : Enough

Each criterion is assigned a weight by the decision-maker, as shown below.:

B1=30%;
B2=20%;
B3=20%;
B4=15%;
B5=15%.

According to the example above, the fundamental additive weighting (SAW) approach can measure the status of teacher evaluation using the simple additive weighting (SAW) method.:

a. **The first step** provides values and weights for each alternative on each predetermined criterion. (See Table 1. Scores and Weights for Criteria).

Table 1.
Values and Weights for Criteria

B1, B2, B3 B4 dan B5			
Written Value	Weights	Criteria Value	Description
80-100	30%	5	Very Good
60-79	25%	4	Good
40-59	15%	3	Enough
20-39	10%	2	Bad
0-19	0%	1	Very bad

b. **Step two**, determine the match rating as shown in Table 2.

Table. 2
Match Rating of each alternative in each criteria

Alternative	Criteria					Rating result				
	B1	B2	B3	B4	B5	B1	B2	B3	B4	B5
Dwi Srinawati Rambe, S.Pd, M.M	4	5	4	4	5	75	85	75	75	90
Helmi Imelda Ritonga, S.Pd	5	5	4	4	4	95	90	75	75	78
Aini Afrida, M.Pd	5	4	4	4	5	80	70	70	75	90
Wahyu Azhar Ritonga, M.Si	5	4	5	5	4	85	75	85	86	75
Lukiy pipit asniah, S.Si	5	5	5	4	4	86	84	85	78	77
Zahara Nasution. S.Pd	5	4	5	4	5	87	79	85	79	88
Icha Rivaldi S.Pd	4	4	4	4	5	75	75	77	79	86
Asmita Hartati, S.P.d	4	5	4	5	5	76	88	75	87	87
Zufri Aman Sani Tambunan, ST	5	4	5	5	5	78	77	85	87	90
Sormawati Sinaga, S.Pd	5	4	5	4	4	86	76	88	79	79

c. **The third step** of the formation of the decision matrix is formed as follows:

$$x = \begin{bmatrix} 4 & 5 & 4 & 4 & 5 \\ 5 & 5 & 4 & 4 & 4 \\ 5 & 4 & 4 & 4 & 5 \\ 5 & 4 & 5 & 5 & 4 \\ 5 & 3 & 4 & 4 & 5 \\ 3 & 4 & 5 & 5 & 3 \\ 4 & 4 & 4 & 4 & 5 \\ 4 & 5 & 4 & 5 & 5 \\ 3 & 4 & 5 & 5 & 4 \\ 5 & 4 & 3 & 4 & 5 \end{bmatrix}$$ identical to $$x = \begin{bmatrix} r_{11} & r_{12} & r_{13} & r_{14} & r_{15} \\ r_{21} & r_{22} & r_{23} & r_{24} & r_{25} \\ r_{31} & r_{32} & r_{33} & r_{34} & r_{35} \\ r_{41} & r_{42} & r_{43} & r_{44} & r_{45} \\ r_{51} & r_{52} & r_{53} & r_{54} & r_{55} \\ r_{61} & r_{62} & r_{63} & r_{64} & r_{65} \\ r_{71} & r_{72} & r_{73} & r_{74} & r_{75} \\ r_{81} & r_{82} & r_{83} & r_{84} & r_{85} \\ r_{91} & r_{92} & r_{93} & r_{94} & r_{95} \\ r_{101} & r_{102} & r_{103} & r_{1044} & r_{105} \end{bmatrix}$$

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d. **The fourth step** calculates the normalization value of each Alternative with the following formula:

$$r_{ij} = \begin{cases} \dfrac{x_{ij}}{Max\, x_{ij}} \; Jika\, j\; adalah\; attribut\; keuntungan\; (benefit) \\ \dfrac{i}{Min\, x_{ij}} \\ \dfrac{i}{x_{ij}} \; jika\, j\; adalah\; attribut\; biaya\; (cost) \end{cases} \quad \text{.....[6]}$$

Fig 3. Formula for normalization

Description :

r_{ij} = normalized performance rating value

x_{ij} = attribute value that is owned by each Criteria

$Max\, x_{ij}$ i = the greatest value of each Criteria

$Min\, x_{ij}$ i = the smallest value of each Criteria.

Then the normalization results are made in the normalization matrix:

$$R = \begin{bmatrix} 0.80 & 1.00 & 0.80 & 0.80 & 1.00 \\ 1.00 & 1.00 & 0.80 & 0.80 & 0.80 \\ 1.00 & 0.80 & 0.80 & 0.80 & 1.00 \\ 1.00 & 0.80 & 1.00 & 1.00 & 1.0.0 \\ 1.00 & 1.00 & 1.00 & 0.80 & 0.80 \\ 1.00 & 0.80 & 1.00 & 0.80 & 1.00 \\ 0.80 & 0.80 & 0.80 & 0.80 & 1.00 \\ 0.80 & 1.00 & 0.80 & 1.00 & 1.00 \\ 1.00 & 0.80 & 1.00 & 1.00 & 1.00 \\ 1.00 & 0.80 & 1.00 & 0.80 & 0.80 \end{bmatrix}$$

Fig 4. Normalization matrix

e. **Step five** determine the weight to be used for the role process:

$$w = [0.30 \quad 0.20 \quad 0.20 \quad 0.15 \quad 0.15]$$

Fig 5. Determining the Weight

f. **Step six** of the role search or best value by entering each given Criteria by using a formula:

$$V_i = \sum_{i=1}^{n} W_j \; r_{ij} \quad \text{.....[6]}$$

Fig 6. best value search

Description:

V_i= Preference value (result value) for each Alternative

W_j= Weight value for each Criteria

r_{ij}= The work rating value is normalized

$\sum_{j=1}^{n}$ = The sum of all data starts from Criteria (j) = 1

We can see the ranking results in table 3 as follows:

Table 3
Ranking results

Alternative	Ranking results
Dwi Srinawati Rambe, S. Pd, M.M	0.87
Helmi Imelda Ritonga, S. Pd	0.90
Aini Afrida, M. Pd	0.89
Wahyu Azhar Ritonga, M. Si	0.96

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Alternative	Ranking results
Lukiy pipit asniah, S. Si	0.94
Zahara Nasution. S. Pd	0.93
Icha Rivaldi S. Pd	0.83
Asmita Hartati, S.Pd	0.90
Zufri Aman Sani Tambunan, ST	0.96
Sormawati Sinaga, S.Pd	0.90

V4 receives the highest value among V1, V2, V3, and V4, so V9 = Zufri Aman Sani Tambunan, ST is the preferred candidate (alternative).

3.3 Algorithm and implementation

The decision support system's criteria, alternatives, and outcomes will be calculated using algorithms and reasoning. The first step in this decision support research is to define the specifications, which involves entering and storing criteria. The second algorithm is used to determine the suitability rating of the Alternative input and the parameters used. This stage is where descriptive principles are transformed into practical principles. The third is a decision-making algorithm that transforms each parameter's actual value of each Option into a single result value. Sorting is the fourth step, which takes place simultaneously. The final score is determined based on this chapter. based on the highest possible score.

a. Algorithm of normalization value for X and R matrix
Input: B1, B2, B3, B4, B5 = Criteria
V1, V2, V3, V4, V5, V6, V7, V8, V9, V10 = Alternative
X (i, j) = weighting matrix Criteria
5 = n (amount Criteria)
10 = p (amount Alternative)
Ouput:
r11.1, r11.2, r11.3, r11.4, r11.5, r21.1, r22.2, r23.3, r24.4, r25.5, r31.1, r32.2, r33.3, r34.4, r35.5,r41.1, r42.2, r43.3, r44.4, r45.5, r51.1, r52.2,
r53.3,r54.4,r55.5,r61.1,r62.2,r63.3,r64.4,r65.5,r71.1,r72.2,r73.3,r74.4,r75.5,r81.1,r82.2,r83.3,r84.4,r85.5 ,r91.1,r92.2,r93.3,r94.4,r95.5,r101.1,r102.2,r103.3,r104.4,r105.5.
Process: for = 1 to n
For j= 1 to p
Rij=Xij/Maxi (Xij; Xij, Xij, Xij) to benefit
Rij=Mini (Xij; Xij, Xij, Xij)/Xij) to cost
Next j
Next i

b. A weighted normalized decision matrix algorithm
Input: W (weight Criteria: Discipline (B1) = 5, Initiative (B2) = 4, Achievement (B3) = 3, Responsibility (B2) = 2, Maintaining a Good Name as an Educator (B5) = 1,
Rij (Normalization)
Output : V_i (Weighted ranking)
Process : $V_i = \sum W_j R_{ij}$

c. Ranking Algorithm
Input : V_i, V_i, V_i, V_i, V_i
Outuput : V_5 (The highest score)
Process : if (W* R_1 1) + (W* R_1 2) + (W* R_1 3) + (W* R_1 4) + (W* R_1 5)
Then The highest score = V1
if (W* R_2 1) + (W* R_2 2) + (W* R_2 3) + (W* R_2 4) + (W* R_2 5)
Then The highest score = V2
if (W* R_3 1) + (W* R_3 2) + (W* R_3 3) + (W* R_3 4) + (W* R_3 5)
Then The highest score = V3
if (W* R_4 1) + (W* R_4 2) + (W* R_4 3) + (W* R_4 4) + (W* R_4 5)
Then The highest score = V4
if (W* R_5 1) + (W* $R_5$2) + (W* $R_5$3) + (W* R_5 4) + (W* R_5 5)
Then The highest score = V5

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d. The next thing is to test out the new one. To do this, one must thoroughly understand how the decision-making process works from beginning to end. an empirical method for discovering possible bugs, which help with potential system development.

4. Conclusion

The SAW method is used to decide the best teaching choice. It's been designed to assist schools in finding the best teacher. Using computers to choose the best teachers will help to enhance data collection, which in turn will decrease errors in grading. Utilize the database. Elicitation outcomes as well as teaching data can be saved in it. It is possible to make corrections when you are entering teacher or assessment details.

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