International Journal of Informatics and Information System ISSN 2579-7069
Vol. 3, No. 1, March 2020, pp. 1-11

Support System for Determination of Low-Income Students Scholarship (BSM) with Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

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Abstract

Muhammadiyah 3 Middle School in Purwokerto is the school that organizes the Low-Income Students Scholarship (BSM) program every first semester held in each new school year. During this time, processing student data and other equipment have been processed with manual calculations, as well as data storage using only Microsoft Excel. In selecting ranking, it still uses paper. The paper calculation on the selection of BSM recipients in the previous year is often lost and hard to find already needed, also there is no particular system for processing the data so that the subjective method is still needed by relying trusts on personal. The purpose of this study is the creation of a Decision Support System (DSS) application for Determining Low-Income Students Scholarship (BSM) using the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method at Muhammadiyah 3 Middle School in Purwokerto so that the selection process of Low-Income Students Scholarship (BSM) can be used. So that it is right on target to students who are entitled to BSM and can store data safely. The system development method used is a waterfall.

Keywords: Decision Support System; Technique for Order Preference by Similarity to Ideal Solution (TOPSIS); Website; Muhammadiyah 3 Middle School in Purwokerto.

1. Introduction

Muhammadiyah 3 Middle School in Purwokerto is one of the private schools established in 1989, based on Islamic religion and found in the city of Purwokerto with the address Jl. Dr. Number No. 79 Bancarkembar North Purwokerto. Muhammadiyah 3 Middle School in Purwokerto is conduct the Low-Income Students Scholarship Program (BSM) at the beginning of each semester are held on each new school year. Currently, student data and other fittings are processed with manual calculations, as well as data storage using only Microsoft Excel. In the attachment, the fishing still uses paper. Calculation paper on BSM receiver screening in previous years is often lost and difficult to find when it is needed, and there is no specific system to process the data so that the way of judgment is still subjective by relying on personal views.

On the system that has been running, the time required by the BSM manager is about a year from the new school year. Data security in Microsoft Excel becomes one of the vulnerable factors due to the absence of restriction of access in its use, then in case of damage to hardware will cause data loss [1]. The absence of a system makes the assessment unobjective and resulted in errors in the recommendation of determining students who are entitled to BSM, and it is necessary a system that can help the job of decision-making BSM and can store data securely and efficiently searchable by using databases. Decision Support System with the method of TOPSIS data selectors, the student candidate of the BSM receiver is carried out through the criteria and predefined weights so that it can help to determine the feasibility of receiving Low-Income Students Scholarship Program accurately.

TOPSIS uses the principle that the selected alternatives should have the closest distance from the ideal positive solution and the longest distance (farthest) of the ideal negative solution from a geometric point of view using Euclidean distance (distance between two points) to determine the relative proximity of an alternative with optimal solution [2].

The purpose of this research is to make the application of the decision-making system (DSS) for Low-Income Students Scholarship (BSM) using the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) at

Muhammadiyah 3 Middle School in Purwokerto to facilitate the process of screening for Low-Income Students Scholarship (BSM) so that the target students who are eligible for BSM and can store data securely.

2. Research Methods

2.1. System Development Methods

Here are the stages of the system development method using waterfall [3].

a. Determination and analysis of specifications

In this stage, analysis of the needs of the software that is analyzed functional needs and analysis of non-functional needs.

b. System design and Software

The design Model used in this study uses UML (Unified Modelling Language).

c. Unit implementation and trial

In the implementation phase and unit trials, researchers in creating the system could be implemented using the Laravel Framework with its programming language PHP (PHP Hypertext Pre-processor) and MySQL used for the creation of its database.

d. System integration and trial

In this research, researchers use BlackBox testing.

e. Operation and Maintenance

The system installed and used. Maintenance includes corrected errors that were not found in the previous step. Improved implementation of system units and improved system services as new needs were found.

2.2. Method of TOPSIS (Technique for Order Performance by Similarity to Ideal Solution)

TOPSIS considers both the distance to the ideal solution positively and the distance to the ideal negative solution by taking the proximity relative to the ideal positive solution. Based on comparisons to their relative distances, alternative priority arrangements can be achieved. This method is widely used to complete decision-making practices. This is because the concept is understandable and straightforward, the computation is efficient, and can measure the relative performance of the alternative decisions [2].

3. Results and Discussion

3.1. System Design

Use Case Diagram

Fig. 1 Use case diagram at Muhammadiyah 3 Middle School in Purwokerto

3.2. System Results

a. Value Data Preference

In this stage, analysis of the needs of the software that is analyzed functional needs and analysis of non-functional needs.

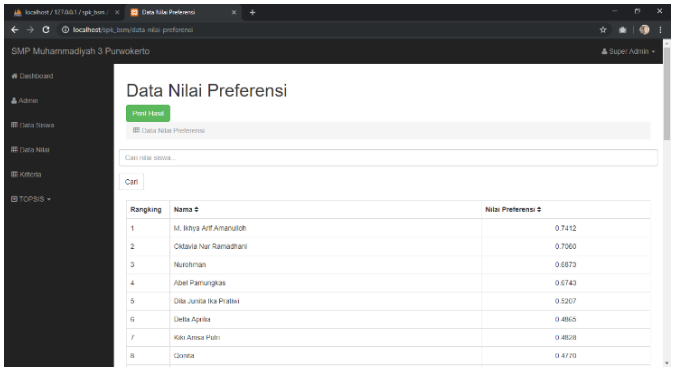

Fig. 2. Value Preference Data

Figure 2 is a preference value data that contains ranking, student names, and preference values.

b. Report

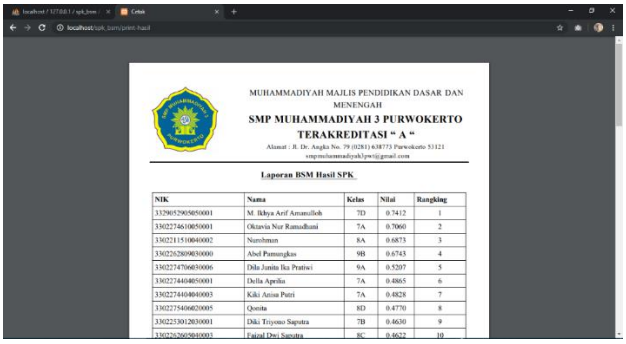

Fig. 3 Report

Figure 3.3 is the result of a report containing NIK, name, class, value, and rank.

c. Manual TOPSIS Result

1) Alternate Data

Table 1 is an alternative data taken from the students in Muhammadiyah 3 Middle School in Purwokerto, the alternative that will be used in the TOPSIS process.

Table 1. TOPSIS Alternative Data

No.	Code	Alternate Names	Address
1.	A1	Abel Pamungkas	Kombas
2.	A2	Adika Caksana Putra Wibowo	Kutasari
3.	A3	Agung Jatmiko	Arcawinangun
4.	A4	Akbar Refandi	Purbalingga
5.	A5	Alfi Nur Aziz	Arcawinangun

2) Criterion-weighted Data

Table 2 is the criteria for weighting a criterion consisting of code, criteria, weights, and properties. The contents of the table below are the data to be used in the TOPSIS process.

Table 2. TOPSIS Criterion-weighted Data

No.	Code	Criteria	Weights	Nature
1.	C1	SKTM	0.2	Benefit
2.	C2	PIP Recipients	0.1	Benefit
3.	C3	Father's income	0.1	Cost
4.	C4	Father's job	0.05	Cost
5.	C5	Mother Income	0.05	Cost
6.	C6	Mother's job	0.05	Cost
7.	C7	KIP Recipients	0.1	Cost
8.	C8	KPS Recipients	0.05	Benefit
9.	C9	Transportation tool	0.05	Cost
10.	C10	Type of residence	0.05	Cost
11.	C11	Home ownership	0.05	Cost
12.	C12	Number of Relatives	0.025	Benefit
13.	C13	Children number …	0.025	Cost
14.	C114	Morals	0.1	Benefit

3) Criterion-weighted Data

Table 3 is value data per criteria such as SKTM, PIP recipient, father income, father's job, mother's income, mother's job, KIP recipient, KPS receiver, transportation tool, type of residence, homeownership, number of relatives, children number, and morals. The value in that criterion will be the value of each alternative in the TOPSIS process.

Table 3. Value of TOPSIS Criterion Data

No.	Criteria	Description	Value
1.	SKTM	Yes	9
		Not	1
2.	PIP Recipients	Yes	9
		Not	1
3.	Father's income	No income	9
		< 500,000	7
		500,000 - 999,999	5
		1 million - 1,999,999	3
		2 million - 4,999,999	1
4.	Father's job	Deceased	9
		Labor	8
		Farmers	7
		Small traders	6
		Other	5
		Private employees	4
		Self-employed	3
		Retired	2
		Civil Servant/Police/Military	1
5.	Mother Income	No income	9
		< 500,000	7
		500,000 S. D 999,999	5
		1 million s. D 1,999,999	3
		2 million S. D 4,999,999	1
6.	Mother's job	Deceased	9
		Not working	8
		Labor	7
		Farmers	6
		Small traders	5
		Other	4
		Private employees	3
		Self-employed	2
		Civil Servant/Police/Military	1
7.	KIP Recipients	Yes	1
		Not	9
8.	KPS Recipients	Yes	9
		Not	1
9.	Transportation equipment	Public transportation	9
		Private vehicle	7
		Shuttle Service	5
		Bicycle	3
		Walk	1
10.	Type of stay	Parlors	9
		Guardian	6
		Parents	3
11.	Homeownership	Do not have	9
		Dormitory	7
		Contract/Lease	5
		Private	3
		Service	1

No.	Criteria	Description	Value
12.	Number of Relatives	> 5	9
		4	7
		3	5
		2	3
		1	1
13.	Children to	1	9
		2	7
		3	5
		4	3
		5	1
14.	Morals	Good	9
		Not good	1

4) Decision Matrix

Table 4 the decision matrix is a value on every alternative/student obtained from the value data on each criterion. The alternative value below will be used for the TOPSIS process.

Table 4. TOPSIS Decision Matrix

No.	Name	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
1.	A1	9	9	9	9	5	7	1	1	1	3	3	5	4	9
2.	A2	1	1	1	3	9	9	1	1	9	6	3	3	6	1
3.	A3	9	1	5	6	5	5	1	9	1	3	3	3	8	1
4.	A4	9	1	7	8	7	7	1	1	1	9	9	3	6	9
5.	A5	1	1	5	8	9	8	1	1	1	3	3	5	4	1

The following will explain the completion stage in the manual calculation process of the decision support system using the Technique for Order Performance by Similarity to Ideal Solution (TOPSIS) method.

a. Calculating the normalized decision matrix

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

Formula TOPSIS Normalization

Description:

r_{ij}: An *R* normalized decision matrix element

x_{ij}: Decision matrix Element X

I : Alternative to 1.2,..... *I*

J : Criteria to 1.2,..... *J*

b. Create a normalized matrix example:

$| X_1| = = 15.6524\sqrt{9^2 + 1^2 + 9^2 + 9^2 + 1^2}$

$R_{11} = = = 0.5749\frac{X11}{|Xi|}\frac{9}{15,6524}$

$R_{21} = = = 0.0638\frac{X21}{|Xi|}\frac{1}{15,6524}$

$R_{31} = = = 0.5749\frac{X31}{|Xi|}\frac{9}{15,6524}$

$R_{41} = = = 0.5749 \frac{X41}{|Xi|} \frac{9}{15,6524}$

$R_{51} = = = 0.063 \frac{X51}{|Xi|} \frac{1}{15,6524} 8$

Table 5 is the result of the normalized matrix table results that are in the can of the student grades of the decision matrix in the normalized TOPSIS process.

Table 5. Normalized Decision Matrix

0.5749	0.9761	0.6689	0.5647	0.3094	0.4275	0.4472	0.1084	0.1084	0.25	0.2773	0.5698	0.3086	0.7006
0.0638	0.1084	0.0743	0.1882	0.5570	0.5497	0.4472	0.1084	0.9761	0.5	0.2773	0.3418	0.4629	0.0778
0.5749	0.1084	0.3716	0.3764	0.3094	0.3054	0.4472	0.9761	0.1084	0.25	0.2773	0.3418	0.6172	0.0778
0.5749	0.1084	0.5203	0.5019	0.4332	0.4275	0.4472	0.1084	0.1084	0.75	0.8320	0.3418	0.4629	0.7006
0.0638	0.1084	0.3716	0.5019	0.5570	0.4886	0.4472	0.1084	0.1084	0.25	0.2773	0.5698	0.3086	0.0778

c. Calculate weighted normalized decision matrix

The normalized decision matrix is weighted, the decision matrix is normalized in step 1 multiplied by the weights of each criterion i.e. 0.2, 0.1, 0.1, 0.05, 0.05, 0.05, 0.1, 0.05, 0.05, 0.05, 0.05, 0.025, 0.025, 0.1. The following table 6 is the result of the weight multiplied by the weighted normalized result.

$$y_{ij} = w_j . r_{ij}$$

Table 6. Normalized Decision Matrix

0,2	0,1	0,1	0,05	0,05	0,05	0,1	0,05	0,05	0,05	0,05	0,025	0,025	0,1
0.1149	0.0976	0.0668	0.0282	0.0154	0.0213	0.0447	0.0054	0.0054	0.0125	0.0138	0.0142	0.0077	0.0700
0.0127	0.0108	0.0074	0.0094	0.0278	0.0274	0.0447	0.0054	0.0488	0.025	0.0138	0.0085	0.0115	0.0077
0.1149	0.0108	0.0371	0.0188	0.0154	0.0152	0.0447	0.0488	0.0054	0.0125	0.0138	0.0085	0.0154	0.0077
0.1149	0.0108	0.0520	0.0250	0.0216	0.0213	0.0447	0.0054	0.0054	0.0375	0.0416	0.0085	0.0115	0.0700
0.0127	0.0108	0.0371	0.0250	0.0278	0.0244	0.0447	0.0054	0.0054	0.0125	0.0138	0.0142	0.0077	0.0077

d. Determines the ideal positive matrix and the ideal negative matrix

The ideal solution is positive and negative; the ideal positive and negative solution can be determined based on the normalized weight rating. Please note the conditions on the positive and negative equations to calculate the value of the ideal solution by first determining whether benefit or cost.

1) Positive Solutions

Y1 + = MAX {0,1149; 0.0127; 0.1149; 0.1149; 0.0127} = 0.1149

Y2 + = MAX {0,0976; 0.0108; 0.0108; 0.0108; 0.0108} = 0.0976

Y3-= MIN {0,0668; 0.0074; 0.0371; 0.0520; 0.0371} = 0.0074

Y4-= MIN {0,0282; 0.0094; 0.0188; 0.0250; 0.0250} = 0.0094

Y5-= MIN {0,0154; 0.0278; 0.0154; 0.0216; 0.0278} = 0.0154

Y6-= MIN {0,0213; 0.0274; 0.0152; 0.0213; 0.0244} = 0.0152

Y7-= MIN {0,0447; 0.0447; 0.0447; 0.0447; 0.0447} = 0.0447

Y8 + = MAX {0,0054; 0.0054; 0.0488; 0.0054; 0.0054} = 0.0488

Y9-= MIN {0,0054; 0.0488; 0.0054; 0.0054; 0.0054} = 0.0054

Y10-= MIN {0,0125; 0.0250; 0.0125; 0.0375; 0.0125} = 0.0125

Y11-= MIN {0,0138; 0.0138; 0.0138; 0.0416; 0.0138} = 0.0138

Y12 + = MAX {0,0142; 0.0085; 0.0085; 0.0085; 0.0142} = 0.0142

Y13-= MIN {0,0077; 0.0115; 0.0154; 0.0115; 0.0077} = 0.0077

Y14 + = MAX {0,0700; 0.0077; 0.0077; 0.0700; 0.0077} = 0.0700

2) Negative Solution

Y1-= MIN {0,1149; 0.0127; 0.1149; 0.1149; 0.0127} = 0.0127

Y2-= MIN {0,0976; 0.0108; 0.0108; 0.0108; 0.0108} = 0.0108

Y3 + = MAX {0,0668; 0.0074; 0.0371; 0.0520; 0.0371} = 0.0668

Y4 + = MAX {0,0282; 0.0094; 0.0188; 0.0250; 0.0250} = 0.0282

Y5 + = MAX {0,0154; 0.0278; 0.0154; 0.0216; 0.0278} = 0.0278

Y6 + = MAX {0,0213; 0.0274; 0.0152; 0.0213; 0.0244} = 0.0274

Y7 + = MAX {0,0447; 0.0447; 0.0447; 0.0447; 0.0447} = 0.0447

Y8-= MIN {0,0054; 0.0054; 0.0488; 0.0054; 0.0054} = 0.0054

Y9 + = MAX {0,0054; 0.0488; 0.0054; 0.0054; 0.0054} = 0.0488

Y10 + = MAX {0,0125; 0.0250; 0.0125; 0.0375; 0.0125} = 0.0375

Y11 + = MAX {0,0138; 0.0138; 0.0138; 0.0416; 0.0138} = 0.0416

Y12-= MIN {0,0142; 0.0085; 0.0085; 0.0085; 0.0142} = 0.0085

Y13 + = MAX {0,0077; 0.0115; 0.0154; 0.0115; 0.0077} = 0.0154

Y14-= MIN {0,0700; 0.0077; 0.0077; 0.0700; 0.0077} = 0.0077

e. Specifies the distance between the values of each alternative with a matrix of positive and negative ideal solutions.

$$D_i^- = \sqrt{\sum_{j=1}^{n}\left(y_{ij} - y_j^-\right)^2}$$

Description:

D_i^+: alternative distance to-I of the ideal positive solution

D_i^-: alternative distance to-I of the ideal negative solution

1) Positive Solutions

$$D1^+ = \sqrt{\begin{array}{c}(0.1149 - 0{,}1149)^2 + (0{,}0976 - 0{,}0976)^2 + (0{,}0074 - 0.0668)^2 + \\ (0.0094 - 0.0282)^2 + (0{,}0154 - 0{,}0154)^2 + (0{,}0152 - 0.0213)^2 \\ +(0{,}0447 - 0{,}0447)^2 + (0{,}0488 - 0{,}0054)^2 + (0{,}0054 - 0{,}0054)^2 \\ +(0.0125 - 0.0125)^2 + (0{,}0138 - 0{,}0138)^2 + (0{,}0142 - 0{,}0142)^2 \\ +(0{,}0077 - 0{,}0077)^2 + (0{,}0700 - 0{,}0700)^2 \\ = 0.0762\end{array}}$$

$$D2^{+} = \sqrt{\begin{matrix}(0{,}1149 - 0.0127)^2 + (0{,}0976 - 0.0108)^2 + (0{,}0074 - 0.0074)^2 + \\ (0.0094 - 0.0094)^2 + (0{,}0154 - 0{,}0278)^2 + (0{,}0152 - 0{,}0274)^2 \\ +(0{,}0447 - 0{,}0447)^2 + (0{,}0488 - 0{,}0054)^2 + (0{,}0054 - 0{,}0488)^2 \\ +(0.0125 - 0.0250)^2 + (0{,}0416 - 0{,}0138)^2 + (0{,}0142 - 0{,}0085)^2 \\ +(0{,}0154 - 0{,}0115)^2 + (0{,}0700 - 0{,}0077)^2 \\ = 0.1616\end{matrix}}$$

$$D3^{+} = \sqrt{\begin{matrix}(0{,}1149 - 0{,}1149)^2 + (0{,}0976 - 0{,}0108)^2 + (0{,}0074 - 0{,}0371)^2 + \\ (0{,}0282 - 0{,}0188)^2 + (0{,}0154 - 0{,}0154)^2 + (0{,}0244 - 0{,}0152)^2 \\ +(0{,}0447 - 0{,}0447)^2 + (0{,}0488 - 0{,}0488)^2 + (0{,}0054 - 0{,}0054)^2 \\ +(0{,}0125 - 0{,}0075)^2 + (0{,}0416 - 0{,}0138)^2 + (0{,}0142 - 0{,}0085)^2 \\ +(0{,}0154 - 0{,}0154)^2 + (0{,}0700 - 0{,}0077)^2 \\ = 0.1117\end{matrix}}$$

$$D4^{+} = \sqrt{\begin{matrix}(0{,}1149 - 0{,}1149)^2 + (0{,}0976 - 0{,}0108)^2 + (0{,}0074 - 0{,}0520)^2 + \\ (0{,}0282 - 0{,}0250)^2 + (0{,}0154 - 0{,}0216)^2 + (0{,}0244 - 0{,}0213)^2 \\ +(0{,}0447 - 0{,}0447)^2 + (0{,}0488 - 0{,}0054)^2 + (0{,}0054 - 0{,}0054)^2 \\ +(0{,}0125 - 0{,}0375)^2 + (0{,}0416 - 0{,}0416)^2 + (0{,}0142 - 0{,}0085)^2 \\ +(0{,}0154 - 0{,}0115)^2 + (0{,}0700 - 0{,}0700)^2 \\ = 0.1147\end{matrix}}$$

$$D5^{+} = \sqrt{\begin{matrix}(0{,}1149 - 0{,}0127)^2 + (0{,}0976 - 0{,}0108)^2 + (0{,}0074 - 0{,}0371)^2 + \\ (0{,}0282 - 0{,}0250)^2 + (0{,}0154 - 0{,}0278)^2 + (0{,}0244 - 0{,}0244)^2 \\ +(0{,}0447 - 0{,}0447)^2 + (0{,}0488 - 0{,}0054)^2 + (0{,}0054 - 0{,}0054)^2 \\ +(0{,}0125 - 0{,}0125)^2 + (0{,}0416 - 0{,}0138)^2 + (0{,}0142 - 0{,}0142)^2 \\ +(0{,}0154 - 0{,}0077)^2 + (0{,}0700 - 0{,}0077)^2 \\ = 0.1585\end{matrix}}$$

2) Negative Solution

$$D1^{-} = \sqrt{\begin{matrix}(0{,}1149 - 0{,}0127)^2 + (0{,}0976 - 0{,}0108)^2 + (0{,}0668 - 0{,}0668)^2 \\ +(0{,}0282 - 0{,}0094 + (0{,}0154 - 0{,}0278)^2 + (0{,}0213 - 0{,}0152)^2 \\ +(0{,}0447 - 0{,}0447)^2 + (0{,}0054 - 0{,}0054)^2 + (0{,}0054 - 0{,}0488)^2 \\ +(0{,}0125 - 0{,}0375)^2 + (0{,}0138 - 0{,}0138)^2 + (0{,}0142 - 0{,}0085)^2 \\ +(0{,}0077 - 0{,}0077)^2 + (0{,}0700 - 0{,}0077)^2 \\ = 0.1579\end{matrix}}$$

$$D2^{-} = \sqrt{\begin{matrix}(0{,}0127 - 0{,}0127)^2 + (0{,}0108 - 0{,}0108)^2 + (0{,}0074 - 0{,}0668)^2 \\ +(0{,}00984 - 0{,}0094)^2 + (0{,}0278 - 0{,}0278)^2 + (0{,}0274 - 0{,}0152)^2 \\ +(0{,}0447 - 0{,}0447)^2 + (0{,}0054 - 0{,}0054)^2 + (0{,}0488 - 0{,}0488)^2 \\ +(0{,}0250 - 0{,}0375)^2 + (0{,}0138 - 0{,}0138)^2 + (0{,}0085 - 0{,}0085)^2 \\ +(0{,}0115 - 0{,}0077)^2 + (0{,}0077 - 0{,}0077)^2 \\ = 0.0620\end{matrix}}$$

$$D3^{-} = \sqrt{\begin{matrix}(0{,}1149 - 0{,}0127)^2 + (0{,}0108 - 0{,}0108)^2 + (0{,}0371 - 0{,}0668)^2 \\ +(0{,}0188 - 0{,}0094)^2 + (0{,}0154 - 0{,}0278)^2 + (0{,}0152 - 0{,}0152)^2 \\ +(0{,}0447 - 0{,}0447)^2 + (0{,}0488 - 0{,}0054)^2 + (0{,}0054 - 0{,}0488)^2 \\ +(0{,}0125 - 0{,}0375)^2 + (0{,}0138 - 0{,}0138)^2 + (0{,}0085 - 0{,}0085)^2 \\ +(0{,}0154 - 0{,}0077)^2 + (0{,}0077 - 0{,}0077)^2 \\ = 0.1265\end{matrix}}$$

$$D4^{-} = \sqrt{\begin{matrix}(0{,}1149 - 0{,}0127)^2 + (0{,}0108 - 0{,}0108)^2 + (0{,}0520 - 0{,}0668)^2 \\ +(0{,}0250 - 0{,}0094)^2 + (0{,}0216 - 0{,}0278)^2 + (0{,}0213 - 0{,}0152)^2 \\ +(0{,}0447 - 0{,}0447)^2 + (0{,}0054 - 0{,}0054)^2 + (0{,}0054 - 0{,}0488)^2 \\ +(0{,}0375 - 0{,}0375)^2 + (0{,}0416 - 0{,}0138)^2 + (0{,}0085 - 0{,}0085)^2 \\ +(0{,}0115 - 0{,}0077)^2 + (0{,}0700 - 0{,}0077)^2 \\ = 0.1324\end{matrix}}$$

$$D5^{-} = \sqrt{\begin{array}{c}(0{,}0127 - 0{,}0127)^2 + (0{,}0108 - 0{,}0108)^2 + (0{,}0371 - 0{,}0668)^2 \\ +(0{,}0250 - 0{,}0094 + (0{,}0278 - 0{,}0278)^2 + (0{,}0244 - 0{,}0152)^2 \\ +(0{,}0447 - 0{,}0447)^2 + (0{,}0054 - 0{,}0054)^2 + (0{,}0054 - 0{,}0488)^2 \\ +(0{,}0125 - 0{,}0375)^2 + (0{,}0138 - 0{,}0138)^2 + (0{,}0142 - 0{,}0085)^2 \\ +(0{,}0077 - 0{,}0077)^2 + (0{,}0077 - 0{,}0077)^2 \\ = 0.0612\end{array}}$$

f. Specifying preference values for each alternative

$$V_i = \frac{D_i^-}{D_i^- + D_i^+}$$

$V_1 = \frac{0.1579}{0.1579+ 0.0792} = 0{,}6658$ Rank 1 =V1

$V_2 = \frac{0.0620}{0.0620+ 0.1646} = 0{,}2736$ Rank 2 =V4

$V_3 = \frac{0.1265}{0.1265+ 0.1154} = 0{,}5228$ Rank 3 =V3

$V_4 = \frac{0.1324}{0.1324+0.1102} = 0{,}5457$ Rank 4 =V5

$V_5 = \frac{0.0612}{0.0612+0.1600} = 0{,}2766$ Rank 5 =V2

4. Conclusions and Suggestions

4.1. Conclusions

Based on the discussion and description in the previous chapters, it can be concluded as follows:

1) Based on the results of the study that the concentration support system for the determination of Low-Income Students Scholarship using the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) in Muhammadiyah 3 Middle School in Purwokerto has been successfully created. The final result of the system shows fourteen criteria that have different weights in each criterion, as well as generating a rank of the highest value to the lowest gained from the calculation decision making Low-Income Students Scholarship.

2) With a web system that has successfully created student data and calculation of Low-Income Students Scholarship stored securely in the system database and can be accessed easily.

4.2. Suggestions

Based on the conclusion of the results of this study, it can be suggested for subsequent studies are as follows:

1) In the next research, it would be better if the current system for the future is developed again to be based on Android.

2) The decision-making system for Low-Income Students Scholarship will be developed by other decision-making methods so that they show similarities or differences in results.

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