Selection of the Best Administrative Staff Using Elimination Et Choix Traduisant La Realite (ELECTRE) Method

Sarida Sirait¹, Doris Yolanda Saragih², Heru Sugara³*, Muhammad Yunus⁴, Sumaizar⁵, M. Ali Hanafiah¹, Victor Marudut Mulia Siregar², Isa Indrawan⁶, Umar Anwar⁶, D Defliyanto⁷

¹Computerized Accounting Department, Politeknik Bisnis Indonesia, Indonesia
²Computer Engineering Department, Politeknik Bisnis Indonesia, Indonesia
³Secretary Department, Politeknik Bisnis Indonesia, Indonesia
⁴Management Department, Sekolah Tinggi Akuntansi dan Manajemen Indonesia, Indonesia
⁵Universitas Pembangunan Panca Budi, Medan, Indonesia
⁶Politeknik Ilmu Pemasyarakatan, Indonesia
⁷Universitas Bengkulu, Bengkulu, Indonesia

*thesugara77@gmail.com

Abstract. The research was carried out aimed at solving problems in selecting the best administrative staff at the Vita Insani Hospital. This problem is overcome by designing a decision support system that is able to help decision makers to select the best administrative staff. This DSS was designed using the Elimination Et Choix Traduisant La Realite (ELECTRE) method. From the results of this study it is concluded that the Electre method is very appropriate to use as a decision support tool where the best alternative is the Vita_staff_001 administrative staff which eliminates other alternatives by having a value of 1 as much as 3 which is more than the value of 1 for the other alternatives.

1. Introduction
Having qualified human resources is an advantage that every company must have[1]. Likewise with hospital agencies. Hospitals as public health service providers are also required to have employees with increasingly qualified and competent human resources so that they are able to compete in advancing the development of the hospital. To improve employee performance, each company provides rewards to employees with the hope that through the provision of these rewards it can trigger an increase in the performance of each employee in the company.

Likewise, the Vita Insani Hospital in the city of Pematangsiantar, North Sumatra Province, Indonesia. This hospital also gives awards to their best Administrative Staff with various kinds of assessments set by the hospital directors. Giving rewards to administrative staff has various benefits for employees and for hospital agencies. For employees, giving rewards will trigger a spirit of competition to be better in the future. This is marked by an increase in the work ethic of the employees themselves, while for the organization it will have an impact on increasing productivity for the organization itself.

However, the obstacle faced in giving rewards is the difficulty of selecting the best Administrative Staff if there are Administrative Staff with the same potential. The difficulty in selecting the best administrative staff is because hospital institutions have not used a computer-based decision support system approach. In addition, the director's decision as the holder of the highest authority allows the
impression of being less transparent and open in assessing by only involving the criteria he
determines.

Currently, the use of computer-based technology has been widely used to make work easier [2]–[5]. Likewise in decision making, Decision Support Systems (DSS) have been widely implemented to make it easier for management to make decisions [6]–[8], [9]–[12]. Therefore, to make it easier for the management of the Vita Insani Hospital in selecting the best administrative staff, a decision support system was designed to simplify and speed up the work in selecting the best administrative staff at the hospital.

The decision support system used in the selection of the best administrative staff at Vita Insani Hospital uses the Elimination Et ChoixTraduisant La Realite (ELECTRE) method. This method is used because it can simplify the work in making decisions [13], [14]–[16]. With the ELECTRE method, decision making is done using pairwise comparisons of alternatives based on each appropriate criterion. Then the alternatives that are not in accordance with the criteria conditions are eliminated so that suitable alternatives can be generated [16].

2. Methodology

Data processing in the decision support system used in selecting the best administrative staff at Vita Insani Hospital is hereby carried out in several stages, starting from determining the weight for each criterion, determining alternative data and then processing data using the Electre method. All stages carried out in this study are described in figure 1. The criteria used in this study consist of honesty, knowledge, discipline, cooperation and responsibility. The weights for each criterion can be seen in table 1.

Data processing in the decision support system for selecting the best administrative staff using the Electre method is carried out using data from administrative staff with the values shown in table 4. Each criterion is given a weight based on the level of importance of each required criterion, which is as follows: [2, 1, 4, 1, 2]

| Alternative          | Score each Criterion |
|----------------------|----------------------|
| Vita_staff_001       | C1: 4, C2: 5, C3: 4, C4: 3, C5: 3 |
| Vita_staff_002       | C1: 5, C2: 5, C3: 4, C4: 4, C5: |

Table 1. Administrative Staff Criteria

| Criteria | Description |
|----------|-------------|
| C1       | Honesty     |
| C2       | Knowledge   |
| C3       | Discipline  |
| C4       | Cooperation |
| C5       | Responsibility |

Table 2. Weighted Value of Each Criterion

| Value Range | Category    | Weight |
|-------------|-------------|--------|
| 81-100      | Excellent   | 5      |
| 61-80       | Good        | 4      |
| 41-60       | Satisfactory| 3      |
| 21-40       | Poor        | 2      |
| 1-20        | Very Poor   | 1      |

Table 3. Alternative Administration Staff and Value of Each Criterion
3. Result and Discussion

After getting the value of each alternative from the administrative staff of the Vita Insani Hospital, then normalize the decision matrix with the following steps:

\[ X_1 = \sqrt{\frac{5^4 + 5^4 + 5^4 + 5^4 + 5^4 + 5^4 + 5^4 + 5^4}{4}} = 13,4907 \]
\[ R_{11} = \frac{5}{13,4907} = 0,2965 \]
\[ R_{21} = \frac{5}{13,4907} = 0,3706 \]
\[ R_{31} = \frac{5}{13,4907} = 0,3706 \]

\[ X_2 = \sqrt{\frac{5^4 + 5^4 + 5^4 + 5^4 + 5^4 + 5^4 + 5^4 + 5^4}{4}} = 12,9615 \]
\[ R_{12} = \frac{5}{12,9615} = 0,3858 \]
\[ R_{22} = \frac{5}{12,9615} = 0,3858 \]
\[ R_{42} = \frac{5}{12,9615} = 0,2315 \]

\[ X_3 = \sqrt{\frac{5^4 + 4^4 + 5^4 + 5^4 + 5^4 + 5^4 + 5^4 + 3^4 + 3^2}{4}} = 13,2288 \]
\[ R_{13} = \frac{5}{13,2288} = 0,3024 \]

So that the normalized R matrix is obtained as below:

\[
\begin{bmatrix}
0.2965 & 0.3858 & 0.3024 & 0.2662 & 0.2171 \\
0.3706 & 0.3858 & 0.3024 & 0.3549 & 0.2894 \\
0.3706 & 0.3858 & 0.3780 & 0.2662 & 0.2894 \\
0.3706 & 0.2315 & 0.3780 & 0.2662 & 0.3618 \\
0.2965 & 0.3086 & 0.3024 & 0.2662 & 0.3618 \\
0.2224 & 0.2315 & 0.3780 & 0.2662 & 0.2171 \\
0.2224 & 0.3858 & 0.2268 & 0.3549 & 0.3618 \\
0.2965 & 0.2315 & 0.3780 & 0.2662 & 0.3618 \\
0.3706 & 0.3086 & 0.2268 & 0.4437 & 0.2894 \\
0.2965 & 0.2315 & 0.2268 & 0.3549 & 0.3618
\end{bmatrix}
\]

After being normalized, each column of the matrix \( R \) is multiplied by the weight (W) that is determined, namely \( W = (2, 1, 4, 1, 2) \), and the results are as follows:

\[
V = \begin{bmatrix}
0.5930 & 0.3858 & 1.2095 & 0.2662 & 0.4341 \\
0.7412 & 0.3858 & 1.2095 & 0.3549 & 0.5789 \\
0.7412 & 0.3858 & 1.5119 & 0.2662 & 0.5789
\end{bmatrix}
\]
In the next step, the alternative value of each criterion is compared with other alternative values to get the index of concordance and disconcordance. Next, the calculation is done to get the concordance and disconcordance matrix values. The following shows the results of the concordance and discordance matrices.

\[
C = \begin{bmatrix}
- & 5 & 2 & 2 & 8 & 6 & 7 & 4 & 5 & 7 \\
10 & - & 6 & 4 & 8 & 6 & 8 & 4 & 9 & 8 \\
10 & 9 & - & 8 & 8 & 10 & 7 & 8 & 9 & 7 \\
9 & 8 & 9 & - & 9 & 10 & 8 & 10 & 8 & 9 \\
9 & 6 & 3 & 4 & - & 6 & 8 & 6 & 7 & 9 \\
7 & 4 & 5 & 6 & 5 & - & 6 & 6 & 4 & 5 \\
4 & 4 & 4 & 4 & 4 & 6 & - & 4 & 7 & 8 \\
9 & 6 & 7 & 8 & 9 & 10 & 8 & - & 6 & 9 \\
5 & 5 & 5 & 4 & 4 & 6 & 7 & 4 & - & 8 \\
5 & 3 & 3 & 4 & 5 & 6 & 9 & 6 & 6 & - \\
\end{bmatrix}
\]

\[
D = \begin{bmatrix}
- & 1 & 1 & 1 & 1 & 1 & 0.9572 & 1 & 0.5869 & 0.9572 \\
0 & - & 1 & 1 & 0.9762 & 1 & 0.4786 & 1 & 0.2935 & 0.4786 \\
0 & 0.2935 & - & 0.9379 & 0.4786 & 0 & 0.2393 & 0.9379 & 0.2935 & 0.2393 \\
0.5103 & 0.5103 & 1 & - & 0.2552 & 0 & 0.2552 & 0 & 0.2935 & 0.1467 \\
0.2666 & 1 & 1 & 1 & - & 1 & 0.2935 & 1 & 0.5869 & 0.2935 \\
0.5103 & 0.9806 & 1 & 1 & 0.9572 & - & 0.4786 & 1 & 0.4903 & 0.4786 \\
1 & 1 & 1 & 1 & 1 & 1 & - & 1 & 1 & 0.9608 \\
0.5103 & 0.5103 & 1 & 1 & 0.2552 & 0 & 0.2552 & - & 0.2935 & 0.1467 \\
1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & - & 0.9762 \\
\end{bmatrix}
\]

The next step is the calculation to obtain the threshold value. The threshold value obtained for the concordance dominant matrix is 6.4778 and for the discordance dominant matrix is 0.7206. Then the value of each element of the dominant concordance matrix and the dominant discordance matrix is compared to the threshold value, so that the F and G matrices are produced with the following values.

\[
F = \begin{bmatrix}
- & 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
1 & - & 0 & 0 & 1 & 0 & 1 & 0 & 1 & 1 \\
1 & 1 & - & 1 & 1 & 1 & 1 & 1 & 1 \\
1 & 1 & 1 & - & 1 & 1 & 1 & 1 & 1 \\
1 & 0 & 0 & 0 & - & 0 & 1 & 0 & 1 & 1 \\
1 & 0 & 0 & 0 & - & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & - & 0 & 1 & 1 & 1 \\
1 & 0 & 1 & 1 & 1 & 1 & 1 & 0 & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & - & 1 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & - & 1 \\
\end{bmatrix}
\]

\[
G = \begin{bmatrix}
- & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 1 \\
0 & - & 1 & 1 & 1 & 1 & 0 & 1 & 0 & 0 \\
0 & 0 & - & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\
0 & 0 & 1 & - & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 1 & - & 1 & 0 & 1 & 0 & 0 & 0 \\
0 & 1 & 1 & - & 0 & 1 & 0 & 0 & 0 & 0 \\
1 & 1 & 1 & 1 & 1 & - & 1 & 1 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & - & 0 & 0 \\
1 & 1 & 1 & 1 & 1 & 0 & 1 & - & 1 & 0 \\
1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & - \\
\end{bmatrix}
\]
Furthermore, the aggregate dominance matrix is defined as an $E$ matrix where each element is the product of the $F$ matrix element with the $G$ matrix element, so that the results like the $E$ matrix below are obtained.

$$E = \begin{bmatrix}
- & 0 & 0 & 0 & 1 & 0 & 1 & 0 & 0 & 1 \\
0 & - & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & - & 1 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & - & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & - & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & - & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & - & 0 & 1 & 1 \\
0 & 0 & 1 & 1 & 0 & 0 & 0 & - & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & - & 1 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & -
\end{bmatrix}$$

Finally, the less favorable alternative is eliminated by adding the points obtained in the aggregated dominance matrix for each alternative. In Table 4, the aggregate dominance matrix is converted into a table form to make it easier to calculate.

**Table 4. Less Favorable Matrix Table**

| Alternative | A1 | A2 | A3 | A4 | A5 | A6 | A7 | A8 | A9 | A10 | Total Point |
|-------------|----|----|----|----|----|----|----|----|----|-----|-------------|
| Vita_staff_001 | -  | 0  | 0  | 0  | 1  | 0  | 1  | 0  | 0  | 1   | 3           |
| Vita_staff_002 | 0  | -  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0   | 1           |
| Vita_staff_003 | 0  | 0  | -  | 1  | 0  | 0  | 0  | 1  | 0  | 0   | 2           |
| Vita_staff_004 | 0  | 0  | 1  | -  | 0  | 0  | 0  | 0  | 0  | 0   | 1           |
| Vita_staff_005 | 0  | 0  | 0  | 0  | -  | 0  | 0  | 0  | 0  | 0   | 0           |
| Vita_staff_006 | 0  | 0  | 0  | 0  | 0  | -  | 0  | 0  | 0  | 0   | 0           |
| Vita_staff_007 | 0  | 0  | 0  | 0  | 0  | 0  | -  | 0  | 1  | 1   | 2           |
| Vita_staff_008 | 0  | 0  | 1  | 1  | 0  | 0  | 0  | -  | 0  | 0   | 2           |
| Vita_staff_009 | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | -  | 1   | 1           |
| Vita_staff_010 | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | -   | 1           |

Based on the data in Table 4, the best choice of administrative staff is the alternative with the highest score of 1 where the alternative is Vita Staff 001. Alternative Vita Staff 001 eliminates other alternatives as it has a value of 1 as much as 3 which exceeds other alternatives. This shows that Vita Staff 001 is the recommended priority to be chosen as the best administrative staff.

4. Conclusion

The Decision Support System (DSS) for selecting the best administrative staff is designed to make it easier for companies in this case the Vita Insani Hospital in selecting and deciding on the best administrative staff. The Decision Support System (DSS) for selecting the best administrative staff using the Electre method can be used as an alternative or tool for decision makers to select and decide who is entitled to receive the award as the best administrative staff.

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