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Performance Appraisal Decision Making System using the Simple Additive Weighting (SAW) Method

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Abstract

The development of science and technology is increasingly rapid, the development of science and technology is developing in line with the times . The use of computer technology can help complete work and overcome problems that arise in daily activities. The Communication and Informatics Service (Kominfo) is one of the departments at the Padang City Hall Government Office. The Padang City Government Communications and Information Service is having difficulty selecting employees in determining employee transfers and promotions. The researcher aims to assist the Padang City Government Communication and Information Department in helping to determine employee transfers and promotions. This research was conducted using the *Simple Additive Weighting* (SAW) method. The SAW method is to find the weighted sum of the performance ratings for each alternative on all criteria. The results of calculations using this method using 4 alternative data that will be tested, obtained alternative results in the name of Wahtu Riansah with a value of 0.951 as the best candidate and from these results it was found that the SAW method can help the department in selecting the right employees for employee transfers and promotions. Therefore, an Information System was built at the Padang City Government Communication and Informatics Service to assist the needs in selecting employees using the system that will be implemented

Keywords : Employees, Decision Support Systems, *Simple Additive Weighting* , Criteria.

1. Introduction

The development of science and technology is increasingly rapid, the development of science and technology is developing in line with the times. There are many examples of the development of science and technology, one of which is computers, computers are a calculating tool that can make human work easier [1].

The use of computer technology can help complete work and overcome problems that arise in daily activities and this has become a very important need for human life and for institutions, with computerization institutions can carry out their operations well.

The employee performance appraisal system is a system used to assess the best performance of employees [2]. Employee performance assessment is an activity process carried out to evaluate the level of work implementation or performance of an employee [3][4]. The assessment referred to in the Civil Servant environment is known as the Job Implementation Assessment List (DP3) which is regulated in Government Regulation Number 10 of 1979 concerning Evaluation of the Job Implementation of Civil Servants. The list contains the results of an assessment of the work implementation of a Civil Servant within a period of 1 (one) year made by the Assessing Officer.

The purpose of the Work Implementation Assessment List is to obtain objective considerations in developing Civil Servants, so that a work implementation assessment is carried out once a year by the Assessing Officer and the results of the assessment of the Civil Servant's work implementation are stated in the Work Implementation Assessment List (DP3) which contains the elements: loyalty, work performance, responsibility, obedience, honesty, cooperation, initiative, and added elements of leadership for State Civil Apparatus who occupy structural positions [5].

The benefits of performance appraisal include determining career development or promotion, education and training, salary standards, employee transfers or transfers, increasing productivity & responsibility, motivation, avoiding favoritism and measuring a person's leadership success [6].

A decision support system is a computer-based system whose output provides various alternative decisions that are needed to assist managers in solving problems using established information data and models [7].

Simple Additive Weighting (SAW) method is often also known as the 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 [8].

Previous research on comparative analysis of the SAW and WP methods in the decision support system for

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selecting wedding organizers in Surabaya, which was then measured and compared against real data from respondents' questionnaires using the hamming distance technique, in the first experiment showed the same results between SAW and WP, namely 80%[9].

Previous research on the decision support system for recruiting BEM members using the SAW and TOPSIS methods found that the results of designing a decision support system for recruiting BEM members using the SAW and TOPSIS methods can be concluded that using this system can make it easier for BEM to rank BEM member recruitment quickly and efficiently. This SPK uses the Topsis and SAW methods with criteria consisting of GPA, Interview Score, Supporting Certificates, Organizational Experience, Commitment[10].

The aim of this research is that researchers will build a performance assessment decision support system using the SAW (Simple Additive Weighting) method. This method was chosen because it is able to determine the weight value for each attribute, then proceed with a ranking process which will select the best alternative from a number of alternatives (registrants) based on certain criteria and weights. [11]

So far, the performance assessment of State Civil Apparatus in the Padang City Government has not been supported by an adequate assessment system, where the assessment system still uses the Microsoft Excel application. This gives rise to several problems, especially the continuity of data from one year's assessment to the next year, not every time, analysis to compare with other State Civil Apparatus , so that at times they cannot provide and provide accurate data for decision making for leaders. Therefore, now it is a necessity for government agencies or state institutions to carry out digital transformation in all aspects of their work, especially in assessing the performance of the State Civil Service in order to create effectiveness and efficiency in decision making related to personnel management.

2. Research methodology

The research framework is a sequence of activities that will be carried out in a study. The research will be carried out applying the Simple Addictive Weighting (SAW) method. The SAW method is used to make it easy to make flexible decisions and is widely used because of its simplicity in responding to needs in decision making, so that decisions can be made effectively and efficiently, which can be seen in Figure 1

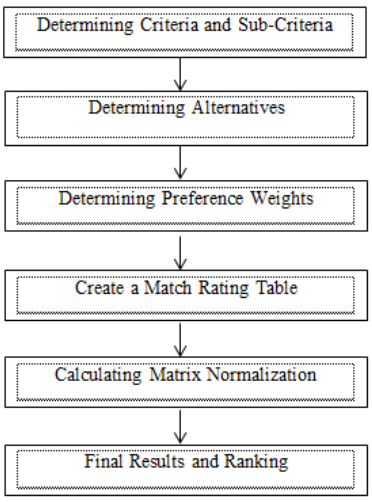

Figure 1. Research Framework

The SAW method requires a process of normalizing the decision matrix (X) to a scale that can be compared with all existing alternative ratings. The SAW method recognizes 2 (two) attributes, namely profit criteria and cost criteria. The following are the steps to complete the SAW method calculation:

1. Determine the criteria and sub-criteria that will be used as a reference in decision making
2. Determine alternatives
3. Determine the preference weight or level of importance (W) for each criterion.
4. Create a suitability rating table for each alternative for each criterion.
5. Create a decision matrix (X) which is formed from the suitability rating table of each alternative for each criterion. The X value of each alternative (Ai) for each predetermined criterion (Cj), where, i=1,2 , …..m and j=1,2,…..n.
6. Normalizing the decision matrix by calculating the normalized performance rating (rij) value of alternative Ai on criteria Cj. Where Rij is the normalized performance rating value. Xij is the attribute value of each Criteria. Max Xij is the largest value of each criterion i. Min Xij is the smallest value of each criterion I. Max is used in Benefit and Min is used in Cost.
7. The results of the normalized rating values (rij) form a normalized matrix.
8. The final result of the preference value (Vi) is obtained from the sum of the multiplication of the normalized matrix row elements (R) with the preference weights (W) corresponding to the matrix column elements (W). With Vi is the ranking for each alternative. Wj is the weight value of each criterion. rij is the normalized performance rating value. A greater Vi value indicates that alternative Ai is preferred

This method is the most well-known method and is widely used by people in dealing with Multipple Attribute Decision Making (MADM) situations. This

method requires the decision maker to determine the weight for each attribute. The total score for an alternative is obtained by adding up all the multiplication results between ratings that can be compared across attributes) weights and each attribute. The rating for each attribute has previously gone through a normalization process. The SAW method is known as the term weighted addition. The basic concept of the SAW method is to find the weighted sum of the performance ratings for each alternative on all attributes. The SAW method requires a process of normalizing the decision matrix (X) to a scale that can be compared with all existing alternative ratings. The formula for carrying out this normalization is as follows:

$r_{ij} = \left\{\frac{X_{ij}}{Max\ X_{ij}}\right\}$ if j is the profit attribute

$r_{ij} = \left\{\frac{Min\ X_{ij}}{X_{ij}}\right\}$ if j is the cost attribute (cost)

Rij is the normalized performance rating of alternative Ai on attribute Cj; i=1 ,2 ,...,m and j=1,2,...,n.

Information:

Rij=normalized performance rating value
Xij = attribute value for each criterion
Maxxij = largest value of each criterion
Minxij = smallest value of each criterion
benefit= if the largest value is the best criterion
cost= if the smallest value is the best criterion

Where rij is the normalized performance rating of alternative Ai on attribute Cj; i=1,2,...,m and j=1,2,...,n. The preference value for each alternative (Vi) is given as:

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

Information:

Vi = ranking for each alternative
wj = weight value of each criterion
rij = normalized performance rating value
larger Vi value indicates that alternative Ai is more selected.

After the Vi value is obtained, ranking is carried out, so that we can find out the best alternative which will be used as a guide for decision making

3. Results and Discussion

3.1 *Simple Additive Weighting* Method

The steps for the SAW method are:

1. Determine the types of employee selection criteria in participating in employee transfers and promotions. In this research, the criteria needed are: 6 criteria factors, namely Service Orientation, Integrity, Commitment, Discipline, Cooperation, Leadership
2. Determine the suitability rating of each alternative for each criterion at a value of 1 to 5, namely: 1 = Very Bad 2 = Bad 3 = Fair 4 = Good 5 = Very Good
3. Create a decision matrix based on criteria (Ci), then normalize the matrix based on equations adjusted to the type of attribute (profit or cost attributes) to obtain a normalized matrix R.
4. The final result is obtained from the ranking process, namely the sum of the multiplication of the normalized matrix R with the weight vector to obtain the largest value which is selected as the best alternative (Ai) as the solution

There are 4 employees whose performance will be assessed based on predetermined criteria. The 4 teachers who became candidates (Alternative) are:

Table 1. Alternative Table

No	Code	Name
1	A1	Wahyu Riansah
2	A2	Helen Yenifer Silvia Manullang
3	A3	Sahaji Kurniawan
4	A4	Dova Farmica

There are six criteria used to carry out the assessment, namely:

Table 2. Criteria Table

No	Code	Criteria
1	C1	Service Orientation
2	C2	Integrity
3	C3	Commitment
4	C4	Discipline
5	C5	Cooperation
6	C6	Leadership

The table above displays a list of criteria with relevant codes. Each criterion reflects important aspects in assessment or evaluation in performance appraisal. There are 6 criteria and each criterion is coded C1 to C6. Next, each criterion is given a weight value, which can be seen in Table 3 below:

Table 3 . Table of Weight Values for Criteria

Weight	Criterion Value	Information
30%	90-100	Very Good
25%	75-89	Good
25%	60-74	Enough
20%	40-59	Bad
0	0-39	Very Bad

The table above presents the weight of each criterion in an evaluation, as well as the range of criteria values associated with the appropriate information or category. Each criterion has a certain weight which indicates how important the criterion is in the overall evaluation.

Table 4 . Suitability Rating for each Alternatives and Criteria

	Criteria					
Alternative	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**
A1	**90**	**76**	**70**	**90**	**80**	**77**
A2	**70**	**70.5**	**85**	**77**	**79**	**90**
A3	**80**	**79**	**78**	**77**	**80**	**90**
A4	**78**	**80**	**75.5**	**90**	**85**	**70**

The decision matrix formed from the suitability table above is:

90	76	70	90	80	77
70	70.5	85	77	79	90
80	79	78	77	80	90
78	80	75.5	90	85	70

The normalized decision matrix from the matrix above can be seen in the following solution:

For C1 :

$r\ 1.1 = \frac{90}{90} = 1$ $r\ 1.3 = \frac{80}{90} = 0.89$

$r\ 1.2 = \frac{70}{90} = 0.78$ $r\ 1.4 = \frac{78}{90} = 0.87$

For C2:

$r\ 2.1 = \frac{76}{80} = 0.95$ $r\ 2.3 = \frac{79}{80} = 0.99$

$r\ 2.2 = \frac{70,5}{80} = 0.88$ $r\ 2.4 = \frac{80}{80} = 1$

For C3:

$r\ 3.1 = \frac{70}{85} = 0.82$ $r\ 3.3 = \frac{78}{85} = 0.91$

$r\ 3.2 = \frac{85}{85} = 1$ $r\ 3.4 = \frac{75,5}{85} = 0.89$

For C4:

$r\ 4.1 = \frac{90}{90} = 1$ $r\ 4.3 = \frac{77}{90} = 0.86$

$r\ 4.2 = \frac{77}{90} = 0.86$ $r\ 4.4 = \frac{90}{90} = 1$

For C5:

$r\ 5.1 = \frac{80}{85} = 0.94$ $r\ 5.3 = \frac{80}{85} = 0.94$

$r\ 5.2 = \frac{79}{85} = 0.93$ $r\ 5.4 = \frac{85}{85} = 1$

For C6:

$r\ 6.1 = \frac{77}{90} = 0.86$ $r\ 6.3 = \frac{90}{90} = 1$

$r\ 6.2 = \frac{90}{90} = 1$ $r\ 6.4 = \frac{70}{90} = 0.78$

Then the normalization results are created in a normalization matrix :

$$R = \begin{bmatrix} 1 & 0,95 & 0,82 & 1 & 0,94 & 0,86 \\ 0,78 & 0,88 & 1 & 0,86 & 0,93 & 1 \\ 0,89 & 0,99 & 0,92 & 0,86 & 0,94 & 1 \\ 0,87 & 1 & 0,89 & 1 & 1 & 0,78 \end{bmatrix}$$

The ranking process uses the weights given by the decision maker, namely:

W = 25%, 10%, 10%, 25%, 20%, 10%

The results obtained are as follows:

$$v1 = (0,25)(1) + (0,1)(0,95) + (0,1)(0,82) + (0,25)(1) + (0,2)(0,94) + (0,1)(0,86) = \mathbf{0,951}$$

$$v2 = (0,25)(0.78) + (0,1)(0,88) + (0,1)(1) + (0,25)(0.86) + (0,2)(0,93) + (0,1)(1) = \mathbf{0,884}$$

$$v3 = (0,25)(0.89) + (0,1)(0,99) + (0,1)(0.92) + (0,25)(0.86) + (0,2)(0,94) + (0,1)(1) = \mathbf{0,917}$$

$$v4 = (0{,}25)(0.87) + (0{,}1)(1) + (0{,}1)(0.89) + (0{,}25)(1) + (0{,}2)(1) + (0{,}1)(0.78) = \mathbf{0,935}$$

The results of the above calculations can be seen in the table below:

No	Code	Name	V value
1	A1	Wahyu Riansah	0.951
2	A2	Helen Yenifer Silvia Manullang	0.884
3	A4	Sahaji Kurniawan	0.917
4	A4	Dova Farmica	0.935

The largest value is in V1, so alternative A1 is the alternative chosen as the best alternative. In other words , there are 3 potential candidates, namely:

Table 5 . Results Calculation Proximity Relatively

Alternative name	Mark	Information
Revelation Riansah	0.951	Best 1
Dova Farmica	0.935	Best 2
Sahaji Kurniawan	0 . 917	Best 3
Helen Yenifer Silvia Manullang	0.884	

3.2 System Testing

In the system testing section, the use of the system will be explained the application created and describes the system on which program testing has been carried out until finished, Which will obtained from results testing the. withinformation on the use of the program that has been designed, both written and written appearance program Which will be executed .

1. Login Page

The Login page is the main menu display or the first display that will appear when you first access the application.

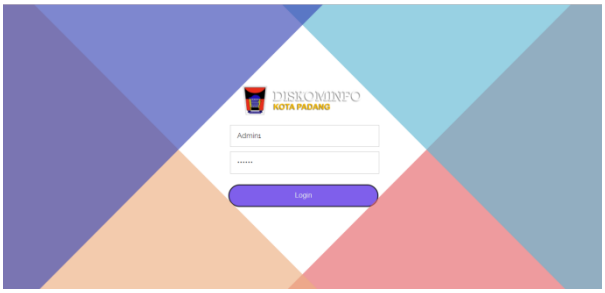

Figure 2 Login Page

2. Employee Data Page

After entering the login page, the admin can access the features contained in the application. For example, the admin can access the Employee Data Page.

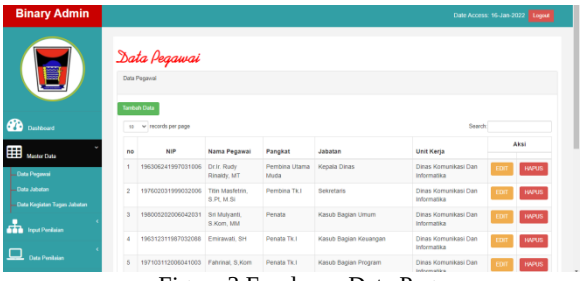

Figure 3 Employee Data Page

On this employee data page the admin can view, edit, add and delete employee data. The employee data page can be seen in Figure 5. 3

3. Achievement Data Input Page

On this achievement data input page, it displays the input of employee performance achievement value data, on this page the admin can also print target data. The achievement data input page can be seen in Figure 4

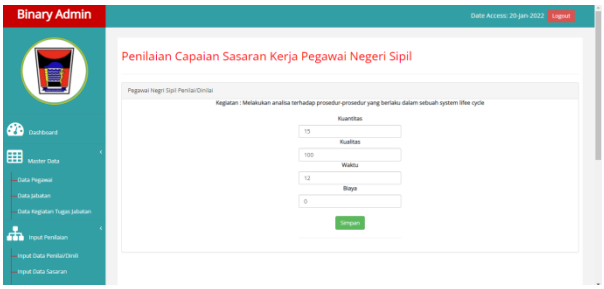

Figure 4 Achievement Data Input Page

On this Achievement Data Input page , the admin can directly print employee target assessment data by pressing the print target button.

4. SKP Data Input Page

The SKP data input page displays data input for employee SKP values. The SKP data input page can be seen at 5

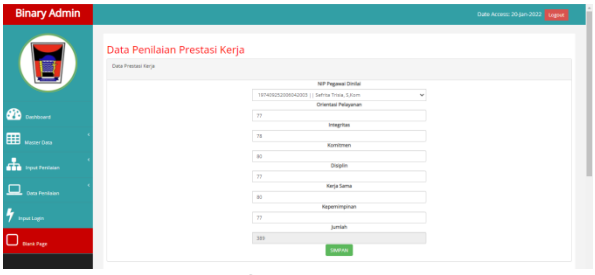

Figure 5 SKP Data Input Page

To input employee skp value data , the admin selects the employee who will be assessed first, after that the admin inputs the employee skp assessment data.

5. Work Target Achievement Assessment Data Page

On this page the admin will select the employee to be assessed first, after that the admin can press the display data button, after that the admin can see the employee target achievement assessment data which can be seen in Figure 6

Figure 6 Data Page for Assessment of Work Target Achievement

6. Candidate Selection Page

This candidate selection page displays assessment data for prospective employees who will be nominated or recommended for position permutations and promotions. The candidate selection page can be seen in Figure 11.

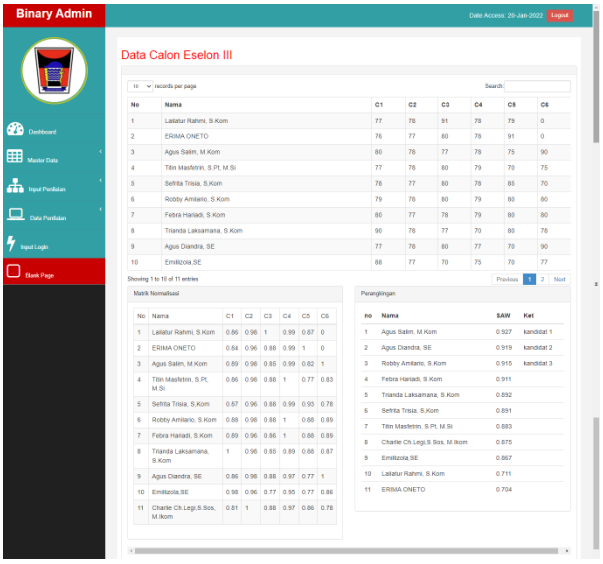

Figure 11 Candidate Selection Page

Here the admin can see the assessment of each employee starting from the results of the matrix value to the ranking value, or also known as the final results of the assessment of candidate candidacy in the context of employee transfers and promotions.

4. Conclusion

After this decision support system was built, this system has answered the need for information regarding employee performance assessment in the context of transfers and promotions to civil servant positions. After creating this system, the system can answer and assist in resolving employee performance assessment problems in the context of transfers and promotions to civil servant positions.

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