

Enhancing Employee Motivation: A TOPSIS-Based by Yuke and Benny

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Enhancing Employee Motivation: A TOPSIS-Based Decision Support System for Incentive Allocation through Performance Evaluation

Yuke Subaikah Sutyawati, Benny Daniawan

Abstract— Information technology is developing rapidly and has a significant role in various aspects, one of which is making decisions to evaluate employee performance. Employee performance assessment is an important activity and is often carried out by companies to determine employee performance in a certain period. A company's progress is greatly influenced by the good and bad of the system that is running. The decision support system can improve and influence the assessment of existing performance in the company. If the decision support system is inadequate, it can lead to errors in decision-making. This research was conducted at PT. App Inti provides enthusiasm and motivation to employees, and the company performs performance assessments every six months, which will influence the adjustment of employee salary increases. However, the current assessment process still uses simple methods and often experiences difficulties assessing performance, making the assessments less effective. Because errors and inaccuracies often occur during assessments, to make it easier for companies to make decisions and help solve these problems, a decision support system was designed using the TOPSIS method. The TOPSIS is a multi-attribute decision-making method often used to complete practical decisions. Then, the results can be considered and help the company determine a decision based on the alternatives and criteria that the company has decided. Then, the results of this research can help companies determine which employees are more visible during the assessment. Then, the TOPSIS ranking results are used to adjust salary increases that have been selected by the company, thereby helping companies make decisions more quickly.

Index Terms— Performance Appraisal, Decision Support System, TOPSIS

I. INTRODUCTION

Information technology is one example that is developing rapidly to help humans in the process of determining strategies for decision-making [1]. Technology also has an essential role in companies, including the employee performance appraisal process [2]. Information technology makes it easier for someone to make a decision [3].

Performance appraisal is one of the essential activities for companies to evaluate the performance of their

employees during work, as well as to determine employee skills and competencies to improve employee performance, motivation, and enthusiasm [4] [5]. Performance assessments are carried out to obtain valuable information in making decisions about the company's human resource management activities [6].

A decision support system is part of an information system that an organization uses to manage data into information as a reference in making semi-structured and unstructured decisions [7], so that it can increase effectiveness when making decisions and be more objective [8]. The best decisions can be obtained from an objective process and can be completed using a decision support system [9].

PT. App Inti is a company in Jakarta engaged in the IT field of Application and Website Development Services. To increase employee morale so that their performance continues to grow, the company gives awards to employees by conducting performance assessments. This assessment will influence the adjustment of employee salary increases. Rewards such as salary increases can have an essential role in improving performance because they are a form of positive assessment of employees for the performance they have achieved [10]. Having a performance appraisal will make employees feel motivated so that it can encourage employees to be more accomplished and make an excellent contribution to the company [11].

Management and leaders of each division carry out employee performance appraisals. Employees are assessed based on criteria determined by the company. These criteria include discipline, responsibility, tidiness, collaborative, commitment, integrity, motivation, and problem-solving. Currently, the assessment process is still carried out manually. The criteria and indicators used are less targeted, so assessors often need help giving grades because there are no benchmarks in the assessment. So, when processing data, management often finds employees with inappropriate values.

In light of the existing problems, a decision to support an information system was designed using the Technique for Order Preference by Similarity to Ideal Solution

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(TOPSIS) method. TOPSIS method is one of the methods that are of interest to researchers in creating decision support systems because the concept is simple but complex in solving problem [6], characterized by solving problems in this method by selecting the best alternative not only from the shortest distance from the positive ideal solution but also from the longest distance from a negative ideal solution [12].

Previous research about Employee Performance Assessment Decision Support systems using the TOPSIS Method with five criteria: presence, cooperation, work quality, initiative, and productivity. From this research, we obtained the results of ranking alternatives that have the potential to become the best employees [12]. Another research study is about the Application of the TOPSIS Method in decision-making with the selection of the best car based on four criteria: style, safety, fuel efficiency, and expansion. From this research, we get results from each alternative that can be used in recommendations for choosing the best car [13]. The study, Determining Employee Bonuses in Companies Using the TOPSIS Method, has four criteria: attendance, employee assessment, length of service, and loyalty. So, the results obtained are that employees with the most significant value weight are entitled to receive an annual bonus based on criteria determined by the company [14].

Based on previous research, the researcher designed a decision support system using the TOPSIS method to assess employee performance for salary increases to obtain results that could help PT. Inti Media App in making assessments and making decisions.

II. METHODS

A. Decision Support System (DSS)

It is a computer-based system that can collect and process information data to be helpful so that it can assist in making decisions by utilizing data and models to solve structured and unstructured problems [7].

DSS is used to help decision-making in structured to unstructured issues, where people need to learn how the decision should be made [15]. Then, DSS is a process of selecting the best alternative from several alternatives used to solve problems [16].

The decision-making process has several objectives [17], i.e.

- 1) Assist management in making decisions on structured and unstructured problems.
- 2) DSS can provide solutions, and the results are acceptable.
- 3) Increase productivity.

B. Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

First introduced by Hwang and Yoon, TOPSIS is known for solving Multi-Criteria Decision Making problems, which has the concept that the alternative chosen must have the shortest distance from the positive ideal solution and the farthest distance from the negative ideal solution [13].

The TOPSIS method can help complete a decision realistically because it has a simple concept and is easy to understand. It also can measure the relative performance of decision alternatives [12].

Determination of alternatives is obtained from several stages, and each stage is interconnected with the others until the final preference value can be obtained. The steps of the TOPSIS method, according to (Chen, Yoon and Hwang, 1992) [17] i.e.

- 1) Determine the attributes or criteria that will be used in forming a suitability rating to form a matrix called the decision matrix.

- 2) Normalize the decision matrix with the following formula :

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}} \quad (1)$$

- 3) Calculating normalized matrix values :

$$y_{ij} = W_i \cdot r_{ij} \quad (2)$$

- 4) Looking for positive ideal and negative ideal solutions :

$$A^+ = (y_1^+, y_2^+, \dots, y_n^+) \quad (3)$$

$$A^- = (y_1^-, y_2^-, \dots, y_n^-) \quad (4)$$

- 5) Determine alternative distance values using positive and negative ideal solution matrix :

$$D_i^+ = \sqrt{\sum_{j=1}^n (y_j^+ - y_{ij})^2} \quad (5)$$

$$D_i^- = \sqrt{\sum_{j=1}^n (y_j^- - y_{ij})^2} \quad (6)$$

- 6) Determine the preference value of each alternative:

$$V_i = \frac{D_i^-}{D_i^- + D_i^+} \quad (7)$$

- 7) Sort preferences

The final step is to sort from relative closeness (V_i), highest to lowest, the best decision alternative will be indicated with the highest relative value.

III. RESULT AND DISCUSSION

The results that have been processed in the performance assessment decision support system by applying the TOPSIS method, the stages of implementing the TOPSIS method are as follows:

A. Criteria and Value Weights

The manager determines assessment criteria with value weights, shown in Table 1 below:

Table 1. Criteria and Value Weights

No	Code Criteria	Criteria	Weight
1	C1	Discipline	10%
2	C2	Responsibility	25%
3	C3	Tidiness	5%
4	C4	Collaborative	20%
5	C5	Commitment	10%

6	C6	Integrity	5%
7	C7	Motivation	10%
8	C8	Problem Solving	15%

Table 2. Discipline Criteria Indicators

Weight	Indicators
5	Consistently always arrives on time, with an absenteeism score of 0
4	Always arrives on time with 3x absenteeism
3	Always present, but likes to be late, intolerable conditions, with 4-6x absences
2	Often late, and absent with an absentee rate of more than 6x
1	Often late and absent for no apparent reason

Table 3. Responsibility Criteria Indicators

Weight	Indicators
5	Can complete assigned tasks on time and follow instructions accurately.
4	Can complete assigned tasks on time, although occasional errors may occur.
3	Can complete assigned tasks but is occasionally late and less accurate.
2	Completes assigned tasks but often late and not accurate.
1	Unable to complete assigned tasks.

Table 4. Tidiness Criteria Indicator

Weight	Indicators
5	Dress neatly and professionally while at work and demonstrate self-awareness in maintaining an orderly work desk.
4	Dress neatly and professionally and frequently preserve the tidiness of the workspace.
3	Occasionally dress in a tidy manner and tidy up the work desk, but may require supervision
2	It doesn't prioritize the tidiness of clothing; the focus is on dressing, and the work desk often needs to be more tidy.
1	Refrain from adhering to company regulations regarding dress code

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Table 5. Rating result

	C1	C2	C3	C4	C5	C6	C7	C8
A1	5	4	4	5	4	4	4	4
A2	5	4	4	4	4	4	4	4
A3	5	4	4	5	5	5	4	5
A4	5	4	4	4	5	4	4	5
A5	5	4	5	5	5	4	5	5
A6	5	4	5	4	5	5	4	4
A7	3	4	5	5	5	4	4	4
A8	5	2	5	3	5	4	4	4
A9	5	4	5	4	4	3	4	4
A10	5	4	5	5	5	5	4	4

Then, the assessment results of 20 ned answers from the management of PT. App Inti is based on a scale of 1-5, as shown in Table 5. After getting the value, here is how to use the TOPSIS method:

B. TOPSIS Method

The following are the stages in using the TOPSIS method as follows:

1) Normalizing the alternative values and the weighted normalized matrix with the values contained in Table 5 above, and the normalized matrix results using formula (1) using eight assessment criteria as follows:

$$C_1 \sqrt{5^2 + 5^2 + 5^2 + 5^2 + 5^2 + 5^2 + 3^2 + 5^2 + 5^2 + 5^2} = 15,2970$$

$$C_2 \sqrt{4^2 + 4^2 + 4^2 + 4^2 + 4^2 + 4^2 + 4^2 + 2^2 + 4^2 + 4^2} = 12,1655$$

$$C_3 \sqrt{4^2 + 4^2 + 4^2 + 4^2 + 5^2 + 5^2 + 5^2 + 5^2 + 5^2 + 5^2} = 14,6287$$

$$C_4 \sqrt{5^2 + 4^2 + 5^2 + 4^2 + 5^2 + 4^2 + 5^2 + 3^2 + 4^2 + 5^2} = 14,0712$$

$$C_5 \sqrt{4^2 + 4^2 + 5^2 + 5^2 + 5^2 + 5^2 + 5^2 + 4^2 + 5^2} = 14,9331$$

$$C_6 \sqrt{4^2 + 4^2 + 5^2 + 4^2 + 4^2 + 5^2 + 4^2 + 4^2 + 3^2 + 5^2} = 13,4164$$

$$C_7 \sqrt{4^2 + 4^2 + 4^2 + 4^2 + 5^2 + 4^2 + 4^2 + 4^2 + 4^2 + 4^2} = 13$$

$$C_8 \sqrt{4^2 + 4^2 + 5^2 + 5^2 + 5^2 + 4^2 + 4^2 + 4^2 + 4^2 + 4^2} = 13,6747$$

$$r_{1.1} = \frac{x_{1.1}}{x_1} = \frac{5}{15,2970} = 0,3268$$

$$r_{1.2} = \frac{x_{1.2}}{x_1} = \frac{5}{15,2970} = 0,3268$$

$$r_{1.3} = \frac{x_{1.3}}{x_1} = \frac{5}{15,2970} = 0,3268$$

$$r_{1.4} = \frac{x_{1.4}}{x_1} = \frac{5}{15,2970} = 0,3268$$

$$r_{1.5} = \frac{x_{1.5}}{x_1} = \frac{5}{15,2970} = 0,3268$$

$$r_{1.6} = \frac{x_{1.6}}{x_1} = \frac{5}{15,2970} = 0,3268$$

$$r_{1.7} = \frac{x_{1.7}}{x_1} = \frac{3}{15,2970} = 0,1961$$

$$r_{1.8} = \frac{x_{1.8}}{x_1} = \frac{5}{15,2970} = 0,3268$$

$$r_{1.9} = \frac{x_{1.9}}{x_1} = \frac{5}{15,2970} = 0,3268$$

$$r_{1.10} = \frac{x_{1.10}}{x_1} = \frac{5}{15,2970} = 0,3268$$

$$r_{2.1} = \frac{x_{2.1}}{x_1} = \frac{4}{12,1655} = 0,3287$$

$$r_{2.2} = \frac{x_{2.2}}{x_1} = \frac{4}{12,1655} = 0,3287$$

$$r_{2.3} = \frac{x_{2.3}}{x_1} = \frac{4}{12,1655} = 0,3287$$

$$r_{2.4} = \frac{x_{2.4}}{x_1} = \frac{4}{12,1655} = 0,3287$$

$$r_{2.5} = \frac{x_{2.5}}{x_1} = \frac{4}{12,1655} = 0,3287$$

$$r_{2.6} = \frac{x_{2.6}}{x_1} = \frac{4}{12,1655} = 0,3287$$

$$r_{2.7} = \frac{x_{2.7}}{x_1} = \frac{4}{12,1655} = 0,3287$$

$$r_{2,8} = \frac{x_{2,8}}{x_1} = \frac{2}{12,1655} = 0,1643$$

$$r_{2,9} = \frac{x_{2,9}}{x_1} = \frac{4}{12,1655} = 0,3287$$

$$r_{2,10} = \frac{x_{2,10}}{x_1} = \frac{4}{12,1655} = 0,3287$$

$$r_{3,1} = \frac{x_{3,1}}{x_1} = \frac{4}{14,6287} = 0,2734$$

$$r_{3,2} = \frac{x_{3,2}}{x_1} = \frac{4}{14,6287} = 0,2734$$

$$r_{3,3} = \frac{x_{3,3}}{x_1} = \frac{4}{14,6287} = 0,2734$$

$$r_{3,4} = \frac{x_{3,4}}{x_1} = \frac{4}{14,6287} = 0,2734$$

$$r_{3,5} = \frac{x_{3,5}}{x_1} = \frac{5}{14,6287} = 0,3417$$

$$r_{3,6} = \frac{x_{3,6}}{x_1} = \frac{5}{14,6287} = 0,3417$$

$$r_{3,7} = \frac{x_{3,7}}{x_1} = \frac{5}{14,6287} = 0,3417$$

$$r_{3,8} = \frac{x_{3,8}}{x_1} = \frac{5}{14,6287} = 0,3417$$

$$r_{3,9} = \frac{x_{3,9}}{x_1} = \frac{5}{14,6287} = 0,3417$$

$$r_{3,10} = \frac{x_{3,10}}{x_1} = \frac{5}{14,6287} = 0,3417$$

The calculation to find the r_{ij} value shown in part using three criteria, provided that the normalized decision matrix is calculated:

$$r_{ij} = \frac{x_{ij}}{x_i}, i=1, \dots, 10 \quad j=1, \dots, 8$$

2) Determine the normalization matrix using formula (2):

Table 6. Normalization Matrix

	A1	A2	A3
C1	0,0326	0,0326	0,0326
C2	0,0821	0,0821	0,0821
C3	0,0136	0,0136	0,0136
C4	0,0710	0,0568	0,0710
C5	0,0267	0,0220	0,0334
C6	0,0149	0,0149	0,0186
C7	0,0307	0,0307	0,0307
C8	0,0438	0,0438	0,0548

Searching for a weighted normalization matrix only displays three alternatives, with normalization:

W_i is the value of the alternative normalization
 r_{ij} is the weight of the criteria

3) Calculate the positive ideal solution and negative ideal solution matrix using formulas (3) and (4):

$$C1 = \frac{MAX}{0,0326 + 0,0326 + 0,0326 + 0,0326 + 0,0326 + 0,0326 + 0,0196 + 0,0326 + 0,0326 + 0,0326} = 0,0326$$

$$C2 = \frac{MAX}{0,0821 + 0,0821 + 0,0821 + 0,0821 + 0,0821 + 0,0821 + 0,0821 + 0,0410 + 0,0821 + 0,0821} = 0,0821$$

$$C3 = \frac{MAX}{0,0136 + 0,0136 + 0,0136 + 0,0136 + 0,0170 + 0,0170 + 0,0170 + 0,0170 + 0,0170 + 0,0170} = 0,0170$$

$$C1 = \frac{MIN}{0,0326 + 0,0326 + 0,0326 + 0,0326 + 0,0326 + 0,0326 + 0,0196 + 0,0326 + 0,0326 + 0,0326} = 0,0196$$

$$C2 = \frac{MIN}{0,0821 + 0,0821 + 0,0821 + 0,0821 + 0,0821 + 0,0821 + 0,0821 + 0,0410 + 0,0821 + 0,0821} = 0,0410$$

$$C3 = \frac{MIN}{0,0136 + 0,0136 + 0,0136 + 0,0136 + 0,0170 + 0,0170 + 0,0170 + 0,0170 + 0,0170 + 0,0170} = 0,0136$$

Table 7. Max and Min Normalization Matrix

Criteria	Max	Min
C1	0,0326	0,0196
C2	0,0821	0,0410
C3	0,0710	0,0136
C4	0,0710	0,0426
C5	0,0334	0,0267
C6	0,0186	0,0111
C7	0,0384	0,0307
C8	0,0548	0,0438

Then the results of the max and min normalization matrix for each criterion and alternative are shown in Table 7 above.

4) Calculate positive and negative ideal matrix :

Table 8. Positive Ideal Solution

S	D_i^+	D_i^-
A1	0,0158	0,0517
A2	0,0212	0,0455
A3	0,0084	0,0537
A4	0,0169	0,0473
A5	0,0037	0,0540
A6	0,0195	0,0466
A7	0,0190	0,0506
A8	0,0518	0,0155
A9	0,0219	0,0455
A10	0,0133	0,0527

Formulas (5) and (6) are used to calculate the ideal matrix so that results are obtained as in the table above.

5) Calculate the preference value of each alternative using formula (7), then look for the highest value and only use five alternatives as an example of the following calculation:

$$A_1 = \sqrt{\frac{0,0517}{0,0517 + 0,0158}} = 0,7661$$

$$A_2 = \sqrt{\frac{0,0455}{0,0455 + 0,0212}} = 0,6818$$

$$A_3 = \sqrt{\frac{0,0537}{0,0537 + 0,0084}} = 0,8645$$

$$A_4 = \sqrt{\frac{0,0473}{0,0473 + 0,0169}} = 0,7365$$

$$A_5 = \frac{0.0540}{\sqrt{0.0540 + 0.0037}} = 0.9354$$

Table 9. Ranking

	Nilai	Rank
A5	0.9354	1
A3	0.8645	2
A10	0.7973	3
A1	0.7661	4
A4	0.7365	5
A7	0.7263	6
A6	0.7047	7
A2	0.6818	8
A9	0.6747	9
A8	0.2304	10

The highest value is 0.9354 from alternative 5 which shows the highest value from other options based on predetermined criteria.

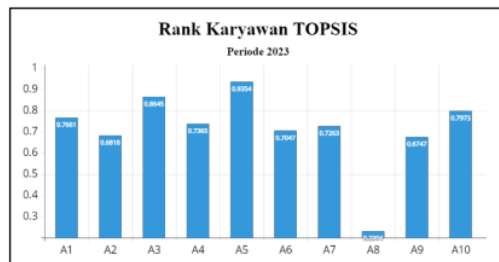


Fig. 1. TOPSIS Ranking Chart

IV. CONCLUSIONS

The Decision Support System for assessing employee performance using the TOPSIS method, consisting of 10 alternatives, obtained the highest ranking results: Alternative 5, Alternative 3, and other alternatives. This assessment system it can help management determine the best alternative to be selected to be given salary increase incentives.

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