Application of Multi Criteria Supporting Elemination and Choice Translation Reality (ELECTRE) Decision in Determining Scholarship Recipients for Employee Children at PT. Nusira

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Abstract – During this time the determination of scholarship recipients for employees' children at PT. Nusira is not so good and is considered not so objective because it is still done by direct election and carried out manually so that it causes nepotism or prioritizes choosing employees who have high positions so that it is not so fair for ordinary employees. Due to the absence of a good system, causing problems to arise in terms of determining the receipt of scholarships for employees' children. Therefore, by using a decision support system based on Elimination and Choice Translation Reality (Electre). It is expected that decision-makers will be helped and reduce existing problems, especially in determining the acceptance of scholarships for employees' children.

Keywords– Decision Support System, Scholarships, Electre.

1. INTRODUCTION

PT. Nusira is a subsidiary of PT. Kirana Megatara, located in North Sumatra. PT. Nusira produces a type of rubber that has been processed into semi-finished materials and is sold as raw material. The products produced are technical specifications rubber is known as Standard Indonesian Rubber (SIR) and are exported to various countries so as to generate foreign exchange for the country. PT. Nusira also implements a planned and sustainable corporate social responsibility program for the community (CSR). One of the CSR activities is the celebration of August 17 which is completed with the distribution of scholarships to children whose parents work at PT. Nusira. Scholarships are aids given to individuals who have good achievements or economies who are less able to continue their education and aim to support progress in the field of education. Scholarships can be given by government agencies, companies or foundations, one of them at PT. Nusira.

During this time the determination of scholarship recipients for employees' children at PT. Nusira is not so good and is considered not so objective because it is still done by direct election and carried out manually so that it causes nepotism or prioritizes choosing employees who have high positions so that it is not so fair for ordinary employees.

To help HRD (Human Resources Development) make it easier and fairer in the selection of prospective scholarships, a decision-making system is used that aims to get the right and accurate alternative decision results. The decision support system is an information system that helps in solving problems with predetermined criteria. This system is very important in helping leaders to make decisions. Decision support systems have several methods that can be applied such as Weight Product (WP), Simple Additive Weighting (SAW), Analytics Hierarchy Process (AHP), Elimination and Choice Translation Reality (ELECTRE), Vise Kriterijumska Optimizacija Kompromisno Resenje (VIKOR) and several methods others[1], [2].

In previous studies to select the best lecturers using the Elimination and Choice Translation Reality (ELECTRE) method conducted at STMIK BUDI DARMA, lecturers who have good performance will improve the quality of higher education. To determine the best computer lecturer from STMIK BUDI DARMA by using criteria, namely ranking, research, scientific publications, the dedication of supporting elements. The results of this study are expected to be useful and easy for policymakers. The selection of the best computer lecturers is believed to be able to motivate the lecturers in higher education so that the lecturers' performance will be better [3].

Based on the above research, the authors chose to use the Elimination and Choice Translation Reality (ELECTRE) method because this problem is appropriate and fits the ranking concept based on alternatives and predetermined criteria and this method is multi-criteria. This method of Elimination and Choice Translation Reality (ELECTRE) can be used in conditions where alternatives that are less appropriate to the criteria are eliminated and suitable alternatives can be produced[4]–[6].

2. THEORY

2.1 Decission Support System

Decision support systems are interactive information systems that provide information, modeling, and manipulation of data. The system is used to help decision making in semi-structured and unstructured situations, where no one knows for sure how decisions should be made[7]–[9].

2.2 Elimination and Choice Translation Reality (ELECTRE) Method

Electre is a multi-criteria decision-making method. Electre is based on the concept of outranking using pairwise comparisons of alternatives based on each appropriate criterion. ELECTRE is used in conditions, alternatives that are less appropriate to the criteria to be eliminated, and suitable alternatives can be produced. ELECTRE is used in cases with many alternatives[10]. Several steps were taken in the ELECTRE method, namely:

1. Normalization of the Decision Matrix.

$$r_{ij} = \frac{X_{ij}}{\sqrt{\sum_{i=}^{m} x_{ij}^2}} \text{ for } i = 1,2,3,\dots,m \text{ dan } j = 1,2,3,\dots,n \quad (1)$$

2. Weighting on a normalized matrix.

$$\begin{bmatrix} v11 & v12 & \cdots & v1n \\ v21 & v22 & \dots & v2n \\ \vdots & & & \\ vm1 & vm2 & \dots vmn \end{bmatrix} = \begin{bmatrix} w1r11 & w2r12 & \dots & wnr1n \\ w1r21 & w2r22 & \dots & wnr2n \\ \vdots & & & \\ wirm1 & w2rm2 & \dots & wnrmn \end{bmatrix} \quad (2)$$

$$W = \begin{bmatrix} w1 & 0 & \dots & 0 \\ 0 & w2 & \dots & 0 \\ \vdots & & & \\ 0 & 0 & & wn \end{bmatrix}$$

3. Determine the set of concordance and discordance index.
   A criterion in an alternative includes concordance if:

   $$C_{kl} = \{j, v_{kj} \geq v_{lj}\}, \text{ for } j = 1,2,3,\dots,n \quad (3)$$

   Conversely, the complementary set of concordance parts is the discordance set, if:

   $$D_{kl} = \{j, v_{kj} < v_{lj}\}, \text{ for } j = 1,2,3,\dots,n. \quad (4)$$

4. Calculate the concordance and discordance matrices
   a. Mathematically to find concordance and discordance matrices, as follows:
      $$C_{kl} = \sum_{j \in C_{kl}} wj \text{ Menghitung matrik } discordance \quad (5)$$
   b. To determine the value of the elements in the discordance matrix, as follows:
      $$d_{kl} = \frac{\max \{|v_{kj} - V_{lj}|\}}{\max \{|v_{kj} - V_{lj}|\} \; \forall j} \quad (6)$$

5. Determine the concordance and discordance dominant matrices
   a. Calculates the concordance dominant matrix. The F matrix as the concordance dominant matrix can be built with the help of a threshold value, namely by comparing each element value of the concordance matrix with the threshold value.
      $$C_{kl} \geq \underline{c} \quad (7)$$

      threshold($\underline{c}$) value is:

      $$\underline{C} = \frac{\sum_{k=1}^{m} \sum_{l=1}^{m} C_{kl}}{m(m-1)} \quad (8)$$

      The matrix element F is determined:

      $$f_{kl} = \begin{cases} 1, jika \; c_{kl} \geq \underline{c} \\ 0, jika \; c_{kl} < \underline{c} \end{cases} \quad (9)$$
   b. Calculates the dominant matrix of discordance

$$\underline{d} = \frac{\sum_{k=1}^{m} \sum_{l=1}^{m} d_{kl}}{m(m-1)} \qquad (10)$$

Matrix element G: $g_{kl} = \begin{cases} 1, jika\ c_{kl} \geq \underline{d} \\ 0, jika\ c_{kl} < \underline{d} \end{cases} \qquad (11)$

6. Determine the aggregate dominance matrix

$$e_{kl} = f_{kl} \times g_{kl} \qquad (12)$$

7. Eliminate alternatives that are less favorable.

3. RESULT AND DISCUSSION

PT. Nusira implements a planned and sustainable corporate social responsibility program for the community. With the celebration of August 17, complete with the distribution of scholarships to children whose parents work at PT. To get the scholarship, it must be in accordance with the rules that have been set.

As for some of the criteria set out in this case study, namely the participation of employees in the August 17 ceremony, Discipline at work, tenure of employees, warning letters (SP) at work, the average value of report cards, achievements of children, number of dependents of parents. With the determination of many criteria, personnel has difficulty determining who is entitled to receive the scholarship, because previously personnel was selected manually. So the decision-making process still requires a long time and involves several parties

From the problem of existing decision making, the problem has been analyzed to create a new system, by using the Electre (Elimination and Choice Translation Reality) method, the criteria and weight are needed to do the calculations so that the best alternative will be obtained. The alternative order that will be displayed starts from the highest alternative to the lowest alternative. The intended alternative is the prospective scholarship recipient student. Alternative data used in determining the scholarship recipient which contains the name of the child, the name of the worker, the education of the child and the part of work that will register the scholarship. The following alternative data are selected by personnel:

Table 1. List of Prospective Scholarship Recipients in 2016

No	Child's Name	Worker Name	Education	Part
1	Aditya Suhendra	Rasino	SMA	Office
2	Sarah Mudiani	Ardian Sugiono	SMA	Material Warehouse
3	Hindra Fachrullah	Syamsul Bahri	SMA	Security
4	Akbar Alamnyah	Rahmat N	SMA	Production
5	Della Y Sitepu	Efendi Sitepu	SMA	Rubber Trap
6	Fitri Ania	Marianto	SMA	Production
7	Mei Yustina L.Batu	Ruden Denus R L.Batu	SMA	Power-House
8	Triski F. Nasution	Fahrul Rozi Nasution	SMA	Security
9	Sonya Sihombing	Humisar Sihombing	SMA	Security
10	Ernawati Sianturi	Sawangin Ediman S	SMA	Bengkel
11	Yuni Desianthy	Suhar	SMA	Driver
12	Neni Gustiana Ketaren	Ferri Happy Kataren	SMA	KGB
13	Aldi Winata	Suparman	SMA	Driver
14	Ananda Waskoto	Hamdan	SMA	Press dan Packing
15	Harun	Poniman	SMA	KGB
16	Ardiansyah	Supriono	SMA	Sipil
17	Azi Alfisya Pasuli	Suprayetno	SMA	Foreman
18	Muhammad Irsan	Suwanto	SMA	Cut Select
19	Diki Prabowo	Tumian	SMA	Foreman
20	Intan Julia	Ali Saidi	SMA	Foreman
21	Andika	Sutriono	SMA	Driver
22	Fadillah Ramadhan	Heri Rusnadi	SMA	Work-Shop

Based on the alternatives in table 1, what is used as an example calculation in determining the recipient of the scholarship is only in 1-7 alternatives, as follows:

Table 2. The Alternative

Alternative	Name
A1	Aditya Suhendra
A2	Sarah Mudiani
A3	Hindra Fachrullah
A4	Akbar Alamnyah
A5	Della Yolanda Sitepu
A6	Fitri Ania
A7	Mei Yustina L. Batu

The following table matches the rating of each alternative on the predetermined criteria.

Table 3. Match Ratings of Each Alternative on Each Criteria

Alternative	Criteria						
	C1	C2	C3	C4	C5	C6	C7
A1	20	20	15	15	10	5	5
A2	15	10	15	20	15	5	10
A3	15	15	15	20	15	10	10
A4	10	15	20	15	15	5	5
A5	15	15	10	15	10	5	5
A6	20	15	10	20	15	5	10
A7	20	10	15	20	20	15	5

Table 4. Simplification of Match Ratings

Alternative	Criteria						
	C1	C2	C1	C4	C1	C6	C1
A1	4	4	3	3	2	1	1
A2	3	2	3	4	3	1	2
A3	3	3	3	4	3	2	2
A4	2	3	4	3	3	1	1
A5	3	3	2	3	2	1	1
A6	4	3	2	4	3	1	2
A7	4	2	3	4	4	3	1

Ada 7 kriteria dan bobot yang sudah di tentukan dan akan menjadi sebagai bahan pertimbangan dan perhitungan :

Table 5. Criteria

Criteria	Description	Weighted %
C1	Employee participation in the August 17 ceremony	0.25%
C2	Discipline at work	0.20%
C3	Period of employment	0.17%
C4	Warning letter (SP) at work	0.15%
C5	Average report card grade	0.10%
C6	Achievements that children have	0.8%
C7	Number of dependents of parents	0.5%

The decision matrix formed from the match table in table 4 is as follows:

$$X = \begin{bmatrix} 4 & 4 & 3 & 3 & 2 & 1 & 1 \\ 3 & 2 & 3 & 4 & 3 & 1 & 2 \\ 3 & 3 & 3 & 4 & 3 & 2 & 2 \\ 2 & 3 & 4 & 3 & 3 & 1 & 1 \\ 3 & 3 & 2 & 3 & 2 & 1 & 1 \\ 4 & 3 & 2 & 4 & 3 & 1 & 2 \\ 4 & 2 & 3 & 4 & 4 & 3 & 1 \end{bmatrix}$$

To solve the problem above with the electre method will be done in accordance with the steps that have been described. The following are the steps for completion:

1. Normalization of the decision matrix

$$|x_1| = \sqrt{4^2 + 3^2 + 3^2 + 2^2 + 3^2 + 4^2 + 4^2} = \sqrt{79} = 8.8881$$

$$r_{11} = \frac{X_{11}}{|X_1|} = \frac{4}{8.8881} = 0.4500$$

$$r_{21} = \frac{X_{21}}{|X_1|} = \frac{3}{8.8881} = 0.3375$$

$$r_{31} = \frac{X_{31}}{|X_1|} = \frac{3}{8.8881} = 0.3375$$

$$r_{41} = \frac{X_{41}}{|X_1|} = \frac{2}{8.8881} = 0.2250$$

$$r_{51} = \frac{X_{51}}{|X_1|} = \frac{3}{8.8881} = 0.3375$$

$$r_{61} = \frac{X_{61}}{|X_1|} = \frac{4}{8.888} = 0.4500$$

$$r_{71} = \frac{X_{71}}{|X_1|} = \frac{4}{8.888} = 0.4500$$

$$|x_2| = \sqrt{4^2 + 2^2 + 3^2 + 3^2 + 3^2 + 3^2 + 2^2} = \sqrt{60} = 7.7460$$

$$r_{12} = \frac{X_{12}}{|X_2|} = \frac{4}{7.7460} = 0.5164$$

$$r_{22} = \frac{X_{22}}{|X_2|} = \frac{2}{7.746} = 0.2582$$

$$r_{32} = \frac{X_{32}}{|X_2|} = \frac{3}{7.7460} = 0.3873$$

$$r_{42} = \frac{X_{42}}{|X_2|} = \frac{3}{7.7460} = 0.3873$$

$$r_{52} = \frac{X_{52}}{|X_2|} = \frac{3}{7.7460} = 0.3873$$

$$r_{62} = \frac{X_{62}}{|X_2|} = \frac{3}{7.7460} = 0.3873$$

$$r_{72} = \frac{X_{72}}{|X_2|} = \frac{2}{7.7460} = 0.2582$$

From the above calculation, a matrix R

$$R=\begin{bmatrix} 0.4500 & 0.5164 & 0.3873 & 0.3145 & 0.2582 & 0.2357 & 0.25 \\ 0.3375 & 0.2582 & 0.3873 & 0.4193 & 0.3873 & 0.2357 & 0.5 \\ 0.3375 & 0.3873 & 0.3873 & 0.4193 & 0.3873 & 0.4714 & 0.5 \\ 0.2250 & 0.3873 & 0.5164 & 0.3145 & 0.3873 & 0.2357 & 0.25 \\ 0.3375 & 0.3873 & 0.2582 & 0.3145 & 0.2582 & 0.2357 & 0.25 \\ 0.4500 & 0.3873 & 0.2582 & 0.4193 & 0.3873 & 0.2377 & 0.5 \\ 0.4500 & 0.2582 & 0.3873 & 0.4193 & 0.5164 & 0.7071 & 0.25 \end{bmatrix}$$

2. Weighting in a normalized matrix (2).

$$V=RW=\begin{bmatrix} 0.4500 & 0.5164 & 0.3873 & 0.3145 & 0.2582 & 0.2357 & 0.25 \\ 0.3375 & 0.2582 & 0.3873 & 0.4193 & 0.3873 & 0.2357 & 0.5 \\ 0.3375 & 0.3873 & 0.3873 & 0.4193 & 0.3873 & 0.4714 & 0.5 \\ 0.2250 & 0.3873 & 0.5164 & 0.3145 & 0.3873 & 0.2357 & 0.25 \\ 0.3375 & 0.3873 & 0.2582 & 0.3145 & 0.2582 & 0.2357 & 0.25 \\ 0.4500 & 0.3873 & 0.2582 & 0.4193 & 0.3873 & 0.2377 & 0.5 \\ 0.4500 & 0.2582 & 0.3873 & 0.4193 & 0.5164 & 0.7071 & 0.25 \end{bmatrix} X$$

$$\begin{bmatrix} 0.25 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.20 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.17 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.15 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.10 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.08 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0.05 \end{bmatrix}$$

$$V=\begin{bmatrix} 0.1125 & 0.1033 & 0.0658 & 0.0472 & 0.0258 & 0.0188 & 0.0125 \\ 0.0844 & 0.0516 & 0.0658 & 0.0629 & 0.0387 & 0.0188 & 0.025 \\ 0.0844 & 0.0775 & 0.0658 & 0.0629 & 0.0387 & 0.0377 & 0.025 \\ 0.0562 & 0.0775 & 0.0878 & 0.0472 & 0.0387 & 0.0188 & 0.0125 \\ 0.0844 & 0.0775 & 0.0439 & 0.0472 & 0.0258 & 0.0188 & 0.0125 \\ 0.1125 & 0.0775 & 0.0439 & 0.0629 & 0.0387 & 0.0190 & 0.025 \\ 0.1125 & 0.0516 & 0.0658 & 0.0629 & 0.0516 & 0.0566 & 0.0125 \end{bmatrix}$$

3. Determine the set of concordance and discordance index
   a. Concordance

   The concordance index set is calculated based on (3).

   K=1 i=1 C_{11} identity = {1,2,3,4,5,6,7}
   i=2 C_{12}
   j=1 if $V_{11} \geq V_{21}$ = 0.1125 ≥ 0.0844 Yes j = 1
   j=2 if $V_{12} \geq V_{22}$ = 0.1033 ≥ 0.0516 Yes j = 2
   j=3 if $V_{13} \geq V_{23}$ = 0.0658 ≥ 0.0658 Yes j = 3
   j=4 if $V_{14} \geq V_{24}$ = 0.0472 ≥ 0.0629 No
   j=5 if $V_{15} \geq V_{25}$ = 0.0258 ≥ 0.0387 No
   j=6 if $V_{16} \geq V_{26}$ = 0.0188 ≥ 0.0188 Yes j = 6
   j=7 if $V_{17} \geq V_{27}$ = 0.0125 ≥ 0.025 No
   C_{12}={1,2,3,6}

   a. Calculate the concordance matrix (5).
   $C_{12} = w_1+w_2+w_3+w_6$= 0.25+0.20+0.17+0.08= 0.7
   $C_{13} = w_1+w_2+w_3$= 0.25+0.20+0.17= 0.62
   $C_{14} = w_1+w_2+w_4+w_6+w_7$= 0.25+0.20+0.15+0.08+0.05= 0.73
   $C_{15} = w_1+w_2+w_3+w_4+w_5+w_6+w_7$
       = 0.25+0.20+0.17+0.15+0.10+0.08+0.05= 1
   $C_{16} = w_1+w_2+w_3$= 0.25+0.20+0.17= 0.62
   $C_{17} = w_1+w_2+w_3+w_7$= 0.25+0.20+0.17+0.05= 0.67
   $C_{21} = w_3+w_4+w_5+w_6+w_7$= 0.17+0.15+0.10+0.08+0.05= 0.55
   $C_{23} = w_1+w_3+w_4+w_5+w_7$= 0.25+0.17+0.15+0.10+0.05= 0.72

$C_{24} = w_1+w_4+w_5+w_6+w_7=0.25+0.15+0.10+0.08+0.05= 0.63$
$C_{25} = w_1+w_3+w_4+w_5+w_6+w_7= 0.25+0.17+0.15+0.10+0.08+0.05=0.8$
$C_{26} = w_3+w_4+w_5+w_7=0.17+0.15+0.10+0.05= 0.47$
$C_{27} = w_2+w_3+w_4+w_7=0.20+0.17+0.15+0.05=0.57$
$C_{31} = w_3+w_4+w_5+w_6+w_7= 0.17+0.15+0.10+0.08+0.05= 0.55$
$C_{32} = w_1+w_2+w_3+w_4+w_5+w_6+w_7$
$\qquad = 0.25+0.20+0.17+0.15+0.10+0.08+0.05= 1$

$$C=\begin{bmatrix} - & 0.7 & 0.62 & 0.73 & 01 & 0.62 & 0.67 \\ 0.55 & - & 0.72 & 0.63 & 0.8 & 0.47 & 0.57 \\ 0.55 & 1 & - & 0.83 & 1 & 0.75 & 0.57 \\ 0.55 & 0.55 & 0.47 & - & 0.75 & 0.47 & 0.42 \\ 0.38 & 0.53 & 0.45 & 0.73 & - & 0.37 & 0.25 \\ 0.63 & 0.83 & 0.75 & 1 & 1 & - & 0.65 \\ 0.8 & 0.95 & 0.75 & 0.63 & 0.8 & 0.75 & - \end{bmatrix}$$

b. Calculates the discordance matrix (6).

$$D_{12} = \frac{\max\{|v_{1j-V_{2j}}|\} \quad j\in D_{12}}{\max\{|v_{1j-V_{2j}}|\} \quad \forall j}$$

$$D_{12} = \frac{\max\{0.0472-0.0629|;|0.0258-0.0387|;|0.0125-0.025\}}{\max\left\{\begin{array}{c}|0.1125-0.0844|;|0.1033-0.0516|;|0.0658-0.0658|;|0.0472-0.0629|; \\ |0.0258-0.0387|;|0.0188-0.0188|;|0.0125-0.025|\end{array}\right\}}$$

$$= \frac{\max\{0.0157;0.0129;0.0125\}}{\max\{0.0281;0.0514;0;0,0157;0.0129;0;0.0125\}} \text{ (ambil yang paling besar)}$$

$$= \frac{0.0157}{0.0514} = 0.305$$

$$D_{13} = \frac{\max\{|v_{1j-V_{3j}}|\} \quad j\in D_{12}}{\max\{|v_{1j-V_{3j}}|\} \quad \forall j}$$

$$D_{13} = \frac{\max\{0.0472-0.0629|;|0.0258-0.0387|;|0.0188-0.0377|;|0.0125-0.025\}}{\max\left\{\begin{array}{c}|0.1125-0.0844|;|0.1033-0.0775|;|0.0658-0.0658|;|0.0472-0.0629|; \\ |0.0258-0.0387|;|0.0188-0.0377|;|0.0125-0.025|\end{array}\right\}}$$

$$= \frac{\max\{0.0157;0.0129;0.0189;0.0125\}}{\max\{0.0281;0.0258;0;0.0157;0.0129;0.0189;0.0125\}}$$
$$= \frac{0.0189}{0.0281} = 0.672$$

$$D_{14} = \frac{\max\{|v_{1j-V_{4j}}|\} \quad j\in D_{12}}{\max\{|v_{1j-V_{4j}}|\} \quad \forall j}$$

$$D_{14} = \frac{\max\{0.0658-0.0878|;|0.0258-0.0387\}}{\max\left\{\begin{array}{c}|0.1125-0.0562|;|0.1033-0.0775|;|0.0658-0.0878|;|0.0472-0.0472|; \\ |0.0258-0.0387|;|0.0188-0.0188|;|0.0125-0.0125|\end{array}\right\}}$$

$$= \frac{\max\{0.022;0.0129\}}{\max\{0.0563;0.0258;0.022;0;0.0129;0;0\}}$$
$$= \frac{0.022}{0.0563} = 0.391$$

$$D_{15} = \frac{\max\{|v_{1j-V_{5j}}|\} \quad j\in D_{12}}{\max\{|v_{1j-V_{5j}}|\} \quad \forall j}$$

$$D_{15} = \frac{\max\{0\}}{\max\left\{\begin{array}{c}|0.1125-0.0844|;|0.1033-0.0775|;|0.0658-0.0439|;|0.0472-0.0472|; \\ |0.0258-0.0258|;|0.0188-0.0188|;|0.0125-0.0125|\end{array}\right\}}$$

$$= \frac{\max\{0\}}{\max\{0.0281;0.0258;0.0219;0;0;0;0\}}$$
$$= \frac{0}{0.0281} = 0$$

$$D_{16} = \frac{\max\{|v_{1j-V_{6j}}|\} \quad j\in D_{12}}{\max\{|v_{1j-V_{6j}}|\} \quad \forall j}$$

$$D_{16} = \frac{\max\ \{0.0472-0.0629|;|0.0258-0.0387|;|0.0188;0.0190|;|0.0125-0.025\}}{\max\begin{Bmatrix}|0.1125-0.1125|;|0.1033-0.0775|;|0.0658-0.0439|;|0.0472-0.0629|;\\ |0.0258-0.0387|;|0.0188-0.0190|;|0.0125-0.025| \end{Bmatrix}}$$

$$= \frac{\max\ \{0.0157;0.0129;0.0002;0.0125\}}{\max\ \{0;0.0258;0.0219;0.0157;0.0129;0.0002;0.0125\}}$$

$$= \frac{0.0157}{0.0258} = 0.608$$

$$D_{17} = \frac{\max\ \{|v_{1j}-V_{7j}|\}\quad j\in D_{12}}{\max\ \{|v_{1j}-V_{7j}|\}\quad \forall j}$$

$$D_{17} = \frac{\max\ \{0.0472-0.0629|;|0.0258-0.0516|;|0.0188-0.0566\}}{\max\begin{Bmatrix}|0.1125-0.1125|;|0.1033-0.0516|;|0.0658-0.0658|;|0.0472-0.0629|;\\ |0.0258-0.0516|;|0.0188-0.0566|;|0.0125-0.0125| \end{Bmatrix}}$$

$$= \frac{\max\ \{0.0157;0.0258;0.0378\}}{\max\ \{0;0.0514;0;0.0157;0.0258;0.0378;0\}}$$

$$= \frac{0.0378}{0.0514} = 0.735$$

So, the discordance matrix is:

$$d = \begin{bmatrix} - & 0.305 & 0.672 & 0.391 & 0 & 0.608 & 0.735 \\ 1 & - & 1 & 0.918 & 1 & 1 & 1 \\ 1 & 0 & - & 0.780 & 0 & 0 & 0 \\ 0 & 0 & 0 & - & 0.642 & 0 & 0 \\ 0 & 0.845 & 0 & 0 & - & 0 & 0 \\ 0 & 0.779 & 0.779 & 0.780 & 0 & - & 1 \\ 1 & 0.331 & 0.922 & 0.46 & 0.685 & 0.689 & - \end{bmatrix}$$

4. Determine the concordance and discordance dominant matrices.
   a. Calculates the concordance dominant matrix

$$C = \frac{\begin{matrix}0.7+0.62+0.73+1+0.62+0.67+0.55+0.72+0.63+0.8+0.47+0.57+0.55+1+0.83+1+0.75+0.57+\\ 0.55+0.55+0.47+0.75+0.47+0.42+0.38+0.53+0.45+0.73+0.37+0.25+0.63+0.83+0.75+1+1+\\ 0.65+0.8+0.95+0.75+0.63+0.8+0.75\end{matrix}}{7(7-1)}$$

$$= \frac{28.24}{42} = 0.672$$

So the concordance dominant matrix is:

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

   b. Calculates the dominant matrix of discordance

$$D = \frac{\begin{matrix}0.305+0.672+0.391+0+0.608+0.735+1+1+0.918+1+1+1+1+0+0.780+0+0+0+0+0+0+\\ 0.642+0+0+0+0.845+0+0+0+0+0.779+0.779+0.780+0+1+1+0.331+0.922+0.46+0.685\\ +0.689\end{matrix}}{7(7-1)}$$

$$= \frac{19.321}{42} = 0.46$$

So the dominant matrix of discordance is

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

5. Determine the aggregate dominance matrix.

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

Matrix E gives a sequence of choices for each alternative, if $e_{kl} = 1$ then alternative A7 is a better alternative than A1. Thus, rows in matrix E that have the number of e_{kl} = more can be eliminated. If A7 is better than A2. Likewise, if A7 is compared to A3, A4, A5, A6 then A7 is a better alternative because alternative A7 has the number 1 more than the other alternatives. So it can be concluded that alternative A7 = Mey Yustina L. Batu is the best alternative

4. CONCLUSION

After analyzing, designing, implementing and testing, the following conclusions are obtained:
1) The creation of a new system that can determine the recipients of scholarships for employees' children by using the ELECTRE method
2) The process of receiving scholarships for employees' children at PT. Nusira has not been done effectively and efficiently. Because the process has not been computerized. so it takes a long time in awarding scholarships.
3) Making a new system, of course, should be applied to the company to determine the employee's child who will receive a scholarship.

REFERENCES

[1] I. Saputra, S. I. Sari, and Mesran, "PENERAPAN ELIMINATION AND CHOICE TRANSLATION REALITY (ELECTRE) DALAM PENENTUAN KULKAS TERBAIK," *KOMIK (Konferensi Nas. Teknol. Inf. dan Komputer)*, vol. I, pp. 295–305, 2017.
[2] M. Yazdani and F. R. Graeml, "VIKOR and its Applications," *Int. J. Strateg. Decis. Sci.*, vol. 5, no. 2, pp. 56–83, Apr. 2014.
[3] Mesran, G. Ginting, Suginam, and R. Rahim, "Implementation of Elimination and Choice Expressing Reality (ELECTRE) Method in Selecting the Best Lecturer (Case Study STMIK BUDI DARMA)," *Int. J. Eng. Res. Technol. (IJERT*, vol. 6, no. 02, pp. 141–144, 2017.
[4] S. Sundari, A. Wanto, S. Saifullah, and I. Gunawan, "Sistem Pendukung Keputusan Dengan Menggunakan Metode Electre Dalam Merekomendasikan Dosen Berprestasi Bidang Ilmu Komputer (Study Kasus di AMIK & STIKOM Tunas Bangsa)," in *Conference Paper*, 2017, no. September.
[5] S. R. Ningsih, I. S. Damanik, I. Gunawan, and W. Saputra, "SISTEM PENDUKUNG KEPUTUSAN DENGAN MENGGUNAKAN METODE ELECTRE DALAM MENENTUKAN PENERIMA PROGRAM INDONESIA PINTAR (PIP) MELALUI KARTU INDONESIA PINTAR (KIP) (STUDI KASUS: SD SWASTA AL – WASHLIYAH MOHO KABUPATEN SIMALUNGUN)," *KOMIK (Konferensi Nas. Teknol. Inf. dan Komputer)*, vol. 1, no. 1, Nov. 2017.
[6] F. Setiawan, F. Indriani, and Muliadi, "Implementasi Metode Electre Pada Sistem Pendukung Keputusan SNMPTN Jalur Undangan," *Kumpul. J. Ilmu Komput.*, vol. 02, no. 02, pp. 88–101, 2015.
[7] S. Kusumadewi, S. Hartati, A. Harjoko, and R. Wardoyo, *Fuzzy Multi-Attribute Decision Making (Fuzzy MADM)*. Yogyakarta: Graha Ilmu, 2006.
[8] D. Nofriansyah and S. Defit, *Multi Criteria Decision Making (MCDM) pada Sistem Pendukung Keputusan*. 2018.
[9] Kusrini, *Sistem Pendukung Keputusan dan Aplikasinya*. Yogyakarta: Andi, 2007.
[10] A. Yanie *et al.*, "Web Based Application for Decision Support System with ELECTRE Method," in *Journal of Physics: Conference Series*, 2018, vol. 1028, no. 1.