TOPSIS Method Application for Decision Support System in Internal Control for Selecting Best Employees

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Abstract. The selection of the best employees is one of the process of evaluating how well the performance of the employees is adjusted to the standards set by the company and usually done by top management such as General Manager or Director. In general, the selection of the best employees is still performed manually with many criteria and alternatives, and this usually makes it difficult for managerial decision making as well as the selection of the best employees periodically into a long and complicated process. Therefore, it is necessary to build a decision support system that can help facilitate the decision maker in determining the best choice based on standard criteria, faster, and more objective. In this research, the computational method of decision-making system used is Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). The criteria used in the selection of the best employees are: job responsibilities, work discipline, work quality, and behaviour. The final result of the global priority value of the best employee candidates is used as the best employee selection decision making tool by top management.

1. Introduction

Inside the company there are many human resources called employees. Improving the function of human resources, especially employees are very influential to improve productivity and progress from achieving the company’s target. Therefore, in this research will be appointed a case that is looking for the best employee[1] based on predetermined criteria by using Technique for Order of Preference by Similarity to Ideal Solution[2], [3] (TOPSIS) method to perform the calculation on selection best employee. This method is chosen because it is able to select the best alternative from a number of
alternatives based on the criteria specified or called Multi Attribute Decision Making[2], [4], [5]. The criteria is dynamic, its weight value can be changed as desired by user. Then do the ranking process that will determine the best employees that have been recommended. The decision taken is not a final decision, because the final decision remains with the decision maker[5–9].

Problems occur in the inappropriateness of the advisor in giving an assessment to the employees because the assessed is the subjectivity for each employee, the resulted in the assessment given is still uncertain, this problem can be solved by using a decision support system with TOPSIS method. Previous research has described the use of TOPSIS method theory for the best employee selection[10], even some previous research on the use of TOPSIS method has been very much with various cases[11], the application of TOPSIS method on web application for the best employee selection is expected to contribute different from previous research that already exist.

2. Methodology
TOPSIS is one of multiple criteria decision making method that was first introduced by Yoon and Hwang[12], [13]. TOPSIS using the principle that the alternatives selected must have the shortest distance from the positive ideal solution and the farthest from the negative ideal solution from a geometrical point by using the Euclidean distance to determine the relative proximity of an alternative to the optimal solution[12–14]. Positive ideal solution is defined as the sum of all the best value that can be achieved for each attribute, while the negative-ideal solution consists of all the worst value achieved for each attribute. TOPSIS into account both the distance of the positive ideal solution and the distance to the negative ideal solution by taking the relative proximity to the positive ideal solution. Based on the comparison[15] of the relative distance, alternative priority order can be achieved. This method is widely used to complete the decision making. This is due to the concept is simple, easy to understand, efficient computation, and has the ability to measure the relative performance of the alternatives decision[13], [14], [16], [17].

The steps in calculating the TOPSIS method[18]:

a. Make a decision matrix is normalized.

\[
\mathbf{r}_{ij} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^{m} X_{ij}^2}}
\]

b. Normalized weighted.

With the weight \(w_j = (w_1, w_2, w_3, \ldots, W_n)\), where \(w_j\) is the weight of the criteria for all \(j\) and \(\sum_{j=1}^{w_j} = 1\), The normalization of weight matrix \(V\), is \(v_{ij} = w_j \times r_{ij}\)

c. Determining the ideal solution matrix of positive and negative ideal solution by using this formula:

\[
A^+ = \{(\text{max} \ v_{ij} \mid j \in J), (\text{min} \ v_{ij} \mid j \in J'), i = 1, 2, 3, \ldots, m\} = \{V^+_1, V^+_2, V^+_3, \ldots, V^+_n\}
\]

\[
A^- = \{(\text{min} \ v_{ij} \mid j \in J), (\text{max} \ v_{ij} \mid j \in J'), i = 1, 2, 3, \ldots, m\} = \{V^-_1, V^-_2, V^-_3, \ldots, V^-_n\}
\]

d. Calculating separation

a. \(S^+\) is an alternative distance from the positive ideal solution is defined as:

\[
\sigma_i^+ = \sqrt{\sum_{j=1}^{m} (v_{ij} - v_{ij}^+)^2}
\]

Where \(i = 1, 2, 3, \ldots, m\)
b. $S_{-}$ is an alternative distance from the negative ideal solution is defined as:

$$ s_i^- = \sqrt{\sum_{j=1}^{n} (y_{ij} - y_{-ij})^2} $$

Where $i = 1, 2, 3, \ldots, m$

e. Calculating positive ideal solution $w_i^+$

$$ C_i^+ = \frac{s_i^-}{s_i^- + s_i^+} $$

f. Alternative rank.

Alternative $C^+$ sorted from largest value to the smallest value. Alternative with the largest value of $C^+$ the best solution.

3. Result and Discussion

Experiment is performed by using few criteria as in Table 1 below:

| Criteria          |
|-------------------|
| Job Responsibilities |
| Work Discipline   |
| Work Quality      |
| Behavior          |

Information criteria listed in Table 1 was added to the application that is designed as in Fig. 1 below:

![Criteria form](image)

**Figure 1.** Criteria form

The next process is to determine the value of weight and weighted value information for each criterion in Table 1.

| Range Criteria | |
|----------------|---|
| 1: Very Bad    |   |
| 2: Bad         |   |
| 3: Pretty Good |   |
| 4: Good        |   |
5: Very Good

Table 3. Weight of Criteria

| No | Criteria          | Weight (W) |
|----|-------------------|------------|
| 1  | Job Responsibilities | 5         |
| 2  | Work Discipline   | 4         |
| 3  | Work Quality      | 3         |
| 4  | Behavior          | 3         |

Based on the information Table 2 and 3 in the input into the program with the following results:

Figure 2. Criteria Weight Value

Alternative data used as in Table 4 below:

Table 4. Alternative

| No | Alternative | Description |
|----|-------------|-------------|
| 1  | Sani        | A1          |
| 2  | Dika        | A2          |
| 3  | Abdul       | A3          |
| 4  | Eli         | A4          |
| 5  | Herbert     | A5          |

Information in Table 4 then adjusted to the program designed, the result is as follows:
After determining the criteria, weights and alternatives, the next process is to determine the value for each alternative and calculate it with the TOPSIS formula, see Table 5 below:

**Table 5. Values Each Alternatives**

| No | Alternative | Job Responsibilities | Work Discipline | Work Quality | Behavior |
|----|-------------|----------------------|-----------------|--------------|----------|
| 1. | A1          | 4                    | 3               | 4            | 4        |
| 2. | A2          | 5                    | 4               | 3            | 3        |
| 3. | A3          | 3                    | 4               | 5            | 4        |
| 4. | A4          | 4                    | 4               | 3            | 3        |
| 5. | A5          | 5                    | 4               | 5            | 4        |

The information contained in Table 5 in the input into the system with the display as in Fig. 4 below:

**Figure 3. Alternative Value**

**Figure 4. Value for each Alternative**
Testing the best employee selection using applications designed by applying the TOPSIS method can be seen in figure 5.

**Figure 5.** Value Alternative in Selection Process

**Figure 6.** TOPSIS Result
Figure 7. Graph Result TOPSIS

Figure 6 and figure 7 is the result of the calculation process in the designed web application. From the calculation process done employed by the name of Herbert is the best employee based on TOPSIS calculation, the result given is not a final decision but only give recommendation to the leader to take the decision better.

4. Conclusion
The use of TOPSIS method on decision support system can assist the managerial in obtaining competent candidates and also be minimized with data obtained from decision support system.

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