

IMPLEMENTATION OF MOORA METHOD AS DECISION SUPPORT SYSTEM FOR SCHOLARSHIP SELECTION IN SMK MUHAMMADIYAH PRAMBANAN

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Abstract— Decision Support System for Scholarship Selection at SMK Muhammadiyah Prambanan Using the MOORA Method aims to implement the Multi-Objective Optimization method based on Ration Analysis. In determining scholarship recipients based on predetermined criteria and building a system in the form of a website to help provide alternative decisions in choosing to accept scholarships at SMK Muhammadiyah Prambanan. Based on the source of the data obtained, primary data, including interview and observation methods, is supported by secondary data from literature studies relevant to the problem. Scholarship data is then ranked based on the final value generated from the MOORA calculation. Scholarships are given out based on a range of characteristics, such as report card grades, parent dependents, income, percentage of attendance, and the presence of many siblings. The Scholarship Selection as Decision Support System Using the MOORA Method is the study's outcome, with the final value in the form of an option with the highest preference value be placed first. . The option will be a recommendation to receive a scholarship.

Keywords: Multi-Objective Optimization based on Ration Analysis, Decision Support System, MOORA, Scholarship.

Abstrak—Sistem Pendukung Keputusan Keputusan Penerimaan Beasiswa di SMK Muhammadiyah Prambanan Menggunakan Metode MOORA bertujuan untuk mengimplementasikan metode Optimasi Multi Objektif berdasarkan Analisis Ransum. Dalam menentukan penerima beasiswa berdasarkan kriteria yang telah ditentukan dan membangun sistem berupa website untuk membantu memberikan alternatif keputusan dalam penentuan penerimaan beasiswa di SMK Muhammadiyah Prambanan.

Berdasarkan sumber data yang diperoleh, dengan menggunakan data primer meliputi metode wawancara dan observasi didukung dengan data sekunder yang diperoleh melalui studi pustaka yang relevan dengan masalah. Data beasiswa dihitung

kemudian di ranking berdasarkan nilai akhir yang dihasilkan dari perhitungan MOORA.

Proses penerimaan beasiswa berdasarkan kriteria antara lain nilai rapor, tanggungan orang tua, pendapatan orang tua, persentase kehadiran, jumlah saudara kandung. Hasil dari penelitian ini adalah Sistem Pendukung Keputusan Penerimaan Beasiswa Menggunakan Metode MOORA, dimana nilai akhir berupa alternatif yang memiliki nilai preferensi terbesar akan ditempatkan pada peringkat teratas. Alternatifnya adalah rekomendasi untuk menerima beasiswa.

Kata Kunci: Multi-Objective Optimization On The Basis Of Ratio Analysis, Sistem Pendukung Keputusan, MOORA, Beasiswa.

INTRODUCTION

Education is one of the essential aspects that every individual must obtain—both formal and non-formal education. However, not everyone has the opportunity to receive proper education because of economic problems.

The scholarship recipient selection process is a critical stage that requires precision and accuracy so that the scholarship is not the wrong destination. Because the lack of weight on the assessment criteria for prospective recipients at the selection stage results in the results obtained not being able to optimize the existing criteria requirements in the scholarship program, the method of selecting scholarship recipients for SMK Muhammadiyah Prambanan has to be taken using the filling out of student data forms.

The decision support system is a system that can solve problems that occur in ranking quickly and can find out the highest to lowest scores in a selection (Manurung, 2018). MOORA (Multi-Objective Optimization based on Ratio Analysis) is a method that aims for multi-objective optimization with discrete alternatives that refers to a matrix of responses of alternatives to objectives to which

ratios are applied (W. K. Brauers & Zavadskas, 2006)

Research about the Decision Support System for Selection of KMS Student Scholarship Recipients with the MOORA Method can provide a concise calculation time output and has the simplest mathematical computation with stable results (Haryanto, 2018)

Research on the KIP Recipient Determination program Using the MOORA Method in delivering aid sometimes does not match the target. The ten criteria used are Father's Job, Mother's Work, Father's Income, Mother's Income, Number of Dependents, Number of Dependents Still in School, Report Card Value, KKS Holder, Residence, Type of House (Sinaga, Andani, & Suhada, 2018)

Research by Isa Rosita et al. regarding the selection of promotional media with criteria such as the cost of making media, time of promotion, reach of media distribution, completeness of information, and flexibility. Promotional media used in the test were brochures, posters, billboards, banners, and newspaper advertisements. Shows the results of this study provide an accuracy value of 100% (Rosita, Gunawan, & Apriani, 2020). Other studies use the SAW method to determine scholarship acceptance with five criteria. These criteria are included in the benefits category and produce a ranking (Kusnadi & Dwiyanisya, 2020).

Multi-Objective Optimization Method by Ratio Analysis (MOORA) is one of the MADM methods that can perform calculations on the value of criteria of attributes (prospective students) that helps decision-makers to produce the right decision in the form of students who enter into the category of prospective students superior (Mesran et al., 2017). It is related to research on MOORA providing the same output between calculations using this method and measures performed manually (Ngemba et al., 2021). This method can give the best alternative results (Marpaung, 2020). The MOORA method is considered a simple method, often implemented in various problems that require a decision support system solution (Hamria, Azwar, & Arja, 2020).

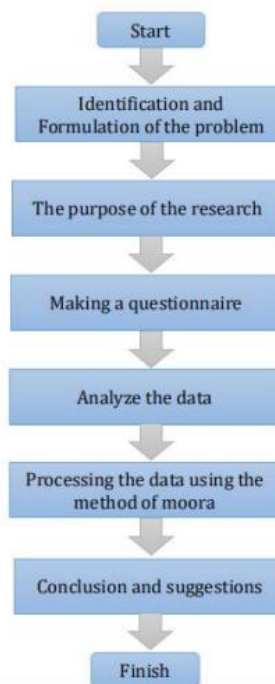
Based on the advantages of the Multi-Objective Optimization based on Ratio Analysis (MOORA) method, the author will also use the MOORA method to overcome the problems faced at SMK Muhammadiyah Prambanan, and it is necessary to create a Decision Support System for scholarship acceptance by determining criteria and alternatives. With the creation of this Decision Support System, I hope that it can facilitate the school in making decisions related to the issue of scholarship selection.

MATERIALS AND METHODS

MOORA method solves problems requiring more complex decisions because decision-makers must assess various alternatives based on conflicting criteria (Attri & Grover, 2013)

Brauer and Zavadskas conclude that MOORA needs less computational time and minimum mathematical calculations and is an easy to use and more stable method (W. K. M. Brauers & Zavadskas, 2012)

This research uses ten alternatives data and five criteria for MOORA implementation. In the process method of MOORA has stages of work, namely the input value of the requirements, changing the values of standards into a decision matrix, the normalization of the methods of MOORA, reducing the weight of the maximax and minimax, deciding the ranking of the results of the calculation of MOORA. The stages of the research conducted can be seen in figure 1 (Ernawati, Al Hakim, & Tuslaela, 2020).



Source: (Ernawati et al., 2020)

Figure 1. Stages of Research

There is an analysis of the data used in the development of this system, namely:

1. Information in the form of student data, an alternative object to the Decision Support System, is required when developing a Decision Support System using the MOORA approach. . The structure of student data shows in Table 1.
2. The Decision Support System using the MOORA method also requires input requirements in the form of criteria and the weight of the standards

used to select students entitled to receive scholarships.

- Following the school's policies, SMK Muhammadiyah Prambanan determined the criteria and weight of standards in the Scholarship Acceptance Decision Support System.

The school has set five tested criteria in selecting candidates for scholarship acceptance. In the decision support system to choose alternatives in the form of students, standards and value parameters are needed. Table 1 displays student data as an alternative to the MOORA approach used.

Tabel 1. Alternative Data

Alternative	Desc.
Adi adiansyah	A1
Aditya Wicaksono Mustopa	A2
Aditya Saputra	A3
Ahmad Devani Yuslah	A4
Ahmad Fikihomsah	A5
Akhmad Irman	A6
Akhmad Rifky Rivana	A7
Aldy Daviryatna	A8
Alya Agista	A9
Amad Juharis	A10

Source: (Perdana, Prabowo, & Sari, 2022)

Table 2 shows five criteria: report card value, personality, parent's income, student attendance percentage, and several siblings.

Table 2. Criteria

Criteria Parameters	De c.
Report Card Value	<i>Benefit</i>
Personality	<i>Benefit</i>
Parents' Income	<i>Cost</i>
Student Attendance Percentage	<i>Benefit</i>
Number of siblings	<i>Benefit</i>

Source: (Perdana et al., 2022)

Fuzzy parameters are in Table 3.

Table 3. Fuzzy Parameters

Value	Parameter Description
1	Very Low
2	Moderate
3	Good
4	Very good

Source: (Perdana et al., 2022)

RESULT AND DISCUSSION

The MOORA method requires a Matrix Normalization (X) decision process to have a scale

compared to all alternative student ratings. With the results of the calculation of the MOORA method, It is possible to assist the school. To decide which prospective students are entitled to receive scholarship assistance and which prospective students are not eligible for scholarships. Table 4-9 parameters used in this study

Table 4. Criteria Parameters

Criteria Parameter	Code	Type	Weight
Report Card Value	C1	<i>Benefit</i>	10%
Personality	C2	<i>Benefit</i>	20%
Parents' Income	C3	<i>Cost</i>	25%
Student Attendance Percentage	C4	<i>Benefit</i>	15%
Number of siblings	C5	<i>Benefit</i>	30%
Total			100%

Source: (Perdana et al., 2022)

Table 5. Report Card Value Parameter

Value Parameter	Description	Weight
Grade <75	Very Low	1
Grade >=75 X < 85	Moderate	2
Grade >=85 X < 95	Good	3
Grade >=95	Very Good	4

Table 6. Personality Parameter

Value Parameter	Description	Weight
Grade <=70	Very Low	1
Grade 71 - 80	Moderate	2
Grade 81-90	Good	3
Grade 91-100	Very Good	4

Source: (Perdana et al., 2022)

Table 7. Parents' Income Parameter

Value Parameter	Description	Weight
<= 1.000.000	Very Good	1
> 1.000.000 - <= 2.000.000	Good	2
> 2.000.000 - <= 3.000.000	Moderate	3
> 3.000.000 - <= 4.000.000	Low	4
> 4.000.000	Very Low	5

Source: (Perdana et al., 2022)

Table 8. Student Attendance Percentage Parameter

Value Parameter	Description	Weight
< 85%	Very Low	1
>= 85% X <=90%	Moderate	2
>= 91% X <95%	Good	3
>=95%	Very Good	4

Source: (Perdana et al., 2022)

Table 9. Number of siblings Parameter

Value Parameter	Description	Weight
One person	Very Low	1
Two persons	Moderate	2
Three persons	Good	3
>=4 persons	Very Good	4

Source: (Perdana et al., 2022)

They evaluate ten prospective scholarship recipients as alternative students. One student will be selected based on predetermined criteria. The value of alternative criteria is in Table 10.

Table 10. Value of Alternative Criteria

Alternative	C1	C2	C3	C4	C5
A1	77	75	3.200.000	92	3
A2	96	77	1.100.000	86	2
A3	98	68	2.200.000	96	4
A4	70	85	900.000	87	1
A5	72	74	2.300.000	93	2
A6	80	65	800.000	80	1
A7	89	93	1.600.000	93	4
A8	89	69	3.400.000	90	3
A9	98	77	1.700.000	95	3
A10	71	83	2.100.000	92	1

Source: (Perdana et al., 2022)

Based on the fuzzy values of each predetermined criterion, the criteria value for each alternative. Table 11 includes the criteria value for each alternative.

Table 11. Weight Value of Alternative Criteria

Alternative	C1	C2	C3	C4	C5
A1	2	2	2	3	3
A2	4	2	4	2	2
A3	4	1	3	4	4
A4	1	3	5	2	1
A5	1	2	3	3	2
A6	2	1	5	1	1
A7	3	4	4	3	4
A8	3	1	2	2	3
A9	4	2	4	4	3
A10	1	3	3	3	1

Source: (Perdana et al., 2022)

The next step is to determine the normalized value for each criterion of each alternative and make it a Normalized matrix. The formula is in formula 1.

$$X^*_{ij} = \frac{x_{ij}}{\sqrt{[\sum_{j=1}^m x_{ij}^2]}} \dots\dots\dots (1)$$

Source : (W. K. M. Brauers, Zavadskas, Peldschus, & Turskis, 2010)

From the results of the Normalization calculation by formula 1, the Normalization Value (X *) matrix is obtained as follows:

0,23	0,27	0,17	0,33	0,36
0,46	0,27	0,35	0,22	0,24
0,46	0,14	0,26	0,44	0,48
0,11	0,41	0,43	0,22	0,12
0,11	0,27	0,26	0,33	0,24
0,23	0,14	0,43	0,11	0,12
0,34	0,55	0,35	0,33	0,48
0,34	0,14	0,17	0,22	0,36
0,46	0,27	0,35	0,44	0,36
0,11	0,41	0,26	0,33	0,12

Calculating the MOORA Multi-objective Optimization Value (max-min) This value is the multiplication of the criterion weight with the maximum attribute value (max), namely the value of the benefit type attribute reduced by the number of times the criteria weight with the minimum attribute value (min), namely the attribute value of the cost type. The formula shows in formula 2.

$$y_i = \sum_{j=1}^g w_j x^*_{ij} - \sum_{j=g+1}^n w_j x^*_{ij} \dots\dots\dots (2)$$

Source : (W. K. M. Brauers et al., 2010)

The table of manual calculations is in table 12.

Table 12. Manual Calculation

Alternative	Result
A1	0,1920
A2	0,1189
A3	0,2181
A4	0,0546
A5	0,1230
A6	0,0056
A7	0,2508
A8	0,1592
A9	0,1881
A10	0,1146

Source: (Perdana et al., 2022)

Table 13 shows the ranking of results for ten alternatives.

Table 13. Ranking Results

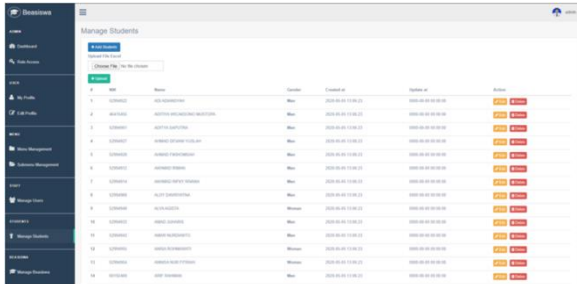
Alternative	Result	Ranking
Akhmad Rifky Rivana	0,2508	1
Aditya Saputra	0,2181	2
Adi Adiansyah	0,1920	3
Alya Agista	0,1881	4
Aldy Daviryatna	0,1592	5
Ahmad FikiHomsah	0,1230	6
Aditiya Wicaksono		
Mustopa	0,1189	7
Amad Juharis	0,1146	8
Ahmad Devani Yuslah	0,0546	9
Akhmad Irman	-0,0056	10

Source: (Perdana et al., 2022)

Thus, out of the ten selected alternatives, they only received the five best alternatives, A1 to A5 were obtained on behalf of Akhmad Rifky Rivana, Aditya Saputra, Adi Adiansyah, Alya Agista, and Aldy Daviryatna were entitled to receive scholarships at Prambanan Muhammadiyah Junior High School.

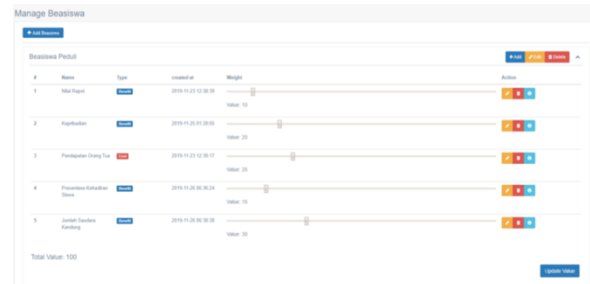
System Interfaces

Figure 2 shows the interface of all of the students as alternative that will be used for scholarship selection.



Source: (Perdana et al., 2022)
 Figure 2. Students Data

All alternatives must be input before being implemented to the MOORA method. Some criteria parameters also will be used for the calculation. Figure 3 shows the criteria.



Source: (Perdana et al., 2022)
 Figure 3. Criteria Parameter

The system generates reports based on the MOORA implementation results. Figure 4 shows the information.

Assessment Detail

Beasiswa Peduli

Normalisasi

Nama Siswa	Nilai Raport - Benefit	Kepribadian - Benefit	Pendapatan Orang Tua - Cost	Persentase Kehadiran Siswa - Benefit	Jumlah Saudara Kandung - Benefit
AKHMAD RIFKY RIVANA	0.34	0.35	0.35	0.33	0.48
ADITYA SAPUTRA	0.46	0.14	0.26	0.44	0.48
ADI ADIANSYAH	0.23	0.27	0.17	0.33	0.36
ALYA AGISTA	0.46	0.27	0.35	0.44	0.36
ALDY DAVIRYATNA	0.34	0.14	0.17	0.22	0.36
AHMAD FIKHOMSAH	0.11	0.27	0.26	0.33	0.24
ADITYA WICAKSONO MUSTORA	0.46	0.27	0.35	0.22	0.24
AMAD JUHARIS	0.11	0.41	0.26	0.33	0.12
AHMAD DEYANI YUSLAH	0.11	0.41	0.43	0.22	0.12
AKHMAD IRMAN	0.23	0.14	0.43	0.11	0.12

Hasil Akhir

Nama Siswa	Nilai Raport - Benefit	Kepribadian - Benefit	Pendapatan Orang Tua - Cost	Persentase Kehadiran Siswa - Benefit	Jumlah Saudara Kandung - Benefit	Total	Peringkat
AKHMAD RIFKY RIVANA	0.0342	0.1099	0.0867	0.0500	0.1434	0.2508	1
ADITYA SAPUTRA	0.0456	0.0275	0.0650	0.0667	0.1434	0.2181	2
ADI ADIANSYAH	0.0228	0.0549	0.0434	0.0500	0.1076	0.1920	3
ALYA AGISTA	0.0456	0.0549	0.0867	0.0667	0.1076	0.1881	4
ALDY DAVIRYATNA	0.0342	0.0275	0.0434	0.0333	0.1076	0.1592	5
AHMAD FIKHOMSAH	0.0114	0.0549	0.0650	0.0500	0.0717	0.1230	6
ADITYA WICAKSONO MUSTORA	0.0456	0.0549	0.0867	0.0333	0.0717	0.1189	7
AMAD JUHARIS	0.0114	0.0824	0.0650	0.0333	0.0359	0.1146	8
AHMAD DEYANI YUSLAH	0.0114	0.0824	0.1084	0.0333	0.0359	0.0546	9
AKHMAD IRMAN	0.0228	0.0275	0.1084	0.0167	0.0359	-0.0056	10

Source: (Perdana et al., 2022)
 Figure 3. Criteria Parameter

CONCLUSION

The assessment parameters are confirmed against five predetermined criteria: Report Card Value, Personality, Parents' Income, Student Attendance Percentage, and Number of Siblings. The scholarship acceptance selection process is carried out by taking a sample of 10 alternatives. MOORA method in this research gives the ranking results: Akhmad Rifky Rivana with value 0,2508, Aditya Saputra with value 0,2181, Adi Adiansyah with value 0,1920, Alya Agista with value 0,1881, and

Aldy Daviryatna with value 0,1592. The scholarship only takes five students as a decision. The results can help the school in the selection process for caring scholarship acceptance and help make objective decisions in deciding which students are eligible to receive scholarships and which students have not been eligible to receive scholarships.

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