Article

SAW and Electre Methods Implementation for Scholarship Awardee Decision

Heru Sugara[1], **Victor Marudut Mulia Siregar**[2*], **Kalvin Sinaga**[3], **M. Ali Hanafiah**[4], **Henry Dunan Pardede**[5]

[1]Department of Secretary, Politeknik Bisnis Indonesia; thesugara77@gmail.com;
[2]Department of Computer Engineering, Politeknik Bisnis Indonesia; victor.siregar2@gmail.com;
[3]Department of Finance and Banking, Politeknik Bisnis Indonesia; kal.sinaga@gmail.com;
[4]Department of Computer Engineering, Politeknik Bisnis Indonesia; ikh.alie84@gmail.com;
[5]Department of Finance and Banking, Politeknik Bisnis Indonesia; henry.dunanpardede@yahoo.co.id

* Corresponding author: victor.siregar2@gmail.com

Abstract: This research was conducted to design a Decision Support System as a tool for decision-makers in distributing Bidik Misi Scholarships at the Indonesian Business Polytechnic. The selection of students who volunteered to become recipients of the Bidik Misi Scholarship required the Decision Support System (DSS) approach, which implemented the Simple Additive Weighting (SAW) method by weighting the criteria and sub-criteria of each alternative for all attributes. The criteria used in the SAW method in this study consisted of 2 (two) criteria, and each of these criteria had sub-criteria. The first criterion is Parents with sub-criteria consisting of the education level, incomes, parents' coverage. The second criterion is students with sub-criteria consisting of age, academic potential, ownership of the Indonesia Smart Card (KIP). The output obtained from the 5 data analyzed in this study, the final value of the highest alternative preference is 0.9, and the lowest alternative preference value is 0.55. The output obtained by using the Electre method is that the Student_Mari004 alternative eliminates other alternatives.

Keywords: Decision Support System, Criteria, Weight, Alternative

Citation: Sugara.H, Siregar.V.M.M, Sinaga.K, Hanafiah. A.M., Pardede. D.H, SAW and Electre Methods Implementation for Scholarship Awardee Decision. *Iota*, **2021**, ISSN 2774-4353, Vol.01, 04. https://doi.org/10.31763/iota.v1i4.496

Academic Editor : P.D.P.Adi

Received : 11 September 2021

Accepted : 12 October 2021

Published : 14 November 2021

1. Introduction

The Indonesian Business Polytechnic is one of several Private Universities located in Jalan Sriwijaya No. 9C-E Pematangsiantar City of North Sumatra Province under the auspices of the Indonesian Business Development Education Foundation, which organizes 4 (four) Study Programs, e.g., Diploma III in Computer Engineering, Diploma III in Accounting Information Systems, Diploma III in Banking and Finance, and Diploma III in Office Administration. The Indonesian Business Polytechnic is a Higher Education that the Central Government mandates through the Directorate General of Higher Education Ministry of National Education of the Republic of Indonesia to manage the Bidik Misi Scholarship Program for prospective students who will study in one of the Study Programs above. The Bidik Misi Scholarship Program is a tuition assistance program for prospective students who have an economic background but have the good academic ability and are considered to study in Higher education institutions. Bidik Misi Scholarship Recipients are determined based on specific criteria determined by the Ministry of Research Technology and Higher Education.

The implementation of the Bidik Misi Scholarship Program at the Indonesian Business Polytechnic is still experiencing difficulties in determining Bidik Misi Scholarship

recipients because the quantity of Bidik Misi Scholarship registrants is increasing. At the same time, the Bidik Misi quota from the government is limited in number. The difficulty in determining the scholarship recipient is because a system has not supported it in making decisions. The determination of the recipient of the existing Bidik Misi Scholarship recipients seems to be treated subjectively, and the resulting choices are less measurable because the assessment factors used in making decisions cannot be clearly defined so that the time needed by decision-makers, in this case, the academic part becomes relatively longer and not on target.

For this reason, researchers created a decision support system in determining recipients of Bidik Misi Scholarships that can help facilitate the work of the academic section in making decisions to determine students who are eligible to receive the Bidik Misi scholarship. Decision support systems are now widely used to help decision making, both in the field of educational education [1], [2], [3], [4] businesses [5], [6], [7], [8], agriculture [9] and others [10], [11], [12], [13], [14], [15], [16], [17], [18].

The Decision Support System built to determine the recipient of the Bidik Misi Scholarship uses the Simple Additive Weighting (SAW) method and Choice Expressing Reality (ELECTRE) Method. Simple Additive Weighting (SAW) method is a method of facilitating the selection of weighting factors or attributes [19], then to determine which students are eligible to receive scholarships the best alternative selection of several alternatives through ranking based on predetermined criteria [8], [20]. The Electre method is a multi-criteria decision-making method based on the concept of outranking by using pairwise comparisons of alternatives based on each appropriate criterion [15].

2. Research Methods

Figure 1 is the research method used in this study, first starting with Start, Data Collection, Determining the criteria, Processing data with the SAW and Electre Method, Comparing the results, and determining the most effective method. Furthermore, to achieve the research objectives, collected data is needed in determining the acceptance of the Bidik Misi Scholarship. Alternative data to be processed in table 1. The information that has been collected will be analyzed using the Simple Additive Weighting (SAW) method and Elimination and Choice Expressing Reality (ELECTR) Method.

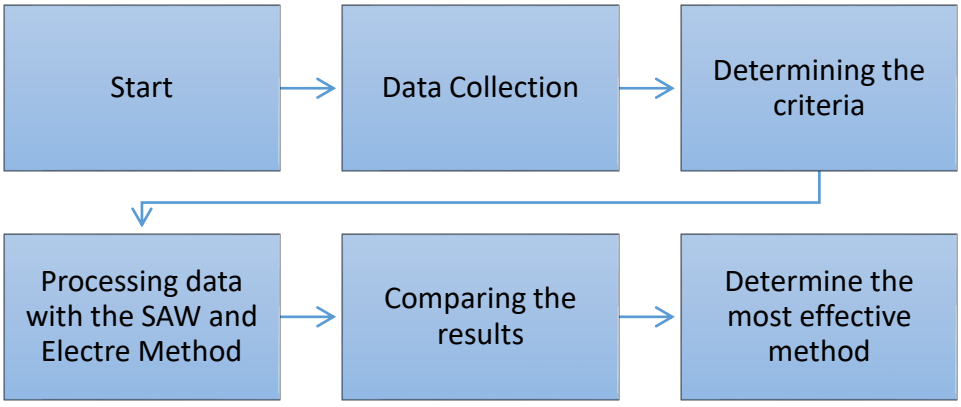

Figure 1. Research Methods

Table 1. Alternative Data

Alternative	Education	Income	Parents' Coverage	Age	Academic Potential	KIP ownership
A1	SD - SMP	1.000.000	3	20	8,5	Yes
A2	DIPLOMA-4 – S1	2.000.000	6	22	8,5	No
A3	SMA – DIPLOMA-3	2.500.000	2	17	9	Yes
A4	SMA – DIPLOMA-3	1.500.000	3	23	8,5	No
A5	SMA – DIPLOMA-3	3.000.000	4	17	7,9	Yes

3. Result and Discussion

Data Analysis using the Simple Additive Weighting (SAW) Method, The steps to analyze data using the SAW method are by Determining the criteria used as a reference for decision making In determining the acceptability of the Bidik Misi Scholarship using 2 Criteria and 6 Sub Criteria to be tested by the SAW method as in Table 2., furthermore, Giving weight preference or level of importance (W) for each criterion; After establishing the criteria, then the researchers assign weight values to each criterion as in table 3. Moreover, From the requirements in table 3, a value scale is made where the values are as contained in table 4.

Table 2. Criteria and Sub-Criteria

Criteria		Sub-Criteria	
Variable	**Information**	**Variable**	**Information**
C1	Parents	C1.1	Education
		C1.2	Income
		C1.2	Number of dependents of parents
C2	Student	C2.1	Age
		C2.1	Academic Potential
		C2.3	KIP ownership

Table 3. Weight Preference or Level of Importance (W)

Criteria		Sub-Criteria		Weight
Variable	**Information**	**Variable**	**Information**	
C1	Parents	C1.1	Education	20%
		C1.2	Income	20%
		C1.3	Parents' Coverage	10%
C2	Student	C2.1	Age	10%
		C2.2	Academic Potential	20%
		C2.3	KIP ownership	20%

Furthermore, Alternative Weighting Process (Matching Ratings of Each Alternative to Each criterion); at this stage, the criteria level is made based on the applicant's scholarship into the crisp value, as in table 5.

Table 4. The intensity of importance of criterion values

Variable	Value
Very low	1
Low	2
Enough	3
High	4
Very high	5

Table 5. Levels of evaluation criteria

Criteria		Sub Criteria		Scale Value	
Variable	**Information**	**Variable**	**Information**	**Scale**	**Value**
C1	Parents	C1.1	Education	S3	1
				S2	2
				DIPLOMA-4 – S1	3
				SMA – DIPLOMA-3	4
				SD – SMP	5
		C1.2	Income	> 4 jt	1
				3 jt - 4 jt	2
				2 jt - 3 jt	3
				1 jt - 2 jt	4
				< 1 jt	5
		C1.3	Parents' Coverage	2	1
				3	2
				4	3
				5	4
				>6	5
C2	Student	C2.1	Age	>21	1
				<18	2
				18 - 21	5

Criteria		Sub Criteria		Scale Value	
Variable	**Information**	**Variable**	**Information**	**Scale**	**Value**
		C2.2	Academic Potential	<75	1
				75.00-79.99	2
				80.00-84.99	3
				85.00-89.99	4
				90.00-100.00	5
		C2.3	KIP ownership	No	1
				Yes	5

Having determined the scale of the values of each criterion, then determining the alternative assessment for each measure. Based on the reference criteria, alternative values for each criterion are determined as in table 6.

Table 6. Alternative assessment for each criterion

Alternative	Criteria / Sub Criteria					
	Parents (C1)			Student (C2)		
	C1.1	**C1.2**	**C1.3**	**C2.1**	**C2.2**	**C2.3**
Student_Vivi001	5	4	2	5	4	5
Student_Anda002	3	3	5	1	3	1
Student_Dian003	4	3	1	2	5	5
Student_Mari004	4	3	3	1	4	1
Student_Raja005	4	2	4	2	1	5

Create the matrix decision (X) obtained from the match rating on each alternative (Ai) for each criterion (Cj).

$$X = \begin{Bmatrix} 5 & 4 & 2 & 5 & 4 & 5 \\ 3 & 3 & 5 & 1 & 3 & 1 \\ 4 & 3 & 1 & 2 & 5 & 5 \\ 4 & 3 & 3 & 1 & 4 & 1 \\ 4 & 2 & 4 & 2 & 1 & 5 \end{Bmatrix}$$

Normalize the decision matrix (X) by calculating the performance rating values normalized (rij) from alternatives (Ai) to criteria (Cj).

Normalization of the matrix is then performed by calculating the normalized performance rating (rij) value of Ai alternatives on the Cj attribute based on the equation adjusted for the type of attribute. By setting all the attributes as benefits, the value of crisp (Xij) of each column is divided by maximum crisp.

$$r_{ij} = \left\{ \frac{C_{ij}}{Max\ C_{ij}} \right\} \quad (1)$$

Table 7. Normalization value

Rij	**Normalization_value**
Normalization For Parent Education	
R11	1
R21	0.6
R31	0.8
R41	0.8
R51	0.8
Normalization For Income	
R12	1
R22	0.75
R32	0.75
R42	0.75
R52	0.5
Normalization For Number of Dependents	
R13	0.4
R23	1
R33	0.2
R43	0.6
R53	0.8
Normalization For Ages	
R14	1
R24	0.2
R34	0.4
R44	0.2
R54	0.4
Normalization For Academic Potential	
R15	0.8

R25	0.6
R35	1
R45	0.8
R55	0.2

Normalization For KIP Ownership

R16	1
R26	0.2
R36	1
R46	0.2
R56	1

The normalized matrix from the analysis of the data is :

$$R = \begin{Bmatrix} 1 & 1 & 0.4 & 1 & 0.8 & 1 \\ 0.6 & 0.75 & 1 & 0.2 & 0.6 & 0.2 \\ 0.8 & 0.75 & 0.2 & 0.4 & 1 & 1 \\ 0.8 & 0.75 & 0.6 & 0.2 & 0.8 & 0.2 \\ 0.8 & 0.5 & 0.8 & 0.4 & 0.2 & 1 \end{Bmatrix}$$

For the Determine the Final Preference Value (Vi), the Final Preference Value for Student_Vivi001 is 0.9, Final Preference Value for Student_Anda002 is 0.55, Final Preference Value for Student_Dian003 is 0.77, Final Preference Value for Student_Mari004 is 0.59, and Final Preference Value for Student_Raja005 is 0.62. Moreover, from the data analysis, the final preference value of each alternative is obtained as in table 7.

Table 8. The final preference value (V)

Alternative	**Final Preference Value (V_i)**
Student_Vivi001	0.9
Student_Anda002	0.55
Student_Dian003	0.77
Student_Mari004	0.59
Student_Raja005	0.62

Furthermore, the ranking for each alternative is determined based on the final preference value obtained by the alternative by sorting the preference value descending from the highest preference value to the lowest preference value. Ranking results can be seen in table 9.

Table 9. Alternative ranking

Alternative	Preference Value	Ranking
Student_Vivi001	0.9	1
Student_Dian003	0.77	2
Student_Raja005	0.62	3
Student_Mari004	0.59	4
Student_Anda002	0.55	5

From table 9 can get it is known that out of 5 (five) applicants for Bidik Misi Scholarships, the highest preference value is the applicant on behalf of Student_Vivi001 than the other applicant's preference values. Thus, Student_Vivi001 became a priority to get the Bidik Misi Scholarship.

Furthermore, Data Analysis using the Elimination and Choice Expressing Reality (ELECTRE) Method, the steps are Creating the decision matrix (X), Normalizing the decision matrix, The weighting results on the normalized matrix, calculating concordance and discordance matrix, Determining the dominant concordance matrix and discordance, Determining aggregate dominance matrix, and Elimination of the less favorable alternative. In detail, the matrix can be seen as follows:

Create the matrix decision (X).

$$X = \begin{bmatrix} 5 & 4 & 2 & 5 & 4 & 5 \\ 3 & 3 & 5 & 1 & 3 & 1 \\ 4 & 3 & 1 & 2 & 5 & 5 \\ 4 & 3 & 3 & 1 & 4 & 1 \\ 4 & 2 & 4 & 2 & 1 & 5 \end{bmatrix}$$

Normalizing the decision matrix

$$R = \begin{bmatrix} 0.552 & 0.583 & 0.270 & 0.845 & 0.489 & 0.570 \\ 0.331 & 0.438 & 0.674 & 0.169 & 0.367 & 0.114 \\ 0.442 & 0.438 & 0.135 & 0.338 & 0.611 & 0.570 \\ 0.442 & 0.438 & 0.405 & 0.169 & 0.489 & 0.114 \\ 0.442 & 0.292 & 0.539 & 0.338 & 0.122 & 0.570 \end{bmatrix}$$

The weighting results on the normalized matrix

$$\begin{bmatrix} 1.104 & 1.167 & 0.270 & 0.845 & 0.997 & 1.140 \\ 0.663 & 0.875 & 0.674 & 0.169 & 0.773 & 0.228 \\ 0.883 & 0.875 & 0.135 & 0.338 & 1.222 & 1.140 \\ 0.883 & 0.875 & 0.405 & 0.169 & 0.977 & 0.228 \\ 0.883 & 0.583 & 0.539 & 0.338 & 0.244 & 1.140 \end{bmatrix}$$

Table 10 is the calculation results of the concordance matrix with Five alternative sample data, Table 11 is a calculation result of the dis-concordance matrix with Five alternative sample data, and Table 12 is an elimination of the less favorable alternative with Five alternative sample data. The tables are described in detail in the sections below:

Calculating concordance and discordance matrix

Table 10. The calculation results of the concordance matrix

Alternative	**Preference Value**	**Preference Value**	**Preference Value**	**Preference Value**	**Preference Value**
Student_Vivi001	0	9	8	9	9
Student_Anda002	1	0	3	6	5
Student_Dian003	4	9	0	9	9
Student_Mari004	3	9	5	0	6
Haries Raja	3	5	6	6	0

Table 11. The calculation results of the disconcordance matrix

Alternative	**Preference Value**	**Preference Value**	**Preference Value**	**Preference Value**	**Preference Value**
Student_Vivi001	0	0.444	0.482	0.148	0.368
Student_Anda002	1	0	1	0.906	1
Student_Dian003	1	0.592	0	0.296	0.414
Student_Mari004	1	1	1	0	1
Haries Raja	1	0.536	1	0.804	0

Determine the dominant concordance matrix and discordance

Concordance Matrix Discordance Matrix

$$\begin{bmatrix} 0 & 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix} \qquad \begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 1 \\ 1 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 & 0 \end{bmatrix}$$

Determining aggregate dominance matrix

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

Table 12. Elimination of the less favorable alternative

Alternative	**Preference Value**
Student_Vivi001	0
Student_Anda002	0
Student_Dian003	0
Student_Mari004	1
Student_Raja005	0

4. Conclusions and Suggestion

The Decision Support System built can help facilitate the academic section of the Indonesian Business Polytechnic in determining eligible students to receive Bidik Misi Scholarships. Therefore, decision-making can be done quickly to determine the relative accuracy level of the two methods; the relative standard deviation method is used. From the calculation results, the value of the relative standard deviation in the SAW method is 21.24%, while the relative standard deviation value in the Electre method is 149%. Based on the calculation of the relative standard deviation value, it can be concluded that the value given by the Electre method for this case is better than the value given by the SAW method.

Author Contributions: Conceptualization; Sugara.H (S.H), Siregar.V.M.M (S.V.M.M), Sinaga.K (S.K), Hanfiah. A.M. (H.A.M), Pardede. D.H (P.D.H); methodology; (S.H), (S.V.M.M), (S.K), (H.A.M), validation; (P.D.H), formal analysis; (S.H), (S.V.M.M), (S.K), (H.A.M), investigation; (S.H), (S.V.M.M), (S.K), (H.A.M), data curation; (S.H), (S.V.M.M), (S.K), (H.A.M); writing—original draft preparation; (S.H), (S.V.M.M), (S.K), (H.A.M), writing—review and editing; (S.H), (S.V.M.M), (S.K), (H.A.M), visualization; (S.H), (S.V.M.M), (S.K), (H.A.M), supervision; (S.H), (S.V.M.M), (S.K), (H.A.M), project administration; (S.H), (S.V.M.M), (S.K), (H.A.M), funding acquisition; (S.H), (S.V.M.M), (S.K), (H.A.M), have read and agreed to the published version of the manuscript.

Acknowledgments: Thanks to the research team at the Politeknik Bisnis Indonesia, so this research can be completed properly, I hope that this research will continue to be

developed from an analytical perspective so that it can produce a more complex level of analysis.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. V. M. M. Siregar, S. Sonang, A. T. Purba, H. Sugara, and N. F. Siagian, "Implementation of TOPSIS Algorithm for Selection of Prominent Student Class," J. Phys. Conf. Ser., vol. 1783, no. 1, p. 012038, Feb. 2021, doi: 10.1088/1742-6596/1783/1/012038.
2. A. T. Purba and V. M. M. Siregar, "Sistem Penyeleksi Mahasiswa Baru Berbasis Web Menggunakan Metode Weighted Product," TEKINKOM, vol. 3, no. 1, pp. 1–8, 2020, doi: 10.37600/tekinkom.v3i1.117.
3. S. H. Musti, D. Irmayani, and G. J. Yanris, "ANALYSIS OF THE ELECTRE METHOD IN DECISION SUPPORT SYSTEMS FOR DETERMINING AREAS OF EXPERTISE FOR," Infokum, vol. 9, no. 2, pp. 184–190, 2021.
4. A. T. Purba, "Sistem Pendukung Keputusan Dalam Penerimaan Mahasiswa Baru Dengan Metode Analytical Hierarchy Process (AHP)," J. Tekinkom, vol. 1, no. 1, pp. 1–7, 2018.
5. H. Indriyawati, S. R. Cholil, and V. G. Utomo, "Penentuan Prediksi Stok Mobil Dengan Pendekatan Kepuasan Pelanggan Menggunakan Metode Moora," Telematika, vol. 11, no. 2, pp. 55–64, 2018.
6. S. Aisyah and W. Purba, "Aplikasi Sistem Pendukung Keputusan Penilaian Kinerja Karyawan Menggunakan Metode Profile Matching," J. Mahajana Inf., vol. 4, no. 2, pp. 16–20, 2019.
7. S. Sumaizar, K. Sinaga, E. D. Siringo-ringo, and V. M. M. Siregar, "Determining Goods Delivery Priority for Transportation Service Companies Using SAW Method," J. Comput. Networks, Archit. High Perform. Comput., vol. 3, no. 2, pp. 256–262, Nov. 2021, DOI: 10.47709/cnahpc.v3i2.1154.
8. J. Simatupang, "Sistem Pendukung Keputusan Penentuan Karyawan Terbaik Menggunakan Metode Saw Studi Kasus Amik Mahaputra Riau," J. Intra-Tech, vol. 2, no. 1, pp. 73–82, 2018.
9. S. P. Tamba, P. Wulandari, M. Hutabarat, M. Christina, and A. Oktavia, "PENGGUNAAN METODE TOPSIS (TECHNIQUE FOR ORDER PREFERENCE BY SIMILARITY TO IDEAL SOLUTION) UNTUK MENENTUKAN KUALITAS BIJI KOPI TERBAIK BERBASIS ANDROID," J. Mantik Penusa, vol. 3, no. 1, pp. 73–81, 2019.
10. Y. M. Kristania, "Implementasi Kombinasi Metode Ahp Dan Saw Dalam Pendukung Keputusan Penentuan Kredit Perumahan Rakyat," Telematika, vol. 11, no. 1, pp. 65–78, 2018, doi: 10.35671/telematika.v11i1.616.
11. V. M. Mulia Siregar and H. Sugara, "Implementation of artificial neural network to assesment the lecturer's performance," IOP Conf. Ser. Mater. Sci. Eng., vol. 420, p. 012112, Oct. 2018, doi: 10.1088/1757-899X/420/1/012112.
12. V. M. M. Siregar, S. Sonang, A. T. Purba, H. Sugara, and N. F. Siagian, "Implementation of TOPSIS Algorithm for Selection of Prominent Student Class," J. Phys. Conf. Ser., vol. 1783, no. 1, p. 012038, Feb. 2021, doi: 10.1088/1742-6596/1783/1/012038.
13. S. P. Tamba, M. D. Batubara, W. Purba, M. Sihombing, V. M. Mulia Siregar, and J. Banjarnahor, "Book data grouping in libraries using the k-means clustering method," J. Phys. Conf. Ser., vol. 1230, no. 1, p. 012074, Jul. 2019, doi: 10.1088/1742-6596/1230/1/012074.

14. V. M. M. Siregar, M. R. Tampubolon, E. P. S. Parapat, E. I. Malau, and D. S. Hutagalung, "Decision support system for selection technique using MOORA method," IOP Conf. Ser. Mater. Sci. Eng., vol. 1088, no. 1, p. 012022, Feb. 2021, doi: 10.1088/1757-899X/1088/1/012022.
15. S. Sirait et al., "Selection of the Best Administrative Staff Using Elimination Et Choix Traduisant La Realite (ELECTRE) Method," J. Phys. Conf. Ser., vol. 1933, no. 1, p. 012068, Jun. 2021, doi: 10.1088/1742-6596/1933/1/012068.
16. V. Sihombing, V. M. M. Siregar, W. S. Tampubolon, M. Jannah, Risdalina, and A. Hakim, "Implementation of simple additive weighting algorithm in decision support system," IOP Conf. Ser. Mater. Sci. Eng., vol. 1088, no. 1, p. 012014, Feb. 2021, doi: 10.1088/1757-899X/1088/1/012014.
17. V. M. M. Siregar et al., "Implementation of ELECTRE Method for Decision Support System," IOP Conf. Ser. Mater. Sci. Eng., vol. 1088, no. 1, p. 012027, Feb. 2021, DOI: 10.1088/1757-899x/1088/1/012027.
18. V. Sihombing et al., "Additive Ratio Assessment (ARAS) Method for Selecting English Course Branch Locations," J. Phys. Conf. Ser., vol. 1933, no. 1, p. 012070, Jun. 2021, DOI: 10.1088/1742-6596/1933/1/012070.
19. M. A. Salim, "Sistem Pendukung Keputusan Pemilihan Penerima Bantuan Perbaikan Rumah Menggunakan Metode Simple Additive Wieghting (SAW) Studi Kasus Kelurahan Tambelan Sampit Kota Pontianak," J. Sist., vol. 7, no. 2, pp. 120–131, 2018, doi: DOI : https://doi.org/10.32520/stmsi.v7i2.293.g124.
20. S. S. S, A. T. Purba, and V. M. M. Siregar, "Sistem Pendukung Keputusan Kelayakan Pemberian Pinjaman Kredit Menggunakan Metode Topsis Pada Cum Caritas HHKBP Pematangsiantar," J. Tek. Inf. dan Komput., vol. 3, no. 1, p. 1, Sep. 2020, doi: 10.37600/tekinkom.v3i1.117.