VOL. 8. NO. 2 FEBRUARY 2023
P-ISSN: 2685-8223 | E-ISSN: 2527-4864
DOI: 10.33480 /jitk.v8i2.3335

JITK (JURNAL ILMU PENGETAHUAN DAN TEKNOLOGI KOMPUTER)

THE DECISION MAKING METHOD FOR AWARDING SCHOLARSHIPS TO STUDENTS USING COMPOSITE PERFORMANCE INDEX ALGORITHM

Budy Satria[1*]; Acihmah Sidauruk[2]; Muhammad Tofa Nurcholis[3]; Raditya Wardhana[4]; Bister Purba[5]

Department of Computer Engineering[1]
Institut Teknologi Mitra Gama
http://www.amikmitragama.ac.id
budysatriadeveloper@gmail.com[1]

Department of Computer Science[2, 3, 4]
Universitas Amikom Yogyakarta
https://home.amikom.ac.id
acihmah@amikom.ac.id[2], tofa@amikom.ac.id[3], raditic@amikom.ac.id[4]

Department of Graphic Multimedia Engineering Technology[5]
Politeknik Negeri Medan
https://polmed.ac.id
bisterpurba36@gmail.com[5]

(*) Corresponding Author

Abstract— *Higher education in Indonesia has several programs to help reduce the burden on students, one of which is through a scholarship program. Scholarships given can be obtained with the terms and conditions that apply at each university. Mitra Gama Institute of Technology is one of the private universities in the province of Riau which always runs a scholarship aid program. The problem that has been happening so far is that the procedures carried out are still using a document checking system without involving a weighting system and the right criteria and time constraints have always been an obstacle in determining scholarship recipients. This research was conducted as a solution to create an innovation in the form of making a computerized decision support system using criteria and weight values so that scholarship recipients are on target. Composite performance index is the method used in this study. The purpose of this research is to create a decision support system for the selection of scholarship recipients to be more systematic and time efficient in the process. There are 5 alternatives used and 4 criteria, namely parents' income, GPA, electricity consumption and semester. The results of the research carried out were obtained the 5 highest composite index values, namely MHS4 with a value of 200.00, MHS1 with a value of 134.14, MHS5 with a value of 120.00, MHS3 with a value of 87.00 and MHS2 with a value of 85.71.*

Keywords: *composite performance index, dss, positive and negative trend, scholarship*

Intisari— *Pendidikan tinggi di Indonesia memiliki beberapa program untuk membantu mengurangi beban kepada mahasiswanya salah satunya melalui program beasiswa. Beasiswa yang diberikan bisa didapatkan dengan syarat dan ketentuan yang berlaku di masing-masing perguruan tinggi. Institut Teknologi Mitra Gama merupakan salah satu perguruan tinggi swasta di provinsi riau yang selalu menjalankan program bantuan beasiswa. Permasalahan yang selama ini terjadi adalah prosedur yang dilakukan masih menggunakan sistem pemeriksaan dokumen tanpa melibatkan sistem pembobotan dan Criteria yang tepat dan keterbatasan waktu selalu menjadi kendala dalam menentukan penerima bantuan beasiswa. Penelitian ini dilakukan sebagai solusi untuk membuat suatu inovasi berupa pembuatan sistem pendukung keputusan berbasis komputerisasi menggunakan Criteria dan nilai bobot agar penerima beasiswa tepat sasaran. Composite performance index adalah metode yang digunakan pada penelitian ini. Tujuan dari penelitian ini adalah untuk membuat suatu sistem pendukung keputusan untuk seleksi penerima beasiswa agar lebih sistematis dan efisiensi waktu dalam prosesnya. Terdapat 5 alternatif yang digunakan dan 4 Criteria yaitu penghasilan orang tua, IPK, pemakaian listrik dan semester. Hasil penelitian adalah diperoleh 5 Nilai composite index tertinggi yaitu MHS4 dengan nilai 200.00, MHS1 dengan nilai 134.14, MHS5 dengan nilai 120.00, MHS3 dengan nilai 87.00 dan MHS2 dengan nilai 85.71.*

Kata Kunci: *beasiswa, indeks gabungan, spk, seleksi, tren positif dan negatif*

Accredited Rank 2 (Sinta 2) based on the Decree of the Dirjen Penguatan RisBang Kemenristekdikti No.225/E/KPT/2022, December 07, 2022. Published by LPPM Universitas Nusa Mandiri

VOL. 8. NO. 2 FEBRUARY 2023
P-ISSN: 2685-8223 | E-ISSN: 2527-4864
DOI: 10.33480/jitk.v8i2.3335

INTRODUCTION

Scholarship is a form of appreciation that appears to students and students while undergoing education in educational institutions [1]. Scholarship is a financing that does not come from individuals, but scholarships are given by the government, companies, embassies, universities, and educational institutions or from the office where they work for the reason of an achievement in order to support the improvement of human resource capacity through education [2]. Assistance provided through a scholarship program with the aim of reducing the cost of studying [3]. The problem that occurs in this study is that the scholarship aid selection system has not been computerized because it has to look at the scholarship requirements document based on the criteria and eligibility of the recipient of the assistance so that it creates difficulties in making a decision[4]. The limited time they have often makes it difficult for the team to determine the right students to receive scholarships [5]. Therefore, not all students who apply to receive scholarships can be granted because the number of submissions is very large [6].

To overcome this problem, it is necessary to have a decision support system. A decision support system is a collection of interconnected systems that produce information for user decision making [7]. The method used in this research is the composite performance index. This method is a method by using a combined index to determine the assessment or ranking of several alternatives based on predetermined criteria [8]. The decision support system only provides alternative decisions, while the final decision is still determined by the decision maker [9]. Decision support systems are not intended to replace the role of decision makers, but to assist and support decision systems [10].

In previous studies, the composite performance index method was used to determine the placement of mentors at development centers [11]. This method is also used to determine the selection of food in patients with ulcer disease, so that the results obtained that ulcer sufferers are helped in choosing foods that are suitable for consumption [12]. In addition, the CPI method has also been used to assess class promotion for PTPN employees of the South Solok business unit with the best alternative results with the most group increases from 1A/4 to 1B/0 in the 2019 period with a value of 108.78[13]. The composite performance index method also helps in determining the chairman of the student council at the Kavri Talun Kenas Private Junior High School [14]. The application of the composite performance index method was also applied by the Social Service of North Sumatra for recipients of joint business group (KUBE) assistance[15].

Research related to the composite performance index method has also been carried out for the selection of the best student thesis [16] and the results obtained that the first rank is A1 with a value of 218.75, the second rank is A2 with a value of 198.75 and the third rank is A4 with a value of 178.75. Another research is in determining the priority selection decision for village infrastructure development using the composite performance index method[17].

The purpose of this study is to create a decision support system using the composite performance index method for the selection of scholarship recipients at the Mitra Gama Institute of Technology. With a decision support system, data processing becomes faster [18].

MATERIALS AND METHODS

Some of the stages carried out in this research are as follows:

1. Identify the problem, which is a problem found when selecting new employees based on the information obtained.
2. Data collection, namely collecting the data needed in this study by means of observation, interviews and literature on the object of research.
3. Determine the criteria, namely to be a reference in the calculation process using the composite performance index (CPI) method for the selection of scholarship recipients.
4. Data analysis, namely data that has been obtained on the object of research will be processed and given a weighted value for each criterion [19]
5. Implementation of the composite performance index (cpi) in order to obtain the best results in determining a decision.
6. Alternative ranking, which is to carry out a ranking process to get the highest value from all alternative data [20].
7. Conclusion, namely taking a conclusion on the data that has been analyzed and processed previously so that it becomes the final result in this study.

The data collection techniques used are:

1. Observation, namely the collection of data sourced from the object of research.
2. Literature study is an approach with references such as journals or books that are in accordance with the research topic
3. Interviews, namely conducting discussions with related parties to be able to obtain information on what is needed as research material.

The following are the steps for calculating using the Composite Performance Index (CPI) equation as follows:

1. Identification of trend criteria is divided into 2, namely positive and negative. The positive trend (benefit) is that the higher the value, the better. The negative trend (cost) is that the lower the value, the better.
2. Formation of the decision matrix (X)

$$X=\begin{bmatrix} X_{01} & \cdots & X_{0j} & \cdots & X_{0n} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ X_{i1} & \cdots & X_{ij} & \cdots & X_{in} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ X_{n1} & \cdots & X_{mj} & \cdots & X_{mn} \end{bmatrix}$$

$$i=\overline{(0,1,2,\dots,m};\ j=\overline{1,2,\dots,n}) \quad \dots\dots (1)$$

The above formula can be given information, namely:

X_{ij} = The performance value of the i alternative on criteria-j

m = Many alternatives

n = Number of criteria

3. Formation of the normalization matrix (R)

In the positive trend criteria, the minimum value for each criterion is transformed to one hundred, while the other values are transformed proportionally higher.

$$r_{ij} = \frac{x_{ij}*100}{x_{ij}(min)} \quad \dots\dots (2)$$

In the negative trend criteria, the minimum value for each criterion is transformed to one hundred, while the other values are transformed lower.

$$r_{ij} = \frac{x_{ij}(min)*100}{x_{ij}} \quad \dots\dots (3)$$

The formula above can be given information, namely:

x_{ij} = Alternative value to i on criterion j

$x_{ij\,(min)}$ = Minimum value on criterion - j

r_{ij} = Normalization value for alternative i on criterion j

4. Composite Index Weighting (I)

$$i_i = \sum_{j=1}^{n}(r_{ij} * w_j) \quad \dots\dots (4)$$

The calculation of the alternative value or composite index (i) is the sum of the multiplication between the criteria values and the criteria weights for each alternative.

5. Ranking

Determination of the best alternative is obtained from the ranking of alternative values or Composite Index (I) from the largest to the smallest. The value with the highest alternative value is the best.

RESULTS AND DISCUSSION

1. Alternative Data

Alternative data (Ai) can be seen in Table 1.

Table 1. Alternative Data

Code	Full Name	Institution
B1	MHS1	Institut Teknologi Mitra Gama
B2	MHS2	Institut Teknologi Mitra Gama
B3	MHS3	Institut Teknologi Mitra Gama
B4	MHS4	Institut Teknologi Mitra Gama
B5	MHS5	Institut Teknologi Mitra Gama

In Table 1 there are 5 prospective scholarship recipients who are at the Mitra Gama Institute of Technology.

2. Determine Criteria and Weights

Determination of criteria (Ci) and weights can be seen in Table 2

Table 2. Criteria and Weights

Code	Criterias	Trend	Weights
C1	Penghasilan Orang Tua	Negatif	0.200
C2	IPK	Positif	0.500
C3	Pemakaian Listrik	Negatif	0.100
C4	Semester	Negatif	0.200

In Table 2 there are criteria consisting of parental income (Negative) with a weight of 0.20, GPA (Positive) with a weight of 0.50, electricity consumption (Negative) with a weight of 0.10 and semester (Negative) 0.20.

3. Evaluation Data

Evaluation data is a collection of data that has been processed based on the weight value of all alternative data (Ai) and criteria (Ci). The evaluation data in this study can be seen as in Table 3.

Table 3. Evaluation Data

Code	Criteria	C1	C2	C3	C4
B1	MHS1	50	40	80	70
B2	MHS2	40	20	70	80
B3	MHS3	50	20	40	80
B4	MHS4	30	60	40	60
B5	MHS5	30	30	80	60

In Table 3 there are 5 alternative data, 4 criteria and weighted values.

Accredited Rank 2 (Sinta 2) based on the Decree of the Dirjen Penguatan RisBang Kemenristekdikti No.225/E/KPT/2022, December 07, 2022. Published by LPPM Universitas Nusa Mandiri

VOL. 8. NO. 2 FEBRUARY 2023
P-ISSN: 2685-8223 | E-ISSN: 2527-4864
DOI: 10.33480/jitk.v8i2.3335

1. Decision Matrix (X)

The decision matrix is derived from evaluation data in tabulated form and then remade into a decision matrix form (X).

$$X=\begin{bmatrix}50 & 40 & 80 & 70\\ 40 & 20 & 70 & 80\\ 50 & 20 & 40 & 80\\ 30 & 60 & 40 & 60\\ 30 & 30 & 80 & 60\end{bmatrix}$$

The decision matrix (X) above consists of 5 alternative data in the top-down order and 4 criteria in the left-to-right order.

2. Determine the Minimum Value of Each Criteria

In the composite performance index method, there are positive trends and negative trends. Determining the minimum value for each Criteria is used to determine the lowest value for each Criteria. The minimum value for each Criteria can be seen as in Table 4.

Table 4. Minimum Value of Each Criteria

Code	Criteria	C1	C2	C3	C4
B1	MHS1	50	40	80	70
B2	MHS2	40	**20**	70	80
B3	MHS3	50	**20**	**40**	80
B4	MHS4	**30**	60	**40**	**60**
B5	MHS5	**30**	30	80	**60**

In Table 4 there are minimum values for each criterion, namely C1 with 2 minimum values, C2 with 2 minimum values, C3 with 2 minimum values and C4 with 2 minimum values. The minimum value of each Criteria is used when calculating the equations in the normalized matrix (R).

3. Normalization Matrix (R)

In this study, there are 1 Criteria with a positive trend value and 3 negative trends. The calculation of the value of the normalization matrix (R) is based on the equations in the positive and negative trend formulas.

The calculation of the normalization matrix on Parental Income (C1) has a negative trend value which can be calculated as follows:

$$\boldsymbol{r_{ij}=\frac{x_{ij}(min)*100}{x_{ij}}}$$

$$=\frac{30*100}{50}$$

$$=\frac{3000}{50}$$

$$=60$$

The calculation of the normalization matrix on the GPA (C2) having a positive trend value can be calculated as follows:

$$\boldsymbol{r_{ij}=\frac{x_{ij}*100}{x_{ij}(min)}}$$

$$=\frac{40*100}{20}$$

$$=\frac{4000}{20}$$

$$=200$$

So that the normalization matrix for all criteria is obtained as follows:

$$R=\begin{bmatrix}60 & 200 & 50 & 85{,}71\\ 75 & 100 & 57{,}14 & 75\\ 60 & 100 & 100 & 75\\ 100 & 300 & 100 & 100\\ 100 & 150 & 50 & 100\end{bmatrix}$$

The normalization matrix above is the result of calculations for each Criteria that has a negative and positive trend. The normalized matrix values in tabulated form are shown in Table 5.

Table 5. Normalization Matrix

Code	Criteria	C1	C2	C3	C4
B1	MHS1	60	200	50	85,71
B2	MHS2	75	100	57,14	75
B3	MHS3	60	100	100	75
B4	MHS4	100	300	100	100
B5	MHS5	100	150	50	100

In Table 5 there are normalized matrix values resulting from calculations using the equations in the negative and positive trend formulas.

4. Composite Index Value (I)

The alternative composite index value is calculated based on the equation in the applicable formula. The calculation of the composite index value for each alternative can be calculated as follows:

$$i_i=\sum_{j=1}^{n}(r_{ij}*w_j)$$

= 60 * 0.20 + 200 * 0.50 + 50 * 0.10 + 85.71 * 0.20
= 12 + 100 + 5 + 17.142
= 134.14

So that the composite index values for all alternative data are obtained as follows:

I =[134.14, 85.71, 87.00, 200.00, 120.00]

The Composite Index value can be seen in Table 6.

Table 6. *Composite Index* (I)

Code	Criteria	Composite Index (I)
B1	MHS1	134,14
B2	MHS2	85,71

B3	MHS3	87,00
B4	MHS4	200,00
B5	MHS5	120,00

In Table 6 there is a composite index value of 5 alternative data.

5. Rangking

The ranking data is obtained from composite index data starting from the largest to the smallest order as shown in Table 7.

Table 7. Ranking Results

Code	Full Name	Composite Index (I)	Ranking
B4	MHS4	200,00	1
B1	MHS1	134,14	2
B5	MHS5	120,00	3
B3	MHS3	87,00	4
B2	MHS2	85,71	5

Based on Table 7, the ranking results have been calculated. Obtained 5 highest composite index values starting from MHS4, MHS1, MHS5, MHS3 and MHS2.

CONCLUSION

This study uses the composite performance index method as a way to assist the process of determining scholarship recipients at the Mitra Gama Institute of Technology. The implementation of the composite performance index method is very helpful in decision making. There are 5 alternative data used, using negative and positive trends and using 4 predetermined criteria. Based on the ranking results, the 5 highest composite index values were obtained, namely 200.00, 134.14, 120.00, 87.00 and 85.71.

REFERENCES

[1] T. S. Rinaldi and Hutrianto, "Implementation of The Oreste Method for Scholarship Recipients at The Institute of Technology & Business (ITBis) Lembah Dempo," *J. Inform.*, vol. 10, no. 1, pp. 24–34, 2022.

[2] Nurmansyah, U. Lestari, and R. Y. Ariyana, "Sistem Pendukung Keputusan Pemberian Beasiswa Dengan Metode Simple Additive Weighting (SAW) Studi Kasus: SMK Negeri 4 Kepahiang Provinsi Bengkulu," *J. Scr.*, vol. 9, no. 2, 2021.

[3] A. Adikvika, N. Merlina, and N. A. Mayangky, "Sistem Pendukung Keputusan Pemilihan Penerima Beasiswa Pendidikan Dengan Menggunakan Metode Weighted Product Di Yatim Mandiri," *Indones. J. Softw. Eng.*, vol. 7, no. 2, pp. 148–158, 2021.

[4] D. Alita, I. Sari, A. R. Isnain, and Styawati, "Penerapan Naïve Bayes Classifier Untuk Pendukung Keputusan Penerima Beasiswa," *JDMSI*, vol. 2, no. 1, pp. 17–23, 2021.

[5] E. Pawan, W. W. Widianto, and P. Hasan, "Implementasi Metode Profile Matching Untuk Menentukan Penerima Beasiswa Bidikmisi," *Creat. Inf. Technol. J.*, vol. 8, no. 1, pp. 54–62, 2021, doi: 10.24076/citec.2021v8i1.257.

[6] D. Ayudia, G. W. Nurcahyo, and Sumijan, "Optimalisasi Penentuan Criteria Penerima Bantuan Program Indonesia Pintar dengan Metode TOPSIS," *J. Sistim Inf. dan Teknol.*, vol. 3, no. 3, pp. 142–149, 2021, doi: 10.37034/jsisfotek.v3i3.58.

[7] M. Iqbal, B. Satria, and T. Radillah, "Implementasi SPK Menggunakan Metode ARAS Untuk Penentuan SMA dan SMK Terbaik Berbasis Website," *Indones. J. Comput. Sci. A*, vol. 10, no. 2, pp. 425–435, 2021.

[8] M. Walid, B. Satria, and M. Makruf, "Seleksi Karyawan Baru Menggunakan Metode Composite Perfomence Index (CPI) dan Rank Order Centroid (ROC)," *J. Ilm. Ilk. - Ilmu Komput. Inform.*, vol. 5, no. 1, pp. 11–18, 2022, doi: 10.47324/ilkominfo.v5i1.137.

[9] I. N. Okta and B. Satria, "Sistem Pendukung Keputusan Dalam Menentukan Perbaikan Jalan Rusak Dengan Menggunakan Metode Simple Additive Weighting (SAW) (Studi Kasus : Kabupaten Kuantan Singingi)," *Jar. Sist. Inf. Robot.*, vol. 3, no. 1, p. 194202, 2019.

[10] R. Siahaan, "Perancangan Sistem Pendukung Keputusan Penerimaan Siswa Baru Dengan Menerapkan Metode Composite Performance Index(cpi) (studi kasus: SDN 101864 Gunung Rintih)," *J. Multimed. dan Teknol. Inf.*, vol. 3, no. 2, pp. 38–46, 2021, doi: 10.54209/jatilima.v3i02.148.

[11] S. Lukas, E. Buululu, A. M. H. Sihite, and D. P. Utomo, "Sistem Pendukung Keputusan Penempatan Mentor Pada Pusat Pengembangan Anak IO 558 Sangkakala Medan Menggunakan Metode CPI dan ROC," *KOMIK (Konferensi Nas. Teknol. Inf. dan Komputer)*, vol. 4, no. 1, pp. 315–321, 2020, doi: 10.30865/komik.v4i1.2713.

[12] C. A. Putri, J. Minardi, and N. Azizah, "Sistem Pendukung Keputusan Pemilihan Makanan Pada Penderita Maag Menggunakan Metode Composite Performance Index (CPI)," *J. Imiah Inform. dan Komput.*, vol. 1, no. 2, pp. 115–121, 2022.

[13] D. E. Dewi, R. Aprilia, and N. H. Prasetya, "Sistem Pendukung Keputusan Penilaian Kenaikan Golongan Pada Karyawan PTPN VI

VOL. 8. NO. 2 FEBRUARY 2023
P-ISSN: 2685-8223 | E-ISSN: 2527-4864
DOI: 10.33480/jitk.v8i2.3335

Unit Usaha Solok Selatan Menggunakan Metode Composite Performance Index (CPI)," *Math. Appl. J.*, pp. 1–7, 2021.

[14] S. A. Tarigan, "Perancangan Sistem Pendukung Keputusan Penentuan Ketua Osis Dengan Menerapkan Metode Composite Performance Index (CPI) (Studi Kasus : SMP Swasta Kavri Talun Kenas)," *J. Multimed. dan Teknol. Inf.*, vol. 3, no. 1, pp. 31–37, 2021, doi: doi.org/10.54209/jatilima. V3i1.147.

[15] Z. Sipahutar, B. Nadeak, and P. Ramadhani, "Penerapan Metode Composite Performance Index (CPI) Dalam Penerima Bantuan Kelompok Usaha Bersama (KUBE)," *J. Sist. Komput. dan Inform.*, vol. 2, no. 3, pp. 255–260, 2021, doi: 10.30865/json.v2i3.2627.

[16] T. T. Muryono, I. K. Sudaryana, and Irwansyah, "Pemilihan Skripsi Mahasiswa Terbaik Menggunakan Metode Composite Performance Index (CPI)," *INFOTECH J. Technol. Inf.*, vol. 7, no. 2, pp. 99–104, 2021, doi: https://doi.org/10.37365/jti.v7i2.119.

[17] F. R. Tampubolon, "Penerapan Metode CPI dan ROC Dalam Keputusan Pemilihan," *BEES Bull. Electr. Electron. Eng.*, vol. 2, no. 2, pp. 67–73, 2021.

[18] B. Satria, "Implementation of Additive Ratio Assessment (ARAS) Method on Decision Support System for Recipient of Inhabitable House," *JITK (Jurnal Ilmu Pengetah. Dan Teknol. Komputer)*, vol. 6, no. 1, pp. 121–128, 2020, doi: 10.33480/jitk.v6i1.1389.

[19] Supriatin, A. R. Saputra, and B. Satria, "Implementation of Aras Algorithm on Decision Support System to Determine The Best Lecturer," *JITK (Jurnal Ilmu Pengetah. Dan Teknol. Komputer)*, vol. 8, no. 1, pp. 25–32, 2022, doi: 10.33480/jitk.v8i1.3152.

[20] B. Satria, M. Iqbal, and T. Radillah, "Additive Ratio Assessment Algorithm on Decision Support System for Selecting The Best SMA and SMK," *JITK (Jurnal Ilmu Pengetah. Dan Teknol. Komputer)*, vol. 7, no. 1, pp. 29–36, 2021, doi: 10.33480/JITK.V7i1.2217.