THE SCHOLARSHIP AWARDING DECISION SUPPORT SYSTEM USES THE TOPSIS METHOD

Tuslaela

Information System
Sekolah Tinggi Manajemen Informatika dan Komputer Nusa Mandiri
www.nusamandiri.ac.id
tuslaela.tll@nusamandiri.ac.id

Abstract

Education has an important role as an effort to educate the nation. Education is the right of everyone, but not everyone can continue higher education for various reasons. One of them is limited financial and financial resources. TOPSIS is a multi-criteria dynamic strategy or elective decision which is an elective that has the littlest good ways from the positive ideal arrangement and the largest distance from the negative ideal solution from a geometric point of view using the Euclidean distance. This study aims to determine the criteria for scholarship recipients that can be implemented in a campus, school, or other social institution that provides funds for scholarship assistance. The research results are expected to serve as a reference for the decision making process. The results showed a preference value of 0.66 which is based on academic achievement.

Keywords: TOPSIS, Decision Support System, Multicriteria, Scholarship

Abstrak

Pendidikan memiliki peran penting sebagai upaya mencerdaskan kehidupan bangsa. Pendidikan merupakan hak setiap orang, namun tidak semua orang mampu melanjutkan pendidikan tinggi karena berbagai alasan. Salah satunya adalah sumber keuangan dan keuangan yang terbatas.TOPSIS merupakan salah satu metode pengambilan keputusan multikriteria atau alternative pilihan yang merupakan alternatif yang memiliki jarakter kecil dari solusi ideal positif dan jarak terbesar dari solusi ideal negatef dari sudut pandang geometris dengan menggunakan jarak Euclidean.Penelitian ini bertujuan untuk mengetahui kriteria penerima beasiswa yang dapat dilaksanakan di kampus, sekolah atau lembaga sosial lain yang memberikan dana bantuan beasiswa. Hasil penelitian diharapkan dapat menjadi acuan dalam proses pengambilan keputusan. Hasil penelitian menunjukkan nilai preferensi sebesar 0,66 yang didasarkan pada prestasi akademik.

Kata Kunci: TOPSIS, Sistem Pendukung Keputusan, Multikriteria, Beasiswa

INTRODUCTION

Based on the education law, it is a conscious and planned effort to create an atmosphere of learning and the learning process so that students actively develop theirs (Syafitri et al., 2019). Potential to have religious-spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, the nation. and the country. (Prapti Utami & Rohaeti, 2019)

To determine the criteria for scholarship acceptance, a more in-depth analysis is needed so that scholarship recipients are people who meet the expected criteria. In general, scholarships are determined based on academic criteria only. However, additional research is needed in

determining scholarship recipients to be right on target. These criteria are factors of the scholarship recipient's economic background and financial ability, academic scores from previous education levels, and other additional achievements as positive values for consideration. It is hoped that the scholarship recipients are the right people so that the rights of all people to receive proper education according to the law can be implemented properly.

As an effort to educate the nation. Education is the right of everyone, but not everyone can continue higher education for various reasons. One of them is limited financial and financial resources. The government and social institutions provide various scholarship schemes for disadvantaged groups of the people,

including the scholarship program. Scholarships are an aid to help students or students who are still in school or college so that they can complete their assignments in seeking knowledge until completion. Scholarships in the form of assistance can be in the form of funds to support the costs incurred by students during their education at the place of study (Renaldo et al., 2019). For the scholarships to be carried out on target, special research is needed to support the decision to grant scholarships for new students or school students with certain criteria.   (Alawiah & Susilowati, 2018)

This is because the concept is simple and easy to understand, the computation is efficient and can measure the relative performance of decision alternatives (Mawartika et al., 2019). TOPSIS is a multi-criteria decision-making method or choice which is an alternative that has the smallest distance from the positive ideal solution (Bai, 2013), (Hancerliogullari et al., 2017) and the largest distance from the negative ideal solution from a geometric point of view using the Euclidean distance. (Vega et al., 2014)

However, the alternative which has the smallest distance from the positive ideal solution does not have to have the largest distance from the negative ideal (Chauhan & Vaish, 2014) solution. Therefore, TOPSIS considers both the distance to the positive ideal solution and the distance to the negative ideal solution simultaneously(Acuña-Soto et al., 2018). The optimal solution in the TOPSIS method is obtained by determining the relative proximity of an alternative to the positive ideal solution (Syamsudin & Rahim, 2017), (Devi & Wardhana, 2018).

TOPSIS will rank alternatives based on the priority value of the relative proximity of an alternative to a positive ideal solution. The ranked alternatives are then used as a reference for decision-makers to choose the best-desired solution(Renaldo et al., 2019).

This study produces a decision support system that can recommend the best employees at PT South Pacific Viscose based on predetermined criteria, namely: knowledge, abilities, attitudes, attendance, and cooperation using the AHP and TOPSIS methods. A trial was conducted in the form of entering a sample of 300 employee data then successfully processed in 0.9531 seconds so that it was proven that this system performed calculations faster than before. Broadly speaking, this has improved the calculation process, and also this system can provide the best employee recommendations based on ranking, of the 300 employees there are 3 employees with the largest ranks, namely: HilmanBakhtiar 0.9549,

BasukiCahyoSetyo 0.9126, and Dimas Haryandi 0.8276(Herman Firdaus et al., 2016).

The results of the calculation using TOPSIS showed that Wildan's outstanding students rank first with the relative preference value for each alternative of 0.66. Ratna ranks second, with a relative preference value of 0.64. Sinta is in third place with a relative preference value of 0.5 (Saragih & Ramdhany, 2013). Rini is in fourth place with a relative preference value of 0.50. Faisal is in fifth place with a relative preference value of 0.38. Sadriyah is in sixth place with a relative preference value of 0.00(Fitriana et al., 2015).

The calculation process using the TOPSIS method begins by determining the criteria for each available scholarship and assigning weights to each of these criteria. Furthermore, the registration team consisting of bk teachers from each madrasah registers their students and assigns a criterion value based on the intended scholarship. method to produce a preference value for each applicant.

This study aims to determine the criteria for scholarship recipients that can be implemented in a campus, school, or other social institution that provides funds for scholarship assistance. The research results are expected to serve as a reference for the decision-making process

RESEARCH METHOD

1. Research Design
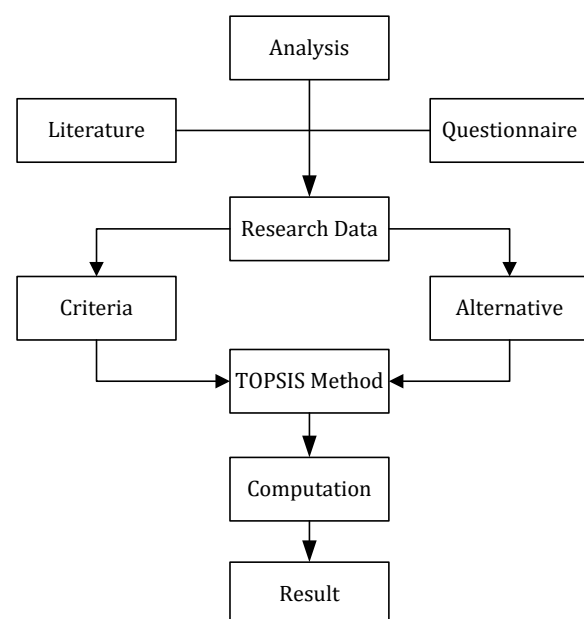The following is a research method design that will be used in this study,

Figure 1 Research Method

2. Data Source

Data is taken from junior high school, high school, and college.

3. Data Collection Technique

The research collection was carried out using literature studies, interviews, and questionnaires. The literature study was carried out by collecting data from journals related to decision support systems and the TOPSIS method. Interviews and questionnaires were conducted at junior high schools, high schools, and colleges.

4. Research Population

Research population in this study was taken from:

Table 1 Population

No.	Criteria	total
1	Junior high school	46
2	Junior high school	53
3	College	36
Total		135

5. Sample and Research Method

Research samples were taken from junior high schools, high schools, and colleges that held scholarship admissions for prospective new students. The study was conducted with a population of 135 people.

6. Research Instrument

The questionnaire used in this study was the closed question with a limited number of statements and answers in advance. The questions on the questionnaire were closed based on studies from various sources related to research. The questions used in the questionnaire were measured using five Likert scales (Table 2) adapted from the provisions of the answers and values as follows.

Table 2 Likert scales

Answer	Score	
	positive	negative
Always	5	1
Often	4	2
Sometimes	3	3
Rarely	2	4
never	1	5

7. Data Analysis

Analysis data uses TOPSIS, the research is divided into several stages, namely:

a. Normalized Decision Matrix Analysis

Making a normalized decision matrix is a step in the TOPSIS method that requires a performance rating of each alternative Ai on each normalized Ci criterion.

$$R_{ij} = \frac{x_{ij}}{\sqrt{\Sigma_{i=1}^{m} x_{ij}^2}} \quad \text{.........................(1)}$$

Under the condition:
i   = 1,2….m
j   = 1.2….n
rij = normalized decision matrix
Xij = the weight of the criteria to j on alternative i
I   = alternative to i
J   = alternative to j

b. Normalized Matrix (R)

Calculating the normalized matrix (R) with the following formula.

$$R_{ij} = \frac{x_{ij}}{\sqrt{\Sigma_{i=1}^{m} x_{ij}^2}} \quad \text{.........................(2)}$$

Where: i = 1, 2….., m; and j = 1, 2, ….., n

c. Normalized Matrix (Y)

Calculate the weighted normalized matrix (Y) with the following formula:

$$y_{ij} = w_i r_{ij} \quad \text{.........................(3)}$$

with i = 1,2, …, m; and j = 1,2, …, n

d. Solution Matrix

Calculate the positive (A +) and negative (A-) ideal solutions with the following formula:

$$A^+ = max(y_1^+, y_2^+, …, y_n^+) \quad \text{.........................(4)}$$

$$A^- = max(y_1^-, y_2^-, …, y_n^-) \quad \text{.........................(5)}$$

e. The distance of the Ideal Solution for Negative (D-) and Ideal Solution for Positive (D +)

Calculating the distance of the ideal negative solution (D-) and the ideal solution positive (+) by Formula:

$$D_i^+ = \sqrt{\Sigma_{j=1}^{n}(y_i^+ - y_{ij})^2}; i = 1,2, …, m \quad \text{.........(6)}$$

f. Preference Value

Calculate the preference value for each alternative offered as follows:

$$V_i = \frac{D_i^i}{D_i^- + D_i^+} \quad \text{.........................(7)}$$

Where $i = 1, 2, 3, \ldots m$

RESULT AND DISCUSSION

Based on the research conducted, the weight of the criteria used in this study include:
a. Economic conditions (C1)
b. Academic grades (C2)
c. Additional achievements (C3)

Table 3. The criterion weight value

Criteria	Rank
Very Good	5
Good	4
Enough	3
Bad	2
Very Bad	1

Table 3 is the criterion weight value which explains the weight value for each criterion analyzed.

Table 4. Instrument data

Instrumen	Criteria
Economic conditions	A1
Academic grades	A2
Additional achievement	A3

Table 4 is the research criteria table economic conditions, academic grades, and additional achievement.

Table 5. Normalization decision matrix

criteria	C1	C2	C3
A1	5	5	2
A2	4	4	4
A3	4	5	3

Table 5 above is the research criteria normalization decision matrix C1, C2, and C3.

Table 6. Results of the Weighted Criteria Value

C1	C2	C3
5	4	3

Table 6 is the research criteria that result in the weighted criteria value.

Table 7. The value is normalized based on the weight of the above criteria

Criteria	C1	C2	C3
A1	5	5	2
A2	4	4	4
A3	4	5	3

Result	57	66	29
The root of the rank	7.54	8.12	5.38

Table 7 is the research criteria the value is normalized based on the weight of criteria value.

Table 8. normalized matrix c1

Criteria	C3	Rank	Result
A1	5	7.54	0,66
A2	4	7.54	0,53
A3	4	7.54	0,53

Table 8 is the research normalized matrix criteria c1

Table 9. Matriksternormalisasi c2

Criteria	C3	Rank	Result
A1	5	8.12	0,62
A2	4	8.12	0,62
A3	5	8.12	0,49

Table 9 is the research normalized matrix criteria c2

Table 10. Matriksternormalisasi c3

Criteria	C3	Rank	Result
A1	2	5.38	0,37
A2	4	5.38	0,74
A3	3	5.38	0,55

Table 10 is the research normalized matrix criteria c3

The final stage of data normalization

The final stage of data normalization is to determine normalized data for each criterion. The following Table 9 is the normal data, namely:

Table 11.Normalized data

Criteria	C1	C2	C3
A1	0,66	0,62	0,37
A2	0,53	0,62	0,74
A3	0,53	0,49	0,55

Table 11 is the research normalized data final.

Weighted normalized matrix

Table 12 Weighted normalized

Criteria	C1	C2	C3
A1	3,30	2,48	1.11
A2	2,65	2,48	2.22
A3	2,65	1,49	1.65

Table 12 is the research weighted normalized.

Value of Positive and Negative Ideal Solutions

Table 13 Positive and Negative Ideal Solutions

Criteria	C1	C2	C3
A1	3,30	2,48	1.11
A2	2,65	2,48	2.22
A3	2,65	1,49	1.65
min	2,65	1,49	1.11
maks	3,30	2,48	2.22

Table 13 is the research positive and negative ideal solutions.

Negative & Positive Ideal Solution Distance

Table 14 Negative & Positive Ideal Solution Distance

Criteria	Rank D+	Rank D-
C1	0.84	0.65
C2	0.98	1.97
C3	1.43	1.52

Table 14 is the research positive and negative ideal solutions distance.

Preference value

Table 15 Final Preference Value

Criteria	Value $Vi=(Di-/(Di-+Di+)$	Value D-
C1	(0.65)/(0.65+0.84)	0.43
C2	(1.97)/(1.97+0.98)	066
C3	(1.52)/(1.52+1.43)	0.51

The results showed from Table 15, a preference value of 0.66 which is based on academic achievement. Research shows that the factor of giving scholarships to students who have academic achievement should take precedence, the second is students with additional achievements, for example, students with honors or talents in certain skills, and the last is students with low economic abilities. Research can be used as a reference for governments, campuses, schools, educational institutions, or social institutions that wish to provide scholarships with an easy method. TOPSIS helps facilitate the decision-making process for multi-criteria.

CONCLUSIONS AND SUGGESTIONS

Conclusion

TOPSIS is a multi-criteria dynamic strategy or elective decision which is an elective that has the littlest good ways from the positive ideal arrangement and the biggest good ways from the negative ideal arrangement from a mathematical perspective utilizing the Euclidean separation. Be that as it may, the elective which has the littlest good ways from the positive ideal arrangement doesn't just have the biggest good ways from the negative ideal arrangement. The results showed a preference value of 0.66 which is based on academic achievement. Research shows that the factor of giving scholarships to students who have academic achievement should take precedence,

Suggestion

Research can use other additional assessment criteria to get varied results. Research can be implemented as a decision support system in providing scholarships to institutions in need.

REFERENCE

Acuña-Soto, C. M., Liern, V., & Pérez-Gladish, B. (2018). Multiple criteria performance evaluation of YouTube mathematical educational videos by IS-TOPSIS. *Operational Research*, 1–23. https://doi.org/10.1007/s12351-018-0405-2

Alawiah, E. T., & Susilowati, S. (2018). Sistem Pendukung Keputusan Pembelian Vending Machine Dengan Metode TOPSIS Studi Kasus PT . KAI Commuter Jabodetabek. *Jurnal Prosiding Seminar Nasional Pendidikan Teknik Informatika*, *1*(1), 256–261.

Bai, Z. Y. (2013). An interval-valued intuitionistic fuzzy TOPSIS method based on an improved score function. *The Scientific World Journal*, *2013*. https://doi.org/10.1155/2013/879089

Chauhan, A., & Vaish, R. (2014). A Comparative Study on Decision Making Methods with Interval Data. *Journal of Computational Engineering*, *2014*, 1–10. https://doi.org/10.1155/2014/793074

Devi, D. K., & Wardhana, A. (2018). *Analysis and Design of the Best Suppliers Selection Case Study : Department Store Kopetri with the Ahp and Topsis Methods*. *7*(6), 109–120.

Fitriana, A. N., Harliana, H., & Handaru, H. (2015). Sistem Pendukung Keputusan Untuk Menentukan Prestasi Akademik Siswa dengan Metode TOPSIS. *Creative Information Technology Journal*, *2*(2), 153. https://doi.org/10.24076/citec.2015v2i2.45

Hancerliogullari, G., Hancerliogullari, K. O., & Koksalmis, E. (2017). The use of multi-criteria decision making models in evaluating anesthesia method options in circumcision surgery. *BMC Medical Informatics and Decision Making*, *17*(1), 1–13. https://doi.org/10.1186/s12911-017-0409-5

Herman Firdaus, I., Abdillah, G., Renaldi, F., & Jenderal Achmad Yani Jl, U. (2016). Sistem Pendukung Keputusan Penentuan Karyawan Terbaik Menggunakan Metode Ahp Dan Topsis. *Seminar Nasional Teknologi Informasi Dan Komunikasi*, *2016*(Sentika), 2089–9815.

Mawartika, Y. E. B., SN, A., & Sihabuddin, A. (2019). TOPSIS and SLR methods on the Decision Support System for Selection the Management Strategies of Funeral Land. *IJCCS (Indonesian Journal of Computing and Cybernetics Systems)*, *13*(2), 169. https://doi.org/10.22146/ijccs.39788

Prapti Utami, R., & Rohaeti, E. (2019). Students' Concept Understanding in Chemistry Learning Using Macromedia Flash Based Inquiry Learning. *Online Submission*, *10*(3), 1–12.

Renaldo, R., Anggraeni, E. Y., & Rudi HC, E. (2019). METODE TOPSIS DALAM SISTEM PENDUKUNG KEPUTUSAN PENENTUAN PENERIMAAN BEASISWA DI STMIK PRINGSEWU. *Jurnal Management Sistem Informasi Dan Teknologi*, *9*(1), 13–18. https://doi.org/10.36448/jmsit.v9i1.1225

Saragih, H., & Ramdhany, R. (2013). Pengaruh Intensi Pelanggan Dalam Berbelanja Online Kembali Melalui Media Teknologi Informasi Forum Jual Beli (Fjb) Kaskus. *Jurnal Sistem Informasi*, *8*(2), 100. https://doi.org/10.21609/jsi.v8i2.331

Syafitri, Y. N. V., Hartati, T., & Tatang, T. (2019). Application of Conferencing Approach to Improve Cooperation Skills of Class IV Elementary School Students. *International Journal of Science and Applied Science: Conference Series*, *3*(1), 142. https://doi.org/10.20961/ijsascs.v3i1.34900

Syamsudin, S., & Rahim, R. (2017). Study Approach Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS). *Int. J. Recent Trends Eng. Res*, *3*(3), 268–285. https://www.researchgate.net/profile/Robbi_Rahim3/publication/315729858_Study_Approach_Technique_for_Order_of_Preference_by_Similarity_to_Ideal_Solution_TOPSIS/links/58dfbb5f4585153bfe97e0a8/Study-Approach-Technique-for-Order-of-Preference-by-Similarity-to-Ideal-Solution-TOPSIS.pdf

Vega, A., Aguarón, J., García-Alcaraz, J., & Moreno-Jiménez, J. M. (2014). Notes on dependent attributes in TOPSIS. *Procedia Computer Science*, *31*(August), 308–317. https://doi.org/10.1016/j.procs.2014.05.273