Decision Support System Best Employee Assessments with Technique for Order of Preference by Similarity to Ideal Solution

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Abstract: Process of employee assessment subjectively be a major problem for any company due to many factors resulting in inaccuracies and errors in judgment, many ways we can do to help the evaluation process one of way were using decision support system with Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) methods, TOPSIS has a simple concept and easy to understand, computationally efficient and has the ability to measure the relative performance of the alternatives in the form of a systematic decision simple.

Keyword: Alternative and Criteria, Decision Support System, Relative Performance, Multi Decision Criteria, TOPSIS

I. INTRODUCTION

Nowadays the concept of decision support system for computer-based growing [1] [2] [3] and many methods very rapidly could be used to help the decision-making process, decision-making carried by doing a systematic approach to the problem through the course of collecting information and also added factors to consider in making a decision [2] [3], based on that implementation of decision support systems need to be applied in everyday life to contribute to making decisions.

Research in this article examine case the selection of the best employees with TOPSIS methods, giving value to the employees is essentially subjective, and it is a separate issue to determine whether or not an employee's right to be the best employee. Decision-making also has criteria that will be influential every aspect criteria that involve [4] [5] [6], in this case, are selecting the best employees, the methods used to assist in the assessment of the best employees using TOPSIS method.

II. THEORY

Multiple Attribute Decision Making (MADM) is a method used to find the optimal alternative of some alternatives with certain criteria [7] [8] [9] [10]. MADM determine the weight values for each attribute, followed by the ranking process that will select the alternative that has been granted [11]. There are three approaches to finding the value of attribute weights is a subjective approach, objective approach, an approach of an integration between the subjectively and objectively [7].

The value of weighting on the individual approach is determined based on the subjectivity of decision-makers so that some of the factors in the ranking process alternatives can be determined freely [9]. Weight value of an objective approach mathematically calculated, so that ignores the subjectivity of the decision makers [1] [7].
2.1 TOPSIS
TOPSIS is one of the multiple criteria decision-making methods that first introduced by Yoon and Hwang [4] [7]. 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 [4] [5] [7]. The 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 obtained 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 of the relative distance, the alternative priority order could achieve. This method is widely used to complete the decision making. TOPSIS method due to the concept is simple, easy to understand, efficient computation, and can measure the relative performance of the alternatives decision [4] [5] [6] [7].

The steps in calculating the TOPSIS method [9]:

1. TOPSIS starts with building a decision matrix.
   The decision matrix $X$ refers to the alternatives that will be evaluated based on the criteria. The decision matrix $X$ could be see in Figure 2 below

   \[
   X = \begin{bmatrix}
   x_{11} & x_{12} & x_{13} & \cdots & x_{1n} \\
   x_{21} & x_{22} & x_{23} & \cdots & x_{2n} \\
   \vdots & \vdots & \vdots & \ddots & \vdots \\
   x_{m1} & x_{m2} & x_{m3} & \cdots & x_{mn}
   \end{bmatrix}
   \]

2. Make a decision matrix is normalized.
   The equation used to transform each element $x_{ij}$, are as follows:

   \[
   r_{ij} = \frac{X_{ij}}{\sqrt{\sum_{j=1}^{m} X_{ij}^2}}
   \]
3. Make a decision matrix is normalized weighted.
With the weight $w_j = (w_1, w_2, w_3, ..., w_n)$, where $w_j$ is the weight of the criteria for all $j$ and $\sum_{j=1}^{n} w_j = 1$. The normalization of weight matrix $V$, is

$$V_{ij} = w_j \cdot r_{ij}$$

4. Determining the ideal solution matrix of positive and negative ideal solution, The ideal solution is denoted positive $A^+$ whereas the negative ideal solution denoted $A^-$. Here is the equation of $A^+$ and $A^-$:

a. $$A^+ = \{(\text{max} v_{ij} | j \in J), (\text{min} v_{ij} | j \in J'), i = 1, 2, 3, ..., m\}$$

b. $$A^- = \{(\text{min} v_{ij} | j \in J), (\text{max} v_{ij} | j \in J'), i = 1, 2, 3, ..., m\}$$

5. Calculating separation
a. $S^+$ is an alternative distance from the positive ideal solution is defined as:

$$S^+_i = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_{ij}^+)^2}$$

Where $i = 1, 2, 3, ..., m$

b. $S^-$ is an alternative distance from the negative ideal solution, defined as:

$$S^-_i = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_{ij}^-)^2}$$

6. Calculating the relative proximity to the positive ideal solution.
The relative proximity of any alternative to the positive ideal solution can be computed using the following equation:

$$C^+_i = \frac{S^-_i}{S^-_i + S^+_i}$$

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

III. RESULT AND DISCUSSION
Selecting the best employees in this study by paying attention to various aspects such as performance, personality and so on, the selection of the different aspects of course not easy to do manually but requires a method, in this case, were using TOPSIS method, the criteria applied in this study as follows:

<table>
<thead>
<tr>
<th>Table 1. Criteria TOPSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria</td>
</tr>
<tr>
<td>Work performance</td>
</tr>
<tr>
<td>Attitude and Personality</td>
</tr>
<tr>
<td>Teamwork</td>
</tr>
<tr>
<td>Intellectual capacity</td>
</tr>
</tbody>
</table>

The next is a weighted value for each criterion listed in Table 1.
Table 2. Range Criteria

<table>
<thead>
<tr>
<th>Range Criteria</th>
<th>1: Very Bad</th>
<th>2: Bad</th>
<th>3: Pretty Good</th>
<th>4: Good</th>
<th>5: Very Good</th>
</tr>
</thead>
</table>

The weight values that will be used to indicate the relative importance of each criterion. The weights of each of the criteria listed in Table 3

Table 3. Weight of Criteria

<table>
<thead>
<tr>
<th>No</th>
<th>Criteria</th>
<th>Weight (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Work performance</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Attitude and Personality</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Teamwork</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Intellectual capacity</td>
<td>3</td>
</tr>
</tbody>
</table>

The sample used in the selection of the best employees with a TOPSIS method using ten alternative and four criteria:

Table 4. Alternative

<table>
<thead>
<tr>
<th>No</th>
<th>Alternative</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yopi</td>
<td>A1</td>
</tr>
<tr>
<td>2</td>
<td>Friska</td>
<td>A2</td>
</tr>
<tr>
<td>3</td>
<td>Donni Sikumbang</td>
<td>A3</td>
</tr>
<tr>
<td>4</td>
<td>Helmi Yahya</td>
<td>A4</td>
</tr>
<tr>
<td>5</td>
<td>Ismail Marzuki</td>
<td>A5</td>
</tr>
<tr>
<td>6</td>
<td>Novita Mustika</td>
<td>A6</td>
</tr>
<tr>
<td>7</td>
<td>Angga Novian</td>
<td>A7</td>
</tr>
<tr>
<td>8</td>
<td>Amelia</td>
<td>A8</td>
</tr>
<tr>
<td>9</td>
<td>Lisa Wardani</td>
<td>A9</td>
</tr>
<tr>
<td>10</td>
<td>Ebenezer</td>
<td>A10</td>
</tr>
</tbody>
</table>

Ratings for each of the criteria will be converted into fuzzy numbers, can be seen in Table 5 below:

Table 5. Ratings Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Work performance</th>
<th>Attitude and Personality</th>
<th>Teamwork</th>
<th>Intellectual capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point</td>
<td>Weight</td>
<td>Point</td>
<td>Weight</td>
<td>Point</td>
</tr>
<tr>
<td>85-100</td>
<td>5</td>
<td>85-100</td>
<td>5</td>
<td>85-100</td>
</tr>
<tr>
<td>75-84.99</td>
<td>4</td>
<td>75-84.99</td>
<td>4</td>
<td>75-84.99</td>
</tr>
<tr>
<td>65-74.99</td>
<td>3</td>
<td>65-74.99</td>
<td>3</td>
<td>65-74.99</td>
</tr>
<tr>
<td>55-64.99</td>
<td>2</td>
<td>55-64.99</td>
<td>2</td>
<td>55-64.99</td>
</tr>
<tr>
<td>0-54.99</td>
<td>1</td>
<td>0-54.99</td>
<td>1</td>
<td>0-54.99</td>
</tr>
</tbody>
</table>

Working procedures for TOPSIS method are:
1. Determining the value of each alternative, sample calculations for each employee could see in Table 6.
### Table 6. Values Each Alternative

<table>
<thead>
<tr>
<th>No.</th>
<th>Alternative</th>
<th>Work performance</th>
<th>Attitude and Personality</th>
<th>Teamwork</th>
<th>Intellectual Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A1</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>A2</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>3.</td>
<td>A3</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>4.</td>
<td>A4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>5.</td>
<td>A5</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>A6</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>7.</td>
<td>A7</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>8.</td>
<td>A8</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>A9</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>10.</td>
<td>A10</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

2. Determine the normalization of decision matrix

Determining the decision matrix normalization, the value of each criterion (xij) for the entire alternative summed then the value of each of these criteria divided by the sum of the criteria.

**a. Work performance (C1)**

\[
|C1| = \sqrt{(4)^2 + (5)^2 + (3)^2 + (4)^2 + (5)^2 + (3)^2} = \sqrt{12,8840} \\
R_{11} = \frac{X_{11}}{C_1} = \frac{4}{12,8840} = 0.3104 \\
R_{21} = \frac{X_{21}}{C_1} = \frac{5}{12,8840} = 0.3880 \\
R_{31} = \frac{X_{31}}{C_1} = \frac{3}{12,8840} = 0.2328 \\
R_{41} = \frac{X_{41}}{C_1} = \frac{4}{12,8840} = 0.3104 \\
R_{51} = \frac{X_{51}}{C_1} = \frac{5}{12,8840} = 0.3880 \\
R_{61} = \frac{X_{61}}{C_1} = \frac{3}{12,8840} = 0.2328 \\
R_{71} = \frac{X_{71}}{C_1} = \frac{4}{12,8840} = 0.3104 \\
R_{81} = \frac{X_{81}}{C_1} = \frac{4}{12,8840} = 0.3104 \\
R_{91} = \frac{X_{91}}{C_1} = \frac{5}{12,8840} = 0.3880 \\
R_{101} = \frac{X_{101}}{C_1} = \frac{3}{12,8840} = 0.2328 \\
\]

**b. Attitude and Personality (C2)**

\[
|C2| = \sqrt{(3)^2 + (4)^2 + (4)^2 + (4)^2 + (4)^2 + (3)^2} = \sqrt{12,4498} \\
R_{12} = \frac{X_{12}}{C_2} = \frac{3}{12,4498} = 0.2409 \\
R_{22} = \frac{X_{22}}{C_2} = \frac{4}{12,4498} = 0.3212 \\
R_{32} = \frac{X_{32}}{C_2} = \frac{4}{12,4498} = 0.3212 \\
R_{42} = \frac{X_{42}}{C_2} = \frac{4}{12,4498} = 0.3212 \\
R_{52} = \frac{X_{52}}{C_2} = \frac{4}{12,4498} = 0.3212 \\
R_{62} = \frac{X_{62}}{C_2} = \frac{4}{12,4498} = 0.3212 \\
R_{72} = \frac{X_{72}}{C_2} = \frac{5}{12,4498} = 0.4016 \\
R_{82} = \frac{X_{82}}{C_2} = \frac{4}{12,4498} = 0.3212 \\
R_{92} = \frac{X_{92}}{C_2} = \frac{4}{12,4498} = 0.3212 \\
R_{102} = \frac{X_{102}}{C_2} = \frac{3}{12,4498} = 0.2409 \\
\]
c. Teamwork (C3)

\[
|C_3| = \sqrt{(4)^2 + (3)^2 + (5)^2 + (3)^2 + (5)^2 + (5)^2 + (4)^2 + (3)^2 + (5)^2 + (5)^2} = 13.5646
\]

\[
R_{13} = \frac{X_{13}}{C_3} = \frac{4}{13.5646} = 0.2948
\]

\[
R_{23} = \frac{X_{23}}{C_3} = \frac{3}{13.5646} = 0.2211
\]

\[
R_{33} = \frac{X_{33}}{C_3} = \frac{5}{13.5646} = 0.3686
\]

\[
R_{43} = \frac{X_{43}}{C_3} = \frac{3}{13.5646} = 0.2211
\]

\[
R_{53} = \frac{X_{53}}{C_3} = \frac{5}{13.5646} = 0.3686
\]

\[
R_{63} = \frac{X_{63}}{C_3} = \frac{5}{13.5646} = 0.3686
\]

\[
R_{73} = \frac{X_{73}}{C_3} = \frac{4}{13.5646} = 0.2948
\]

\[
R_{83} = \frac{X_{83}}{C_3} = \frac{3}{13.5646} = 0.2211
\]

\[
R_{93} = \frac{X_{93}}{C_3} = \frac{5}{13.5646} = 0.3686
\]

\[
R_{103} = \frac{X_{103}}{C_3} = \frac{5}{13.5646} = 0.3686
\]

d. Intellectual Capacity (C4)

\[
|C_4| = \sqrt{(4)^2 + (3)^2 + (4)^2 + (3)^2 + (4)^2 + (4)^2 + (5)^2 + (3)^2 + (4)^2 + (4)^2} = 12.5299
\]

\[
R_{14} = \frac{X_{14}}{C_4} = \frac{4}{12.5299} = 0.3192
\]

\[
R_{24} = \frac{X_{24}}{C_4} = \frac{3}{12.5299} = 0.2394
\]

\[
R_{34} = \frac{X_{34}}{C_4} = \frac{4}{12.5299} = 0.3192
\]

\[
R_{44} = \frac{X_{44}}{C_4} = \frac{3}{12.5299} = 0.2394
\]

\[
R_{54} = \frac{X_{54}}{C_4} = \frac{4}{12.5299} = 0.3192
\]

\[
R_{64} = \frac{X_{64}}{C_4} = \frac{5}{12.5299} = 0.3990
\]

\[
R_{74} = \frac{X_{74}}{C_4} = \frac{3}{12.5299} = 0.2394
\]

\[
R_{84} = \frac{X_{84}}{C_4} = \frac{4}{12.5299} = 0.3192
\]

\[
R_{94} = \frac{X_{94}}{C_4} = \frac{5}{12.5299} = 0.3990
\]

\[
R_{104} = \frac{X_{104}}{C_4} = \frac{4}{12.5299} = 0.3192
\]

<p>| Table 7. Normalization Matrix |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>Alternative</th>
<th>Work performance</th>
<th>Attitude and Personality</th>
<th>Teamwork</th>
<th>Intellectual Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A1</td>
<td>0.3104</td>
<td>0.2409</td>
<td>0.2948</td>
<td>0.3192</td>
</tr>
<tr>
<td>2.</td>
<td>A2</td>
<td>0.3880</td>
<td>0.3212</td>
<td>0.2211</td>
<td>0.2394</td>
</tr>
<tr>
<td>3.</td>
<td>A3</td>
<td>0.2328</td>
<td>0.3212</td>
<td>0.3686</td>
<td>0.3192</td>
</tr>
<tr>
<td>4.</td>
<td>A4</td>
<td>0.3104</td>
<td>0.3212</td>
<td>0.2211</td>
<td>0.2394</td>
</tr>
<tr>
<td>5.</td>
<td>A5</td>
<td>0.3880</td>
<td>0.3212</td>
<td>0.3686</td>
<td>0.3192</td>
</tr>
<tr>
<td>6.</td>
<td>A6</td>
<td>0.2328</td>
<td>0.3212</td>
<td>0.3686</td>
<td>0.3990</td>
</tr>
<tr>
<td>7.</td>
<td>A7</td>
<td>0.3104</td>
<td>0.4016</td>
<td>0.2948</td>
<td>0.2394</td>
</tr>
<tr>
<td>8.</td>
<td>A8</td>
<td>0.3104</td>
<td>0.3212</td>
<td>0.2211</td>
<td>0.3192</td>
</tr>
<tr>
<td>9.</td>
<td>A9</td>
<td>0.3880</td>
<td>0.3212</td>
<td>0.3686</td>
<td>0.3990</td>
</tr>
<tr>
<td>10.</td>
<td>A10</td>
<td>0.2328</td>
<td>0.2409</td>
<td>0.3686</td>
<td>0.3192</td>
</tr>
</tbody>
</table>

3. Determine the weighted normalized decision matrix

Determination of the weighted normalized decision matrix calculation is taken from the weight of each criteria:
a. Work performance (C1)

\[
\begin{align*}
Y_{11} &= W_1 R_{11} = 5 \times 0.3104 = 1.552 \\
Y_{21} &= W_1 R_{21} = 5 \times 0.3880 = 1.94 \\
Y_{31} &= W_1 R_{31} = 5 \times 0.2328 = 1.164 \\
Y_{41} &= W_1 R_{41} = 5 \times 0.3104 = 1.552 \\
Y_{51} &= W_1 R_{51} = 5 \times 0.3880 = 1.94 \\
Y_{61} &= W_1 R_{61} = 5 \times 0.2328 = 1.164 \\
Y_{71} &= W_1 R_{71} = 5 \times 0.3104 = 1.552 \\
Y_{81} &= W_1 R_{81} = 5 \times 0.3880 = 1.94 \\
Y_{91} &= W_1 R_{91} = 5 \times 0.2328 = 1.164 \\
Y_{101} &= W_1 R_{101} = 5 \times 0.3104 = 1.552
\end{align*}
\]

b. Attitude and Personality (C2)

\[
\begin{align*}
Y_{12} &= W_2 R_{12} = 4 \times 0.2409 = 0.9636 \\
Y_{22} &= W_2 R_{22} = 4 \times 0.3212 = 1.2848 \\
Y_{32} &= W_2 R_{32} = 4 \times 0.3212 = 1.2848 \\
Y_{42} &= W_2 R_{42} = 4 \times 0.3212 = 1.2848 \\
Y_{52} &= W_2 R_{52} = 4 \times 0.3212 = 1.2848 \\
Y_{62} &= W_2 R_{62} = 4 \times 0.3212 = 1.2848 \\
Y_{72} &= W_2 R_{72} = 4 \times 0.4016 = 1.6064 \\
Y_{82} &= W_2 R_{82} = 4 \times 0.3212 = 1.2848 \\
Y_{92} &= W_2 R_{92} = 4 \times 0.3212 = 1.2848 \\
Y_{102} &= W_2 R_{102} = 4 \times 0.2409 = 0.9636
\end{align*}
\]

c. Teamwork (C3)

\[
\begin{align*}
Y_{13} &= W_3 R_{13} = 3 \times 0.2948 = 0.8844 \\
Y_{23} &= W_3 R_{23} = 3 \times 0.2211 = 0.6633 \\
Y_{33} &= W_3 R_{33} = 3 \times 0.3686 = 1.1058 \\
Y_{43} &= W_3 R_{43} = 3 \times 0.2211 = 0.6633 \\
Y_{53} &= W_3 R_{53} = 3 \times 0.3686 = 1.1058 \\
Y_{63} &= W_3 R_{63} = 3 \times 0.3686 = 1.1058 \\
Y_{73} &= W_3 R_{73} = 3 \times 0.2948 = 0.8844 \\
Y_{83} &= W_3 R_{83} = 3 \times 0.2211 = 0.6633 \\
Y_{93} &= W_3 R_{93} = 3 \times 0.3686 = 1.1058 \\
Y_{103} &= W_3 R_{103} = 3 \times 0.3686 = 1.1058
\end{align*}
\]

d. Intellectual Capacity (C4)

\[
\begin{align*}
Y_{14} &= W_4 R_{14} = 3 \times 0.3192 = 0.9576 \\
Y_{24} &= W_4 R_{24} = 3 \times 0.3192 = 0.9576 \\
Y_{34} &= W_4 R_{34} = 3 \times 0.3192 = 0.9576 \\
Y_{44} &= W_4 R_{44} = 3 \times 0.3192 = 0.9576 \\
Y_{54} &= W_4 R_{54} = 3 \times 0.3192 = 0.9576 \\
Y_{64} &= W_4 R_{64} = 3 \times 0.3990 = 1.197 \\
Y_{74} &= W_4 R_{74} = 3 \times 0.3192 = 0.9576 \\
Y_{84} &= W_4 R_{84} = 3 \times 0.3192 = 0.9576 \\
Y_{94} &= W_4 R_{94} = 3 \times 0.3990 = 1.197 \\
Y_{104} &= W_4 R_{104} = 3 \times 0.3192 = 0.9576
\end{align*}
\]
4. Determining the ideal solution matrix of positive and negative
The next step is to determine the ideal solution matrix of positive and negative (yij +):
+= (1+, 2+, 3+, ..., +);
-= (1−, 2−, 3−, ..., −);
\[
\begin{align*}
\max_i Y_{ij} \\
\min_i Y_{ij}
\end{align*}
\]
Positive ideal solution is calculated as follows:
\[
\begin{align*}
1+ &= \{1,552; 1,94; 1,164; 1,552;1,94; 1,164; 1,552; 1,552; 1,94; 1,164;\} = 1,94 \\
2+ &= \{0,9636; 1,2848;1,2848;1,2848;1,2848;1,2848;1,6064;1,2848;1,2848;0,9636;\} = 1,6064 \\
3+ &= \{0,8844;0,6633;1,1058;0,6633;1,058;0,8844;0,6633;1,1058;1,058;\} = 1,1058 \\
4+ &= \{0,9576;0,7182;0,9576;0,7182;0,9576;1,197;0,7182;0,9576;1,197;0,9576;\} = 1,197 \\
+ &= \{1,94;1,6064;1,1058; 1,197;\}
\end{align*}
\]
Negative ideal solution is calculated as follows:
\[
\begin{align*}
1- &= \{1,552; 1,94; 1,164; 1,552;1,94; 1,164; 1,552; 1,552; 1,94; 1,164;\} = 1,164 \\
2- &= \{0,9636; 1,2848;1,2848;1,2848;1,2848;1,2848;1,6064;1,2848;1,2848;0,9636;\} = 0,9636 \\
3- &= \{0,8844;0,6633;1,1058;0,6633;1,058;0,8844;0,6633;1,1058;1,058;\} = 0,6633 \\
4- &= \{0,9576;0,7182;0,9576;0,7182;0,9576;1,197;0,7182;0,9576;1,197;0,9576;\} = 0,7182 \\
- &= \{1,164;0,9636; 0,6633; 0,7182;\}
\end{align*}
\]
\[
\begin{tabular}{|c|c|c|c|}
\hline
Solution & Ideal (+) & Ideal (-) \\
\hline
Y1 & 1,94 & 1,164 \\
Y2 & 1,6064 & 0,9636 \\
Y3 & 1,1058 & 0,6633 \\
Y4 & 1,197 & 0,7182 \\
\hline
\end{tabular}
\]

5. Determine the distance between the value of each alternative with a matrix of positive and negative ideal solution, looking for an alternative to the distance between the positive ideal solution matrix.
\[
+ = \sqrt{\sum_{j=1}^{n} (Y_i^+ - Y_{ij})^2}
\]
Distance between alternative A, with a negative ideal solution formulated as
\[
- = \sqrt{\sum_{j=1}^{n} (Y_i^j - Y_{ij})^2} \; i=1,2,...,m
\]
Make the distance between the weighted value of each alternative to the positive ideal solution:
\[
\begin{align*}
1 + &= \frac{(1,552 - 1,94)^2 + (0,9636 - 1,6064)^2 + (0,8844 - 1,1058)^2 + (0,9576 - 1,197)^2}{4} = 0,8185 \\
2 + &= \frac{(1,94 - 1,94)^2 + (1,2848 - 1,6064)^2 + (0,6633 - 1,1058)^2 + (0,7182 - 1,197)^2}{4} = 0,7269 \\
3 + &= \frac{(1,164 - 1,94)^2 + (1,2848 - 1,6064)^2 + (1,1058 - 1,1058)^2 + (0,9576 - 1,197)^2}{4} = 0,8734 \\
4 + &= \frac{(1,552 - 1,94)^2 + (1,2848 - 1,6064)^2 + (0,6633 - 1,1058)^2 + (0,7182 - 1,197)^2}{4} = 0,8240 \\
\end{align*}
\]
Make the distance between the weighted value of each alternative against the negative ideal solution:

1. \[ \sqrt{(1,552 - 1,164)^2 + (0,9636 - 0,9636)^2 + (0,8844 - 0,6633)^2 + (0,9576 - 0,7182)^2} = 0,5066 \]

2. \[ \sqrt{(1,94 - 1,164)^2 + (1,2848 - 0,9636)^2 + (0,6633 - 0,6633)^2 + (0,7182 - 0,7182)^2} = 0,8840 \]

3. \[ \sqrt{(1,164 - 1,164)^2 + (1,2848 - 0,9636)^2 + (0,6633 - 0,6633)^2 + (0,9576 - 0,7182)^2} = 0,5968 \]

4. \[ \sqrt{(1,552 - 1,164)^2 + (1,2848 - 0,9636)^2 + (0,6633 - 0,6633)^2 + (0,7182 - 0,7182)^2} = 0,5036 \]

5. \[ \sqrt{(1,94 - 1,164)^2 + (1,2848 - 0,9636)^2 + (0,6633 - 0,6633)^2 + (0,9576 - 0,7182)^2} = 0,9790 \]

6. \[ \sqrt{(1,164 - 1,164)^2 + (1,2848 - 0,9636)^2 + (0,6633 - 0,6633)^2 + (0,9576 - 0,7182)^2} = 0,7267 \]

7. \[ \sqrt{(1,552 - 1,164)^2 + (1,6064 - 0,9636)^2 + (0,8844 - 0,6633)^2 + (0,7182 - 0,7182)^2} = 0,7827 \]

8. \[ \sqrt{(1,552 - 1,164)^2 + (1,2848 - 0,9636)^2 + (0,6633 - 0,6633)^2 + (0,9576 - 0,7182)^2} = 0,5576 \]
9. \[ 9 = \sqrt{(1.94 - 1.164)^2 + (1.2848 - 0.9636)^2 + (1.1058 - 0.6633)^2 + (1.197 - 0.7182)^2} = 1.0632 \]

10. \[ 10 = \sqrt{(1.164 - 1.164)^2 + (0.9636 - 0.9636)^2 + (1.1058 - 0.6633)^2 + (0.9576 - 0.7182)^2} = 0.5031 \]

**Table 9. Distance to the positive and negative ideal solution**

<table>
<thead>
<tr>
<th></th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>D5</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>Distance Ideal (+)</td>
<td>0.8185</td>
<td>0.7269</td>
<td>0.8734</td>
<td>0.8240</td>
</tr>
<tr>
<td></td>
<td>Distance Ideal (-)</td>
<td>0.5066</td>
<td>0.8840</td>
<td>0.5968</td>
<td>0.5036</td>
</tr>
<tr>
<td>D2</td>
<td>Distance Ideal (+)</td>
<td>0.8400</td>
<td>0.6548</td>
<td>0.7121</td>
<td>0.3216</td>
</tr>
<tr>
<td></td>
<td>Distance Ideal (-)</td>
<td>0.7267</td>
<td>0.7827</td>
<td>0.5576</td>
<td>1.0632</td>
</tr>
</tbody>
</table>

6. The last step in the calculation of TOPSIS is seeking preference value for each alternative.

\[ V_i = \frac{D_i^+}{D_i^- + D_i^+}; \quad i = 1,2, \ldots, m \]

Values greater \( V_i \) showed that \( A_i \) preferred alternative, the value of preference calculating as below:

a. Preference Values A1

\[ V_1 = \frac{D_1^-}{D_1^- + D_1^+} = \frac{0.5066}{0.5066 + 0.8185} = 0.3823 \]

b. Preference Values A2

\[ V_2 = \frac{D_2^-}{D_2^- + D_2^+} = \frac{0.8840}{0.8840 + 0.7269} = 0.5487 \]

c. Preference Values A3

\[ V_3 = \frac{D_3^-}{D_3^- + D_3^+} = \frac{0.5968}{0.5968 + 0.8734} = 0.4059 \]

d. Preference Values A4

\[ V_4 = \frac{D_4^-}{D_4^- + D_4^+} = \frac{0.5036}{0.5036 + 0.8240} = 0.3793 \]

e. Preference Values A5

\[ V_5 = \frac{D_5^-}{D_5^- + D_5^+} = \frac{0.9790}{0.9790 + 0.4009} = 0.7094 \]

f. Preference Values A6

\[ V_6 = \frac{D_6^-}{D_6^- + D_6^+} = \frac{0.7267}{0.7267 + 0.8400} = 0.4638 \]

g. Preference Values A7

\[ V_7 = \frac{D_7^-}{D_7^- + D_7^+} = \frac{0.7827}{0.7827 + 0.6548} = 0.5444 \]
h. Preference Values A8
\[
V_8 = \frac{D_8^-}{D_8^- + D_8^+} = \frac{0.5576}{0.5576 + 0.7121} = 0.4391
\]
i. Preference Values A9
\[
V_9 = \frac{D_9^-}{D_9^- + D_9^+} = \frac{1.0632}{1.0632 + 0.3216} = 0.7677
\]
j. Preference Values A10
\[
V_{10} = \frac{D_{10}^-}{D_{10}^- + D_{10}^+} = \frac{0.5031}{0.5031 + 1.1156} = 0.3108
\]

The results of the preference values calculated for all the alternatives can see from table below:

<table>
<thead>
<tr>
<th>Table 10: Value Alternatives for Each Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>--------</td>
</tr>
<tr>
<td>V1</td>
</tr>
<tr>
<td>V2</td>
</tr>
<tr>
<td>V3</td>
</tr>
<tr>
<td>V4</td>
</tr>
<tr>
<td>V5</td>
</tr>
<tr>
<td>V6</td>
</tr>
<tr>
<td>V7</td>
</tr>
<tr>
<td>V8</td>
</tr>
<tr>
<td>V9</td>
</tr>
<tr>
<td>V10</td>
</tr>
</tbody>
</table>

According to the table above, the value of the preference in the alternative \( V_9 = A_9 = \text{Lisa Wardani} \) is the best employee.

**IV. CONCLUSION**

TOPSIS Method in this research examines the case of the best employees, with the use of this method any cases could be resolved properly by using value for each alternative by comparing each value, the calculation of the alternative criteria be expedited and comparing among the alternative is also not difficult, for another case with the concept of multi-criteria could be resolved with this method, one development that can be done with this approach is the need to add functionality so that the optimal weight calculation process does not need to be repeatedly done with results not much different.

**REFERENCES**


