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DECISION SUPPORT SYSTEM OF EMPLOYEE PERFORMANCE ASSESSMENT APPLYING COMBINATION SIMPLE ADDITIVE WEIGHTING (SAW) METHOD WITH RANK ORDER CENTROID (ROC)

Muliati Badaruddin, Marlin Lasena
Information Systems Study Program, STMIK Ichsan Gorontalo, Gorontalo, Indonesia
Email: [1]mulybadarudin@gmail.com [2]marlinlasena@gmail.com

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Abstract:

This research aims to produce company manager decisions in evaluating employee performance by applying a combination of Rank Order Centroid (ROC) and Simple Additive Weighting (SAW) methods. The results of employee performance appraisals are expected to more effective and objective due to the support of the decision support system used. Many studies have been conducted in performance appraisal by using the Simple Additive Weighting method, but it have not used good weighting. With a combination of weighting and ranking methods, the results of the decision can be ascertained to more effective.

Keywords: DSS, Rank Order Centroid, ROC, Simple Additive Weighting, SAW, Performance, Employee

1. INTRODUCTION

The application of information technology that it has developed until now is increasingly being used in all people, the implementation of applications that support decisions, both the semi-structured and the structured, it provides effectiveness to the decisions made by company managers. So that it to facilitate the assessment of the performance of employees in the company. Employee performance appraisal is very important to do, so, the incentives provided by company managers are right on target.

Some of the objectives of employee performance evaluation are to provide work incentives to promotions, improve work quality, motivate employees, evaluate the work done, and others. The magnitude of the benefits given to performance appraisal is very important for company managers. The implementation of technology that supports employee decisions can be used by implementing a Decision Support System (DSS)[1].

Decision Support System is a system based on computer that assists managers in solving both structured and unstructured problems by using data and methods [2]–[4]. The good decisions result from an objective process and it can be resolved by using DSS [5]. The implementation of methods in decision making needs to be done, so that, the results can be properly accounted for. Until now, the implementation of methods in decision support systems is widely carried out among researchers, some of these methods include Simple Additive Weighting[6], TOPSIS[7], [8], ELECTRE[9]–[11], MOORA[12] –[14], ARAS[15], [16].

In this research, the authors used the Simple Additive Weighting (SAW) method. This method is very easy and simple in making decisions. However, in the implementation of the SAW method, the weights are still generated by assigning direct values in the ranking processing. This certainly provides a major weakness in ranking by using the SAW method. In order for the weighting of the criteria to be better, the author uses the Rank Order Centroid (ROC) method. ROC is a simple method that can generate weight values against several criteria used [15].

2. METHODOLOGY OF RESEARCH

2.1 Employee

According to *undang-undang No.14 Tahun 1969* about Principal Labor, employees are people who able to carry out work, both inside and outside the employment relationship and to produce services or goods to meet the needs of the community. An employee is someone who can do work and it provide the results of their work to the entrepreneur or the agency where the employee works, where the results of work in accordance with the profession or occupation of the expertise in the field.

2.2 Rank Order Centroid (ROC)

Rank Order Centroid (ROC) is a method in providing the required weighting results in ranking of the decision support system. The implementation of the ROC method is quite easy. ROC works by emphasizing that the first criterion is more important than the second criterion, the second criterion is more important than the third criterion, and so on [15], [17]. So that, the importance of the criteria can be described as below:

C1>C2>C3>Cm (1)

Nilai bobot(W), dapat dihasilkan dengan berikut:

$$W_m = \frac{1}{m}\sum_{1=1}^{m}\left(\frac{1}{i}\right) \quad (2)$$

2.3 Simple Additive Weighting

The Simple Additive Weighting method is a method that can perform ranking by adding weighted on each alternative value [6], [18], [19]. This method is quite easy in the calculation process. Several steps in the implementation of the SAW method [20], [21], as in the following steps:

1. Prepare the decision matrix

$$= \begin{bmatrix} x_{11} & x_{12} & . & x_{1n} \\ x_{21} & x_{11} & . & x_{2n} \\ . & . & . & . \\ x_{m1} & x_{m1} & . & x_{mn} \end{bmatrix} \quad (3)$$

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2. Normalize the decision matrix

For benefit criteria use the following equation:

$$= \quad R_{ij} = \frac{x_{ij}}{Max\, x_{ij}} \quad (4)$$

For the cost criteria use the following equation.

$$R_{ij} = \frac{Min\, x_{ij}}{x_{ij}} \quad (5)$$

3. Doing the rangking.

$$= \Sigma \quad V_i = \sum_{j=1}^{n} W_j . R_{ij} \quad (6)$$

=1

The best alternative is the alternative that has the highest Vi value.

3.ANALYSIS AND DISCUSSION

In the implementation of a decision support system, it takes alternatives, criteria and the weights of the criteria used as data in producing a decision. The following in table 1, are the criteria which the conditions used for evaluating employee performance. While in table 2, it is an alternative to the company's employees whose performance will be assessed in this research

Table 1. Performance Assessment Criteria

Criteria	Description	Type
C1	Work Quality	Benefit
C2	Discipline	Benefit
C3	Coorperation	Benefit
C4	Loyalty	Benefit
C5	Warnings	Cost

Table 2. Employee Alternative

Alternative	Discipline (C2)	Cooperation (C3)	Loyalty (C4)	Warning (C5)
A 1	Very Good	Enough	Very Good	Never
A 2	Good	Good	Enough	Never
A 3	Good	Good	Good	Never
A 4	Very Good	Very Good	Enough	Never

Alternative	Work Quality (C1)	Discipline (C2)	Cooperation (C3)	Loyalty (C4)	Warning (C5)
A 5	Very Good	Good	Good	Good	Never
A 6	Not Good	Enough	Good	Very Good	Ever
A 7	Enough	Good	Good	Good	Never
A 8	Good	Enough	Good	Very Good	Never
A 9	Not Good	Good	Good	Good	Ever
A 10	Good	Very Good	Not Good	Good	Ever

In table 1, the criteria above do not yet have a weight, so that, the first step is to determine the weight value for each criterion. This is done by using the ROC method, the following calculations apply the ROC method (equation 2).

$$W_1 = \frac{1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}}{5} = 0{,}457$$

$$W_2 = \frac{0+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}}{5} = 0{,}257$$

$$W_3 = \frac{0+0+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}}{5} = 0{,}156$$

$$W_4 = \frac{0+0+0+\frac{1}{4}+\frac{1}{5}}{5} = 0{,}090$$

$$W_5 = \frac{0+0+0+0+\frac{1}{5}}{5} = 0{,}040$$

The results of the above weighting calculations can be seen in table 3.

Table 3. Weight Value

Criteria	Weight
C1	0,457
C2	0,257
C3	0,156
C4	0,090
C5	0.040

In table 2, the values of each criterion in each alternative are weighted using tables 4 and 5, as follows:

Table 4.Criteria Score Weighting of C1-C4

Description	Weight
Very Good	5
Good	4
Enough	3
Not Good	2
Bad	1

Table 5. Criteria Score Weighting of C5

Description	Weight
Never	1
Ever	2

So, the results of the weighting can be seen in table 6 as follows:

Table 6. Match Rating

Alternative	(C1)	(C2)	(C3)	(C4)	(C5)
A 1	4	5	3	5	1
A 2	5	4	4	3	1
A 3	5	4	4	4	1
A 4	4	5	5	3	1
A 5	5	4	4	4	1

Alternative	(C1)	(C2)	(C3)	(C4)	(C5)
A 6	2	3	4	5	2
A 7	3	4	4	4	1
A 8	4	3	4	5	1
A 9	2	4	4	4	2
A 10	4	5	2	4	2

After the suitability rating data has been obtained, the ranking calculation is carried out by applying the Simple Additive Weighting (SAW) method. The first step is to prepare a decision matrix (equation 3), as follows:

Xij

4	5	3	5	1
5	4	4	3	1
5	4	4	4	1
4	5	5	3	1
5	4	4	4	1
2	3	4	5	2
3	4	4	4	1
4	3	4	5	1
2	4	4	4	2
4	5	2	4	2

The next step is to normalize the decision matrix by using equations 4 and 5.
The results obtained are as in the Rij matrix as follows:

Rij

0.8	1	0.6	1	1
1	0.8	0.8	0.6	1
1	0.8	0.8	0.8	1
0.8	1	1	0.6	1
1	0.8	0.8	0.8	1
0.4	0.6	0.8	1	0.5
0.6	0.8	0.8	0.8	1
0.8	0.6	0.8	1	1
0.4	0.8	0.8	0.8	0.5
0.8	1	0.4	0.8	0.5

Next, determine the final preference by using equation 6, so that, the final result can be seen in table 7.

Table 7. Final Preference Results

Alternative	Value Vi	Description
A 3	0.8994	Very Good
A 5	0.8994	Very Good
A 2	0.8814	Very Good
A 4	0.8726	Very Good
A 1	0.8462	Very Good
A 10	0.777	Enough
A 8	0.7746	Enough
A 7	0.7166	Enough
A 9	0.6052	Poor
A 6	0.5718	Poor

In table 7, it can be seen that employees who have a value below 0.7 are employees who have poor performance, between or equal to 0.7 and below 0.8 have a enough value and those above or equal to 0.8 have very good performance. From the results of the calculations in table 7, it is the basis for company managers to assess employees and determine which employees will be given incentives, promotions or rewards

4. CONCLUSION

From the result of research, it can be concluded that:

1. Decision Support System provides decisions for managers to produce objective decisions, so that to increase the effectiveness of the resulting decisions.
2. The implementation of the combination of ROC and SAW provides a better decision when compared to the result of weighting without the calculation process.

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