

IMPLEMENTATION OF THE ELECTRE METHOD IN DETERMINING THE DIRECTOR OF THE SUMATERA BLIND FOUNDATION

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ABSTRACT- The Sumatera Blind Foundation is one of the foundations that manage special schools and manages dormitories for these students. The Sumatera blind foundation is led by a director. The appointment of directors has been carried out based on the results of selection with various tests that have been carried out and decided at a foundation meeting held behind closed doors, thereby arousing suspicion from other interested parties. To solve the problem of selecting directors, it is proposed to implement a method, namely the ELECTRE method, so that the selection process can be more effective, efficient, and accurate. The criteria that must be fulfilled include managing schools and hostels, the ability to speak English, the ability in the spiritual field, the ability in the field of leadership, and the ability in special school education. Implementing the ELECTRE method resulted in elected director candidates and eliminated director candidates. Based on the four samples used as method testing, samples with alternative A1 can be selected as directors while A2, A3, and A4 are eliminated.

Keywords: ELECTRE method, Less favorable alternative, Alternative elimination

1. INTRODUCTION

Special Schools are educational institutions that are an integrated part of the national education system organized explicitly for students who have difficulty participating in the learning process due to physical, emotional, and social-mental disorders but have the potential for exceptional intelligence and talents. A particular School is part of an educational institution that can accommodate and organize special education for children who also have special needs, one of which is students with special needs, such as people who are blind [1], [2].

The Sumatera Blind Education Foundation is one of the foundations engaged in educational programs and care for blind children. As one of the foundations that provide teaching and skills to blind children, the Sumatera Blind Education Foundation is tasked with developing and realizing the potential that exists in blind children so that they can be empowered in society [3].

The director of the Sumatera Blind Education Foundation plays a vital role in the management of special education schools and the management of dormitories. The director must have school and dormitory management skills, spiritual leadership, special education, and English skills. Therefore, the Sumatera Blind Education Foundation selects director candidates based on predetermined criteria.

The number of director candidates who have registered and the number of criteria determined will cause difficulties for the foundation in determining the director. Based on the system that has been running, the appointment of directors has been carried out based on the selection results with various predetermined tests but has yet to implement a method. The decision to appoint directors is based on the selection results and the results of the foundation meeting, and the meeting is held behind closed doors which will arouse suspicion from other

interested parties. Based on these problems, the solution for determining directors is to apply a method, namely the ELECTRE method.

The ELECTRE method is one method multicriteria based decision making on the concept of outranking by using pairwise comparisons of alternatives based on each suitable criterion [4], [5]. Method ELECTRE is used in conditions where alternatives those who do not fit the criteria are eliminated and suitable alternatives can be generated. In a word else, ELECTRE is used for cases with many alternatives but few the criteria involved [6], [7].

The ELECTRE method has been used to evaluate employees to determine employees who get termination of employment to provide effective decisions [8]. The ELECTRE method can provide convenience in recommending detailed information to the company in determining the event's location. It is one of the marketing strategy activities and is an important activity, especially in achieving company targets [9]. The ELECTRE method has also been implemented in the Human Resources Division of LPP Radio Republik Indonesia (RRI) Palembang to find out where there are deficiencies in the performance must be repaired [10].

Based on the above background, this research implements the ELECTRE method in determining directors at the Sumatera Blind Education Foundation.

2. METHODOLOGY

The research method is a set of efforts and systematic methods applied by researchers to obtain answers to the research question. The research method is directly related to how to know something. This research method uses an experimental design with a science approach to generate new knowledge [11].

The research method for determining the Director of Yapentra Sumatera using the ELECTRE method is described in the following framework in Figure 1.

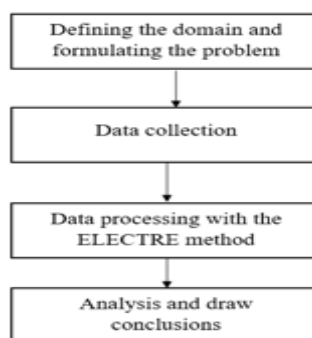


Figure 1. Research Framework (Source: results of research processing)

2.1 Data Collection

The data set collected is the primary data set relating to the data of the candidate for director of the Sumatran Blind Foundation, which consists of the results of interviews with visual impairments (C1), interviews with foundation officials (C2), psychological test results (C3), English language test results (C4) and independent tests from HBM (C5). The data pre-processing results can be seen in the suitability rating in Table 1 below.

Table 1. The data pre-processing

Alternatif	C1	C2	C3	C4	C5
A1	4	5	5	2	5
A2	4	4	5	3	3
A3	4	4	4	3	4
A4	4	4	4	2	1

Source: data processing results

1.2 ELECTRE Method Implementation

The ELECTRE method is based on ranking through pairwise comparisons between alternatives and criteria in accordance [12]. An alternative is said to dominate other alternatives if one or more criteria are exceeded other alternative criteria or the same as the other remaining criteria [13]. The steps in solving the problem using the electability method are as follows [14], [15]:

1. The ELECTRE method starts by forming pairwise comparisons for each alternative in each criterion (x_{ij}). x values are normalized into a comparable scale (r_{ij}):

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

with $i=1,2,\dots,m$; and $j=1,2,\dots,n$; in this case m is the number of alternatives and n is the number of criteria.

$$r_{11} = \frac{x_{11}}{\sqrt{x_{11}^2+x_{21}^2+x_{31}^2+x_{41}^2}} = \frac{4}{\sqrt{4^2+4^2+4^2+4^2}} = 0.50$$

$$r_{21} = \frac{x_{21}}{\sqrt{x_{11}^2+x_{21}^2+x_{31}^2+x_{41}^2}} = \frac{4}{\sqrt{4^2+4^2+4^2+4^2}} = 0.50$$

$$r_{31} = \frac{x_{31}}{\sqrt{x_{11}^2+x_{21}^2+x_{31}^2+x_{41}^2}} = \frac{4}{\sqrt{4^2+4^2+4^2+4^2}} = 0.50$$

and so on until r_{45} we get the normalized R matrix,

$$R = \begin{bmatrix} 0.50 & 0.59 & 0.55 & 0.39 & 0.70 \\ 0.50 & 0.47 & 0.55 & 0.59 & 0.42 \\ 0.50 & 0.47 & 0.44 & 0.59 & 0.56 \\ 0.50 & 0.47 & 0.44 & 0.39 & 0.14 \end{bmatrix}$$

2. Weighting on the matrix that has been normalized. Where the decision-making weight is $W = \{c1, c2, c3, c4, c5\} = \{5, 4, 3, 4, 5\}$.

$$v_{ij} = r_{ij} \times w_{j..} \dots\dots\dots(2)$$

$$v_{ij} = \begin{bmatrix} 0.50 & 0.59 & 0.55 & 0.39 & 0.70 \\ 0.50 & 0.47 & 0.55 & 0.59 & 0.42 \\ 0.50 & 0.47 & 0.44 & 0.59 & 0.56 \\ 0.50 & 0.47 & 0.44 & 0.39 & 0.14 \end{bmatrix} \times \begin{bmatrix} 50000 \\ 04000 \\ 00300 \\ 00040 \\ 00005 \end{bmatrix}$$

So that the matrix V is obtained by multiplying R and W

$$V = \begin{bmatrix} 2.50 & 2.34 & 1.66 & 1.57 & 3.50 \\ 2.50 & 1.87 & 1.66 & 2.35 & 2.10 \\ 2.50 & 1.87 & 1.32 & 2.35 & 2.80 \\ 2.50 & 1.87 & 1.32 & 1.57 & 0.70 \end{bmatrix}$$

3. Define concordance and discordance sets.

The concordance is:

$$C_{kl} = \{j, y_{kj} \geq y_{lj}\}, \dots\dots\dots(3)$$

$j = 1, 2, 3, \dots, n$ (column).

Concordance set is:

$$C_{12} = \{1,2,3,5\}$$

$$C_{13} = \{1,2,3,5\}$$

$$C_{14} = \{1,2,3,4,5\}$$

$$C_{21} = \{1,3,4\}$$

$$C_{23} = \{1,2,3,4\}$$

$$C_{24} = \{1,2,3,4,5\}$$

$$C_{31} = \{1,4\}$$

$$C_{32} = \{1,2,4,5\}$$

$$C_{34} = \{1,2,3,4,5\}$$

$$C_{41} = \{1,4\}$$

$$C_{42} = \{1,2\}$$

$$C_{43} = \{1,2,3\}$$

Discordance, that is if:

$$D_{kl} = \{j, y_{kj} < y_{lj}\} \dots\dots\dots(4)$$

for $j = 1, 2, 3, \dots, n$.

Discordance set is

$$D_{12} = \{4\}$$

$$D_{13} = \{4\}$$

$$D_{14} = \{ \}$$

$$D_{21} = \{2,5\}$$

$$D_{23} = \{5\}$$

$$D_{24} = \{ \}$$

$$D_{31} = \{2,3,5\}$$

$$D_{32} = \{3\}$$

$$D_{34} = \{ \}$$

$$D_{41} = \{2,3,5\}$$

$$D_{42} = \{3,4,5\}$$

$$D_{43} = \{4,5\}$$

4. Calculating the Concordance (C) and discordance (D) matrices.

To determine the value of the elements in the concordance matrix, add the weights included in the concordance subset.

$$c_{kl} = \sum_{j \in C_{kl}} W_j \dots\dots\dots(5)$$

$$C = \begin{bmatrix} - & 17 & 17 & 21 \\ 12 & - & 16 & 21 \\ 9 & 18 & - & 21 \\ 9 & 9 & 12 & - \end{bmatrix}$$

Likewise, the discordance matrix contains elements calculated from the discordance index. This matrix relates to attribute values, namely:

$$D_{kl} = \frac{\max\{|v_{kj} - v_{lj}|\}_{j \in D_{kl}}}{\max\{|v_{kj} - v_{lj}|\}_{\forall j}} \dots\dots\dots(6)$$

$$D = \begin{bmatrix} - & 0.56 & 1 & 0 \\ 1 & - & 1 & 0 \\ 0.9 & 0.49 & - & 0 \\ 1 & 1 & 1 & - \end{bmatrix}$$

5. Determine the dominant matrix of concordance and discordance.

The dominant concordance matrix can be constructed with the help of threshold values by comparing each element value of the concordance matrix with the threshold value.

$C_{kl} \geq c$ with a threshold value (c) is

$$\underline{c} = \frac{\sum_{k=1}^n \sum_{l=1}^n C_{kl}}{m(m-1)} \dots \dots \dots (7)$$

$$\underline{c} = \frac{182}{4(3)} = \frac{182}{12} = 15,17$$

And the value of each element of matrix F as the dominant concordance matrix is determined as follows:

$f_{kl} = 1$, if $c_{kl} \geq c$ and $F_{kl} = 0$, if $c_{kl} < c$

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

To build the dominant discordance matrix also uses the help of a threshold value, namely:

$$\underline{d} = \frac{\sum_{k=1}^n \sum_{l=1}^n d_{kl}}{m(m-1)} \dots \dots \dots (8)$$

$$\underline{d} = \frac{7.95}{4(3)} = \frac{7.95}{12} = 0.66$$

and the value of each element for matrix G as the dominant discordance matrix is determined as follows:

$g_{kl} = 0$, if $c_{kl} \geq d$ and $g_{kl} = 1$, if $c_{kl} < d$

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

6. The next step is to determine the aggregate domination matrix as an E matrix, each element of which is an addition between the elements of the matrix F and the elements of the matrix G, as follows:

$e_{kl} = f_{kl} \times g_{kl} \dots \dots \dots (9)$

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

7. Eliminate the less favorable alternative.

Matrix E provides the order of choice of each alternative; if $e_{kl} = 1$, alternative A_k is a better choice than A_l . So that the row in matrix E with the least number of $e_{kl} = 1$ can be eliminated. Thus the best alternative is the one that dominates the other alternatives.

3. RESULTS AND DISCUSSION

Elimination at this final stage aims to reduce which alternative is not good. Matrix E shows the selection step of each alternative. So, if $e_{kl} = 1$, alternative A_k is better than A_l . Therefore, the row in matrix E with the smallest total $k = 1$ can be eliminated. From matrix E obtained in the previous step, it gives the order of choice for each alternative. From matrix E, the following values are obtained:

$$\begin{aligned} e_{12} &= 1, e_{13} = 0, e_{14} = 1 \\ e_{21} &= 0, e_{23} = 0, e_{24} = 1 \\ e_{31} &= 0, e_{32} = 0, e_{34} = 0 \\ e_{41} &= 0, e_{42} = 0, e_{43} = 0 \end{aligned}$$

Thus, alternative A_1 is better than alternatives A_2 , A_3 and A_4 because it has more $e_{kl} = 1$ values.

The results of the ELECTRE method get the Director of the Sumatera Blind Foundation with alternative A_1 . Alternative A_1 is an elected director with competence that meets standards as a director, where the results of several tests show the highest score.

4. CONCLUSION

The ELECTRE method can be used as a decision support method in determining the Director of the Sumatera Blind Education Foundation. The ELECTRE method is used when alternatives not under the criteria are eliminated, and suitable alternatives can be generated.

As a suggestion from this study, other methods can be used to determine which director is the most appropriate method so that differences and comparisons can be seen.

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