Implementation of ELECTRE Method for Decision Support System

Victor Marudut Mulia Siregar\(^1\), Volvo Sihombing\(^2\), Nimrot Siahaan\(^3\), Indra Kumalasari M\(^4\), Muhammad Yusuf Siregar\(^3\), Elviana Sagala\(^3\), Toni\(^4\)

\(^1\)Computer Engineering Department, Politeknik Bisnis Indonesia, Indonesia
\(^2\)Faculty of Science and Technology, Universitas Labuhanbatu, Indonesia
\(^3\)Faculty of Law, Universitas Labuhanbatu, Indonesia
\(^4\)Prodi PPKn, Universitas Labuhanbatu, Indonesia

*victor.siregar2@gmail.com

Abstract. This study aims to design a decision support system to determine users' priority of office inventory items at PT. INL. Deciding the priority of users of office inventory items aims to determine the most appropriate employees to use office inventory items in their daily work so that each employee's performance can be more optimal. Deciding office inventory users' priority is done using the ELECTRE (Elimination Et Choix Traduisant La Realite) method. The result of this research is a decision scavenger system that can help and facilitate companies in selecting and prioritizing users of office inventory items at the company. Employees who are prioritized as inventory users in the Electre method are the alternative that has the most value of 1, which outperforms other alternatives.

1. Introduction

Inventory is a list of all office properties used to perform tasks. Office inventory items are essential to the continuity of the company and the agency. Many companies still consider the management of office inventory items unnecessary, and the only important thing is to record inventory data. The fact shows that errors in determining who is more appropriate for the use of office inventory items will not have an optimal impact on each employee's performance in the company.

Determination of users of inventory items is needed as a decision-making material for the distribution of new assets to existing employees in a company. The accuracy of the decision of office assets users helps the company carry out its activities. However, if the assets' users are not correct in practice, the performance of the employees will not be optimal, which will hinder the company's activities. Therefore, we need an asset user management system that can support decision-making by selecting the right asset user in a company.

PT. Industri Nabati Lestari has adequate office equipment, such as computers, laptops and printers. Companies still distribute office equipment without using the Decision Support System's technical approach in the division of users of office equipment. The decision support system was, therefore designed to make it easier for PT. Industri Nabati Lestari in the selection of recipients for office inventory users.

Many uses of information technology are used in today's technological world to facilitate problem-solving [1], [2], [3], [4], [5], [6]. Among the technologies used to help solve problems, one often used is a decision-making technique with a decision-making support system. [7]–[9], [10], [11], [12], [13].
Several algorithm methods can be used to solve DSS problems, one of which is the Elimination Et Choix Traduisant la Réalité (ELECTRE) algorithm. ELECTRE is a multi-criteria decision-making method based on the concept of outranking, based on each appropriate criterion, using peer-to-peer comparisons of alternatives. The ELECTRE method is used when alternatives are eliminated that do not meet the criteria and appropriate alternatives can be created [14]–[16], [17]–[19].

Therefore, in this study designed a decision support system for users of office inventory items at PT. Lestari Nabati Industry with the ELECTRE method can help and facilitate companies in selecting and prioritizing office inventory items at the company.

2. Methodology
In Figure 1, the steps taken to complete this research can be seen. By collecting data and determining the required criteria, the research was carried out. In Table 1, Table 2 and Table 3, the criteria required can be seen. For each criterion, the weight used is \( W = \{1,1,3,2,3\} \).

The next phase is the processing of the collected data using the ELECTRE method. The phases performed with the method of ELECTRE include (1) initializing the dataset; (2) normalizing the dataset; (3) comparing each row of the dataset with the other rows; (4) determining the concordance and discordance quantity; (5) determining the threshold value; (6) determining the dominant aggregate matrices; (7) determining the alternative ratings [17].

![Figure 1. Research Framework](image-url)

### Table 1. Criteria

| Criteria | Description | Properties |
|----------|-------------|------------|
| C1       | Age         | Benefit    |
| C2       | Education   | Benefit    |
| C3       | Experience  | Benefit    |
| C4       | Expertise   | Benefit    |
| C5       | Cooperation | Benefit    |

### Table 2. Weight Value

| Weight   | Score |
|----------|-------|
| Very Low | 1     |
| Low      | 2     |
| Moderate | 3     |
| High     | 4     |
| Very High| 5     |

The list of criteria and values for each criterion used in the decision support system for determining the priority of users of office inventory items can be found in Table 3 below.

### Table 3. Criteria and Value of Each Criterion

| Criteria | Score |
|----------|-------|
|          | 1     | 2     | 3     | 4     | 5     |
| C1       | >=36  | 31-35 | 27-30 | 24-26 | <=23  |
| C2       | Secondary School | Associate Degree | Bachelor Degree | Graduate |
| C3       | 0     | <= 1  | 1-2   | 3-4   | >4    |
| C4       | <= 60 | 61-70 | 71-80 | 81-90 | <90   |
| C5       | <= 60 | 61-70 | 71-80 | 81-90 | <90   |
3. Result and Discussion

Data processing will be performed at this stage using the method of Elimination and Choice Translation Reality (ELECTRE). Employee data with the values listed in Table 4 is the alternative employee data to be processed in this study.

| Alternatif | C1 | C2 | C3 | C4 | C5 |
|------------|----|----|----|----|----|
| Empl_001   | 3  | 4  | 5  | 4  | 3  |
| Empl_002   | 1  | 4  | 2  | 4  | 3  |
| Empl_003   | 2  | 4  | 5  | 3  | 4  |
| Empl_004   | 3  | 3  | 2  | 3  | 4  |
| Empl_005   | 3  | 4  | 2  | 1  | 3  |
| Empl_006   | 1  | 4  | 2  | 1  | 3  |

In addition, calculations are performed using the Electre method, which begins with the production of a normalized matrix in order to obtain the normalized matrix as follows:

\[
V = \begin{bmatrix}
0.5222 & 0.4240 & 0.6155 & 0.5547 & 0.3638 \\
0.1741 & 0.4240 & 0.2462 & 0.5547 & 0.3638 \\
0.3482 & 0.4240 & 0.6155 & 0.4160 & 0.4851 \\
0.5222 & 0.3180 & 0.2462 & 0.4160 & 0.4851 \\
0.5222 & 0.4240 & 0.2462 & 0.1387 & 0.4851 \\
0.1741 & 0.4240 & 0.2462 & 0.1387 & 0.3638 \\
\end{bmatrix}
\]

The next step is to assign \( W = \{1,1,1,2,3\} \) to the normalized matrix by weight. So that we get a normalized \( V \)-weighted matrix, as follows:

\[
V = \begin{bmatrix}
0.5222 & 0.4240 & 1.8464 & 1.1094 & 1.0914 \\
0.1741 & 0.4240 & 0.7385 & 1.1094 & 1.0914 \\
0.3482 & 0.4240 & 1.8464 & 0.8321 & 1.4552 \\
0.5222 & 0.3180 & 0.7385 & 0.8321 & 1.4552 \\
0.5222 & 0.4240 & 0.7385 & 0.2774 & 1.0914 \\
0.1741 & 0.4240 & 0.7385 & 0.2774 & 1.0914 \\
\end{bmatrix}
\]

In the next stage, for each criterion, the alternative's value is compared to the value of the other alternative’s. If the alternative value is greater than or equal to the other alternative value, the concordance set is entered and, vice versa, if the alternative value is lower than the alternative value, the discordance set is entered, and the results are shown in Table 5 and Table 6.

| Table 5. Concordance Set | Table 6. Discordance Set |
|--------------------------|--------------------------|
| C12 \{1,2,3,4,5\}       | D12 \{\}                |
| C13 \{1,2,3,4\}        | D13 \{\}                |
| C14 \{1,2,3,4\}        | D14 \{\}                |
| C15 \{1,2,3,4,5\}      | D15 \{\}                |
| C16 \{1,2,3,4,5\}      | D16 \{\}                |
| C21 \{2,4,5\}          | D21 \{1,3\}             |
| C22 \{2,4\}            | D22 \{1,3,5\}           |
| C23 \{2,4\}            | D23 \{1\}               |
| C24 \{2,3,4\}          | D24 \{1,5\}             |
| C25 \{2,3,4,5\}        | D25 \{\}                |
| C26 \{1,2,3,4,5\}      | D26 \{\}                |
| C31 \{2,3,5\}          | D31 \{1,4\}             |
| C32 \{1,2,3,5\}        | D32 \{4\}               |
To get the value of the concordance and discordance matrices based on the set of concordances and discordances above, then calculate the data above. The results obtained for the concordance and discordance matrices are based on the following data:

\[
C = \begin{bmatrix}
-10 & 7 & 1 & 10 & 10 \\
6 & -3 & 6 & 9 & 10 \\
7 & 8 & -9 & 9 & 10 \\
4 & 7 & 6 & -9 & 9 \\
5 & 8 & 2 & 5 & -10
\end{bmatrix}
\]

\[
D = \begin{bmatrix}
-0 & 1 & 0.3284 & 0 & 0 \\
1 & -1 & 1 & 0.4184 & 0 \\
0.7624 & 0.2504 & -0.1571 & 0.1571 & 0 \\
1 & 0.7624 & 1 & -0.1911 & 0.1911 \\
1 & 1 & 1 & 1 & -0
\end{bmatrix}
\]

The next step is to find the threshold of the dominant concordance matrix and the dominant discordance matrix, with the following results:

\[
C = \frac{10 + 7 + 10 + 10 + 6 + 3 + 6 + 9 + 10 + 7 + 8 + 9 + 9 + 10 + 7 + 8 + 9 + 9 + 10 + 4 + 7}{6 \times (6 - 1)} = \frac{212}{30} = 7.0667
\]

\[
D = \frac{1 + 0.3284 + 1 + 1 + 0.4184 + 0.7624 + 0.2504 + 0.1571 + 1 + 0.7624 + 1 + 0.1911 + 0.1911 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1}{6 \times (6 - 1)} = \frac{18.2183}{30} = 0.6073
\]

Then, by comparing each element of the dominant concordance matrix to the threshold value and the dominant discordance matrix to the threshold value, the form of the matrix F and G with each element's value is obtained. As follows, it forms the matrix of F and G:

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

\[
G = \begin{bmatrix}
-0 & 1 & 0 & 0 & 0 \\
1 & -1 & 1 & 0 & 0 \\
1 & 0 & -1 & 0 & 0 \\
1 & 1 & 1 & - & 0 \\
1 & 1 & 1 & 1 & -
\end{bmatrix}
\]
The next step is to define the matrix of aggregate dominance as an E matrix, where each element is a multiplication between the elements of the matrix F and the elements of the matrix, thus forming the matrix E below:

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

The final step is to eliminate the less favorable alternatives by adding the points obtained for each alternative based on the aggregate dominance matrix. In Table 7, the aggregate dominance matrix is converted into a table form to make it simpler to calculate.

| Alternatif | A1 | A2 | A3 | A4 | A5 | A6 | Total Point |
|-----------|----|----|----|----|----|----|-------------|
| Empl_001  | -  | 0  | 0  | 0  | 0  | 0  | 0           |
| Empl_002  | 0  | 0  | -  | 0  | 0  | 0  | 0           |
| Empl_003  | 0  | 0  | 0  | -  | 0  | 0  | 0           |
| Empl_004  | 0  | 0  | 0  | 0  | -  | 0  | 0           |
| Empl_005  | 1  | 0  | 0  | 0  | -  | 0  | 1           |
| Empl_006  | 1  | 0  | 0  | 0  | 1  | -  | 2           |

Based on the data in the table, it can be seen that the alternative with the highest value of 1 is the best alternative where the number of numbers 1 on employee_6 is more than employee_5, which implies that the employee_6 alternative is the priority recommendation for inventory users in the company.

4. Conclusion

Based on data processing performance in order to assess office inventory beneficiaries' priority in PT Industri Nabati Lestari, the Electre method can be concluded to be used as a decision support system for office store recipients, as calculation results can, through this scheme, be obtained to help decision-making to determine office inventory recipients eligible for inventories.

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