Article

Decision Support System for Selecting KIP-K Recipients at Amikom University, Purwokerto Using the TOPSIS Method

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Abstract:

The Indonesia Smart College Card Program (KIP-K) is a tuition assistance program (scholarship) from the government through the Ministry of Education, Culture, Research, and Technology (Kemdikbudristek). In the KIP-K scholarship selection process, criteria are needed to determine who is suitable to receive the KIP-K scholarship. This study aims to carry out the process of determining the ranking of KIP-K scholarship recipients based on the TOPSIS method. To determine scholarship recipients with outstanding achievements, Amikom Purwokerto University selects prospective scholarship recipients based on several criteria. The criteria used are Student DTKS Status, Parents' Income, Parents' Dependents, Average School Exams, and Student Transportation Costs. The results obtained from this study are in the form of a ranking from the highest to the lowest. One hundred twelve prospective students were entitled to get KIP-K scholarships out of 314 applicants.

Keywords: DSS, MOORA, Students, Criteria, Field practice

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1. INTRODUCTION

Recently, education has been essential in our lives because of the progress and development of technology and human resources, which are constantly growing. Education is also one of the keys to overcoming poverty in Indonesia. However, many underprivileged people still cannot experience education because of economic limitations and the high cost of education. [1]

For this reason, various efforts to encourage equity in quality education, as stated in the National Education Goals, will continue to be carried out. Through the Smart Indonesia Program, the Government of Indonesia issued the Indonesia Smart College Card (KIP College) as a form of educational assistance. This card is given to the high school or vocational graduates from underprivileged families so they can continue their education to tertiary or academic levels. The national education system has a strategic role in educating the nation's life and advancing science and technology. Regardless of their economic background, every child must have the same rights and opportunities to obtain an education, so efforts to develop Indonesian human resources must be fair, quality, inclusive and equitable. [2]

Based on Law No. 12/2012 on Higher Education, the Government of Indonesia is obliged to increase access and opportunities to study at tertiary institutions and

prepare intelligent and competitive Indonesians. Therefore the government will always try to ensure that underprivileged Indonesian children, especially those with achievements, can continue their education up to the university level through the Smart Indonesia Program (PIP). [3]

At Amikom University, Purwokerto, the selection process for determining new student admissions through the KIP-K route is still done manually using Microsoft Excel, which is then carried out by a sorting process one by one looking at the requirements and assessment criteria for prospective new students through the KIP-K route. There are several criteria for the assessment and applicants. There are around 300 new student applicants and complete data on all administrative requirements for about 280 new applicants in 2022. But there are several problems in the selection process for determining KIP-K new student admissions, including requiring accuracy and a very long time. By considering all of these things, we need a system that can assist in the selection process for determining new student admissions. [4]

Decision Support Systems (DSS) are gaining attention among programmers and systems analysts. This system helps decision-making by managing data and using specific models to solve problems. Decision support systems are unique because they can solve unstructured or semi-structured problems. In many fields, decision support systems have many benefits and dependencies that are felt to use increasingly complex systems with increasingly complex data management processes for information retrieval systems [5].

Technique For Order Preference By Similarity To Ideal Solution (TOPSIS) is a method that is widely used to solve practical decision-making. The SPK (Decision Support System) technique for KIP-K new admissions at Amikom University in Purwokerto uses the TOPSIS method. This method was chosen because this method determines the weight value for each attribute, followed by ranking, which will select the best alternative from some other options; in this case, the option in question is the one entitled to receive a scholarship based on the specified requirements. With this ranking method, a more precise score will be obtained because it is based on the value of each condition and the weight that has been determined so that more accurate results will be obtained on who will receive the scholarship. [6]

Based on research by Victor Marudut Mulia Siregar with the title Implementation of TOPSIS Algorithm for Selection of Prominent Student Class using the TOPSIS method to produce a decision support system for selecting best class XI IPA students in determining rankings. This Decision Support System is helpful and makes it easier for the school and homeroom teacher to determine the ranking for the selection of superior-class students. [7]

Furthermore, a study entitled The Strategy of Enhancing Employee Rewards Using the TOPSIS Method as a Decision Support System in 2020 aims to develop a decision support system using the Technique for Order of Preference by Similarity (TOPSIS) method. Moreover, the PHP programming language to select employee recipients of rewards at university. The results of this study are in the

form of an information system program as a decision-making tool for the process of selecting reward recipient employees. [8]

In a study entitled A Decision Support System To Determine The Best Natural Feed For Fish Cultivation Using Topsis Method in 2022, The research aimed to choose the best natural carp to feed using a Decision Support System (DSS) with the TOPSIS method. From the calculations performed using the TOPSIS method, the highest preference level with a value of 1 is A1. The results of the Decision-Making System with the TOPSIS method from the natural selection of carp that farmers can use are earthworms. [9]

Furthermore, looking at this problem, a decision-making solution can be taken using the Technique for Orders Preference by Similarity to Ideal Solution (TOPSIS) method to determine scholarship recipients at Amikom University in Purwokerto by calculating the criteria that have been set. With this system, it is hoped that the determination of scholarship recipients will be more objective, effective, and efficient in processing data through a system that is automatically computerized and stored in a database.

2. THEORY

A. System

The system is a collection of all the elements within a scope of problems that are integrated; therefore, any existing information can be utilized by parties within the scope of the problem to achieve a certain goal. [10]

B. Decision Support System

A decision support system is part of a computer-based information system (including knowledge-based systems (knowledge management)) that is used to support decision-making in an organization or company. It can also be said to be a computer system that processes data into information to decide specific semi-structured problems [11]. Decision Support Systems (DSS) are interactive information systems that provide information, modeling, and data manipulation. The system is used to assist decision-making in semi-structured and unstructured situations where no one knows how decisions should be made book. [12]

C. Scholarship

Scholarships are funding that does not originate from self-funding or from parents but is provided by the government, private companies, embassies, universities, educational or research institutions, or also from the office where one works because of the achievements of an employee, and they can be allowed to increase their resource capacity. Human resources through education. The award can be in the form of certain access to an institution or an award in the form of financial assistance. [10]

D. KIP-K (Indonesian Smart College Card Program)

The Indonesia Smart College Card Program (KIP-K) is a tuition assistance program (scholarship) from the government through the Ministry of Education, Culture, Research, and Technology (Kemdikbudristek). [2]

E. TOPSIS (Technique for Orders Preference by Similarity to Ideal Solution)

TOPSIS is the process of calculating the normalized matrix, the process of calculating the weighted normalized matrix, the process of determining positive ideal solutions and negative ideal solutions, the process of calculating the distance between each alternative to the ideal solution, and the process of calculating the preference value of each alternative. [4] TOPSIS considers the distance to the positive ideal solution and the distance to the negative ideal solution by taking the distance relative to the positive ideal solution. Based on the comparison of the relative distances, alternative priority settings can be achieved. This method is widely used to complement decision-making practices. This is because the concept is understandable and straightforward, computationally efficient, and can measure the relative performance of decision alternatives [13].

F. Steps to Solving Problems with TOPSIS

The steps for solving the problem with TOPSIS are as follows:

1. Create a normalized decision matrix.
2. Create a weighted normalized decision matrix.
3. Determine the positive ideal solution matrix & negative ideal solution matrix.
4. Determine the distance between the values of each alternative with the positive ideal solution matrix & negative ideal solution matrix.
5. Determine the preference value for each alternative. [14]

3. METHOD

In this case, it will explain the steps taken to obtain a research methodology which is a stage that must be applied so that research can be carried out in a directed manner and facilitate the analysis of existing problems. The steps of research studies on Decision Support Systems for Selecting KIP-K recipients at Amikom University, Purwokerto, with the Technique For Order Reference by Similarity to the Ideal Solution (TOPSIS) method is generally explained as follows:

1. Literature Study

Conduct a literature study on various references related to the research being conducted. In this stage, literature was studied on the concept of a Decision Support System for accepting KIP-K scholarships using TOPSIS in various sources in the form of books, articles, and journals. The literature study method can be interpreted as data collection by studying, observing, and analyzing existing files or documents related to the problem [15].

2. Data Collection

Based on the study of the literature, the data needed in this study is data that includes students' data. While the graduation data used is all student data applying for the KIP-K scholarship at Amikom University, Purwokerto.

3. Calculation of TOPSIS

Make a decision matrix in equation 1 for the problem to be solved with the following conditions [14]:

$$D = \begin{bmatrix} x11 & x12 \dots & x1n \\ x21 & x22 \dots & x2n \\ \dots & \dots \dots & \dots \\ xm1 & xm2 \dots & xmn \end{bmatrix} \quad (1)$$

Matrix normalization with equation 2:

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

The normalization of the R_{ij} matrix uses weight ratings so that a normalized weight ranking matrix is obtained. The equation used is as follows in equation 3:

$$Y_y = w_i r_y \quad (3)$$

Y_y is the weighted rank matrix, w_i is the i-th rank weight, and r_{ij} is the normalized matrix in the second step. For i = 1,2, …, m, and j = 1, 2, …, n. in this case, the weight of the assessment must be determined based on the number of decision variables resolved. The positive ideal solution (A+) and negative ideal solution (A-) are based on the weighted rating matrix in step 3. The following equation is used to find the value of positive and negative solutions.

$$A^+ = (y_1^+, y_2^+, \dots, y_n^+) \quad (4)$$

$$A^- = (y_1^-, y_2^-, \dots, y_n^-) \quad (5)$$

Determine the distance between the weighting values of each alternative with positive ideal solutions and negative ideal solutions. To determine the distance between the weighted values of each alternative to the positive ideal solution, use the following equation 6.

$$D_i^+ = \sqrt{\sum_{i=1}^{n} (y_i^+ - y_{ij})^2} \quad (6)$$

To calculate the distance between the weighted values of each alternative to the negative ideal solution, the following equation 7.

$$D_i^- = \sqrt{\sum_{i=1}^{n} (y_{ij} - y_i^-)^2} \quad (7)$$

The final step is to calculate the preference value for each alternative by comparison:

$$V_i = \frac{D_i^-}{D_i^- + D_i^+} \quad (8)$$

4. Determination of Criteria

The criteria that will be used in the assessment of prospective Bidikmisi scholarship recipients include (1) Name of Student, (2) Student DTKS Status, (3) Income of Parents, (4) Dependents of Parents, (5) Average School Examination, (6) Student Transportation Costs. The criteria used in this study were obtained from interviews with the Bidikmisi scholarship acceptance selection committee and based on the guidelines for organizing KIP-K scholarship assistance in 2022.

5. Weighting

The weighting used in this study was obtained from interviews with the KIP-K scholarship acceptance selection committee and based on the guidelines for organizing KIP-K financial assistance in 2022. The weighting given to each criterion is as follows.

a) Student DTKS Status (C1)

The status of DTKS is Integrated Social Welfare Data, and this DTKS includes Social Welfare Service Requirements (PPKS), Social Assistance and Empowerment Recipients, and Social Welfare Potential and Resources (PSKS) of prospective students, as shown in Table 1.

Table 1. Status of Student DTKS

DTKS Status	**Weight**
Not Yet Registered	1
Registered	2

b) Parents' Income (C2)

The income of the student's parents is the amount of the father's and mother's income than in the monthly average of the income of the father and mother of the prospective KIP-K scholarship recipients. The income classification of the prospective student's parents is shown in Table 2.

Table 2. Income classification of parents of prospective students

Parent's Income	**Weight**
<= 700.000	5
700.000 – 1.200.000	4
1.200.001 – 1.700.000	3
1.700.001 – 2.200.000	2
2.200.001 – 3.000.000	1

c) Parental Dependents (C3)

Parents' dependents are the number of dependents of the parents of the prospective KIP-K scholarship recipient. The classification of parental dependents is shown in Table 3.

Table 3. Classification of the number of dependents of parents

Number of Dependents of Parents	Weight
>5	5
4	4
3	3
2	2
1	1

d) School Examination Average (C4)

The average school exam score is the middle school exam score students achieve during high school or vocational high school. The classification of the average school exam scores is shown in Table 4.

Table 4. Classification of average school exam scores

School Grade Point Average	Weight
91 -100	5
86 – 90	4
81 – 85	3
75 – 80	2
<= 70	1

e) Student Transportation Fees (C5)

Student Transportation Costs are daily transportation costs needed by prospective students, as shown in Table 5; Table 6 is a Weight Criterion.

Table 5. Student Transportation Costs

Transportation costs	Weight
>=100.000	1
41.000 – 50.000	2
31.000 – 40.000	3
21.000 – 30.000	4
10.000 – 20.000	5

Table 6. Weight Criteria

Weight Criteria	Criteria	Weight
C1	Student DTKS Status	3
C2	Parents Income	4
C3	Parental Responsibilities	1
C4	School Examination Average	5
C5	Student Transportation Fees	2

4. RESULT AND ANALYZES

Furthermore, this assessment was carried out by collecting data at Amikom University, Purwokerto. The data obtained totaled 314 prospective students who registered for KIP – K in 2022 at Amikom University, Purwokerto.

In implementing the TOPSIS method, there are several calculation processes to get the assessment results according to this method. Implementation of TOPSIS as follows:

1. Define criteria.
2. Determine the value of each alternative.
3. Establish a normalized decision matrix
4. Create a weighted normalized decision matrix.
5. Determine the positive ideal solution matrix and the negative ideal solution matrix.
6. Determine the distance between the values of each alternative with the positive ideal matrix and negative ideal matrix.
7. Determine the preference value for each alternative. The following results from the steps of the TOPSIS method are presented in table 7.

Table 7. Determining Criteria

Weight Criteria	Criteria	Attribute	Weight
C1	Student DTKS Status	benefit	3
C2	Parents' income	cost	4
C3	Parent's responsibility	benefit	1
C4	School Examination Average	benefit	5
C5	Student Transportation Fees	cost	2

Table 7 is a table for determining criteria, attributes, and weights from student data who register for KIP-K at Amikom University, Purwokerto.

Table 8. Value of each alternative

Alternative	Criteria				
	C1	C2	C3	C4	C5
Ginanjar Wisnu Agustrian	1	4	1	1	5
Muhammad Faiq Arifin	1	5	5	1	5
Samsul Dwi Cahyo	1	5	2	1	5
Dyah Ayu Widyaningsih	2	3	4	3	1
Wahyu Latifatun	2	5	3	1	5
…	…	…	…	…	…
…	…	…	…	…	…
Epri Anggriani	1	1	1	5	5

Table 8 shows each alternative's value taken from the data of students who registered for KIP-K at Amikom University, Purwokerto.

Table 9. Normalized Decision Matrix

Divider	29.68164	74.86655	50.55690	45.42026	78.89867
Alternative	**Criteria**				
	C1	**C2**	**C3**	**C4**	**C5**
Ginanjar Wisnu Agustrian	0.03369	0.05343	0.01978	0.02202	0.06337
Muhammad Faiq Arifin	0.03369	0.06679	0.09890	0.02202	0.06337
Samsul Dwi Cahyo	0.03369	0.06679	0.03956	0.02202	0.06337
Dyah Ayu Widyaningsih	0.06738	0.04007	0.07912	0.06605	0.01267
Wahyu Latifatun	0.06738	0.06679	0.05934	0.02202	0.06337
…	…	…	…	…	…
…	…	…	…	…	…
Epri Anggriani	0.03369	0.01336	0.01978	0.11008	0.06337

Table 9 is a table that shows the results of the normalized decision matrix, which is calculated using the formula equation 2.

Table 10. Weighted Normalized Decision Matrix

Alternative	**Criteria**				
	C1	**C2**	**C3**	**C4**	**C5**
Ginanjar Wisnu Agustrian	0.10107	0.21371	0.01978	0.11008	0.12674
Muhammad Faiq Arifin	0.10107	0.26714	0.09890	0.11008	0.12674
Samsul Dwi Cahyo	0.10107	0.26714	0.03956	0.11008	0.12674
Dyah Ayu Widyaningsih	0.20215	0.16029	0.07912	0.33025	0.02535
Wahyu Latifatun	0.20215	0.26714	0.05934	0.11008	0.12674
…	…	…	…	…	…
…	…	…	…	…	…
Epri Anggriani	0.10107	0.05343	0.01978	0.55042	0.12674

Table 10 shows the results of the weighted normalized decision matrix, which is calculated using the formula equation 3.

Table 11. Matrix of Positive and Negative Ideal Solutions

Ideal solution matrices	**C1**	**C2**	**C3**	**C4**	**C5**
	Benefit	**Cost**	**Benefit**	**Benefit**	**Cost**
Positive	0.20215	0.05343	0.11868	0.55042	0.02535
Negative	0.10107	0.26714	0.01978	0.11008	0.12674

Table 11 shows the results of the positive ideal and negative ideal solution matrices, which are calculated using calculation formulas 4 and 5.

Table 12. The distance between the values of each alternative

	Ginanjar Wisnu Agustrian	**0.499861414**		**Ginanjar Wisnu Agustrian**	**0.053428402**
D+	Muhammad Faiq Arifin	0.510346863	**D-**	Muhammad Faiq Arifin	0.079118777
	Samsul Dwi Cahyo	0.5160644		Samsul Dwi Cahyo	0.019779694
	Dyah Ayu Widyaningsih	0.247904052		Dyah Ayu Widyaningsih	0.289671174
	Wahyu Latifatun	0.503356878		Wahyu Latifatun	0.108538515
	…	…		…	…
	Epri Anggriani	0.174004874		Epri Anggriani	0.489454692

Table 12 is a table that shows the results of the distance between the values of each alternative calculated using equations 6 and 7. Furthermore, Table 13 shows the results of the preference values for each option which are calculated using the formula equation 8. Table 14 shows that the higher the preference value, the more prospective students are recommended by the system to be given KIP – K. The committee can determine which students are accepted based on the set quota of 112 out of 314 participants.

Table 13. Preference Value of Each Alternative

	Ginanjar Wisnu Agustrian	**0.096564947**		**Ginanjar Wisnu Agustrian**	**288**
V1	Muhammad Faiq Arifin	0.134221186	**Rating**	Muhammad Faiq Arifin	280
	Samsul Dwi Cahyo	0.036913152		Samsul Dwi Cahyo	299
	Dyah Ayu Widyaningsih	0.5388477		Dyah Ayu Widyaningsih	60
	Wahyu Latifatun	0.177380834		Wahyu Latifatun	230
	…	…		…	…
	…	…		…	…
	Epri Anggriani	0.737731004		Epri Anggriani	4

5. CONCLUSIONS

Based on research results. The outcome or decision to select KIP-K recipient students at Amikom University in Purwokerto in 2022 is in the form of ranking from the highest and lowest scores based on the criteria for student DTKS status, parents' income, parents' dependents, average school exams, and student transportation costs. One hundred twelve students passed the KIP-K program out of a total of 314 applicants, which means that the ranking results from 1 to 112 were students who passed the selection of KIP-K recipients at Amikom University, Purwokerto.

AUTHOR CONTRIBUTIONS

Conceptualization; Khusnul Khotimah [K.K], Lintang Wahyu Anggraini [L.W.A], Weersa Talta Alfirnanda [W.T.A], Imam Tahyudin [I.T], methodology; [K.K],[L.W.A],[W.T.A],[I.T], validation; [K.K],[L.W.A],[W.T.A],[I.T], formal analysis; [K.K],[L.W.A],[W.T.A],[I.T], investigation; [K.K],[L.W.A],[W.T.A],[I.T], data curation; [K.K],[L.W.A],[W.T.A],[I.T], writing—original draft preparation; [K.K],[L.W.A],[W.T.A],[I.T], writing—review and editing; [K.K],[L.W.A],[W.T.A],[I.T], visualization; [K.K],[L.W.A],[W.T.A],[I.T], supervision project administration; [K.K],[L.W.A],[W.T.A],[I.T], funding acquisition; [K.K],[L.W.A],[W.T.A],[I.T], have read and agreed to the published version of the manuscript.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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