



Comparative Analysis Of AHP With TOPSIS In The selection Of New Student Majors At The Universitas Nasional

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ABSTRACT

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Every year high school graduates / equivalent have the desire to continue Reviews their education to a higher level one of them at the National University roomates study has many programs but there are some obstacles faced by graduates that are still not knowing what programs are Appropriate study. With this the researcher Utilizes a decision support system designed by applying the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method is then roomates Compared to the Analytical Hierarchy Process (AHP) method. So the results of system design are Able to help in finding and Determining the Appropriate study program. The results of the comparison based on the level of suitability are 10:12% for the AHP method and 98.84% for the TOPSIS method.

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1. Introduction

National University (UNAS) is the Private Universities (PTS) in Jakarta's oldest and second oldest in Indonesia. Established on October 15, 1949 on the initiative of leading figures who gathered in the Society of Promotion of Science and Culture (PMIK). Currently the National University has a level of academic of the diploma, there are four courses including D3 Korean, D3 Mandarin and D4 Midwifery, Strata I are nine faculties and 20 study programs, Tier II, there are five courses and Tier III for Political Sciences program.

Each year student / i graduate high school / equivalent have the desire to continue their education to a higher level, but a lot of them who do not understand in choosing courses that will they live. Quite a lot of new students who failed in the middle of the road and quite a lot of students who do not get along when it was in the majors or courses of study that eventually many of them to stop or switch courses.

Of the problems that have been submitted, the researchers wanted a system that can assist in selecting and determining the appropriate course and certainly will affect all areas of student employment after graduation. Here comes the role of decision support system that can help the institutions in determining the course students / i in accordance with their wishes. However, not all decisions are in this system.

By The researchers used a Decision Support System (DSS) as a tool for decision makers to expand the capabilities of the decision makers, but not to replace the judgment of the decision makers. The decision at the decision support system, tend to quickly and quantitatively is pilihanterbaik by importance / weight criteria provided by the management as a decision-maker, then the decision is quite complex could be shortened. In a decision support system, there are several methods that can be used.





The concept of Decision Support System (DSS) was first proposed in the early 1970s by Michael S.Scott Morton explained that the Decision Support System is a computer-based system intended to help decision makers in utilizing data and specific models to solve various problems unstructured [3].

2. Methodology

2.1 System Design

In designing this system the researchers used a flowchart diagram as an overview of system design that created that defines the course of the program.

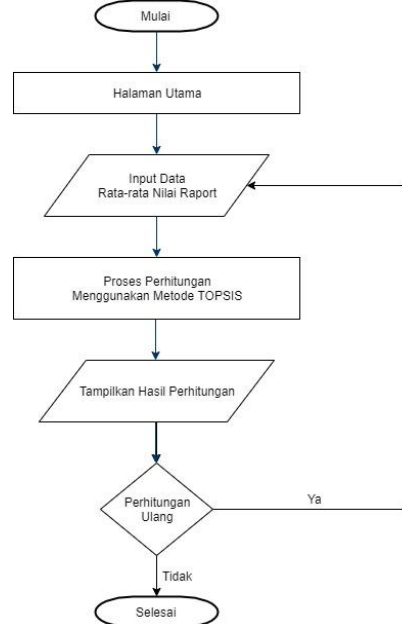


Image 1. Flowchart Electoral System Program

In Figure 1 is a flowchart contained on the website system using TOPSIS method that explains how the user to determine the course of study, starting with the user entry to the main page and then enter the data value on the form contained on the website and will be processed by the system with the calculation TOPSIS, after the calculation process is complete will appear on the appropriate course, if users want to try recalculation then back to the page recommendation, if not then the program ends.

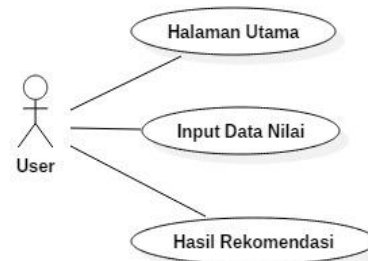


Figure 2. Use Case Diagram User

In figure 2 explains how the program can be used by the user, the user's first entry to the main page, then enter the value data will appear the result of the data that has been entered.

2.2 Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

Decision making is the process of looking for the best choice of a number of alternatives. TOPSIS method is one method of multi-criteria that identify alternative solutions to a finite set. Based on a concept whereby the selected alternative has the shortest distance from the positive ideal solution and has the longest distance from the ideal solution alternatives. In general, TOPSIS procedure following the steps as follows [4]:

- 1) Calculating the value of normalization





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

(1)

- 2) Calculates the normalized weighted value

$$y_{ij} = w_i r_{ij}$$

(2)

- 3) Identification of the positive ideal solution and negative ideal solution

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

(3)

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

(4)

- 4) Distance value weighted with positive ideal solution and negative ideal solution

$$D_i^+ = \sqrt{\sum_{j=1}^n (y_1^+ - y_{ij})^2}$$

(5)

$$D_i^- = \sqrt{\sum_{j=1}^n (y_{ij} - y_1^-)^2}$$

(6)

- 5) The value of each alternative closeness to the ideal solution

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

(7)

Information :

r_{ij} = Normalization matrix

x_{ij} = The value of the data on line i and column j

w = Weighted priority

y_{ij} = Normalized weighted matrix

A^+ = Solution ideal positive / maximum value of the normalized weighted matrix

A^- = Solution ideal negative / minimum value of the normalized weighted matrix

D^+ = Distance between alternative with positive ideal solution

D^- = Distance between alternative with negative ideal solution

V_i = Value of preference

2.3 Analytical Hierarchy Process (AHP)

Analytical Hierarchy Process (AHP) by Saaty is a method of multicriteria decision for solving complex problems or complicated, the situation for structured into sections (variable) which is then formed into a hierarchy of functional or structural to show the problems to be solved and then establish the order of priority for alternatives through pairwise comparisons based on the assessment of the decision-makers of the system. Here are some of the procedures used AHP [5]:

- 1) Defining the problem and determine the desired solution.
- 2) Determining Ratio Index (RI) and weight criteria. AHP has an index ratio of standard value according to the number of indicators used.

Table 1
Index ratio

n	1	2	3	4	5	6	7	8	9	10	11	12
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48

- 3) Make a comparison matrix (A), the matrix comparison of equal value between 1 to 9 according to the value bobt criteria and calculated matrix pairs
- 4) Calculate Consistency Index (CI), with the following equation:

$$CI = \frac{(\lambda_{max} - n)}{n - 1}$$

(8)

Information :

n = Number of elements





$\lambda \max$ = Number of results for the number of existing elements

5) Calculate Consistency Ratio (CR), with the following equation:

$$CR = \frac{CI}{RI}$$

(9)

Information :

CR = Consistency Ratio

CI = Consistency Index

RI = Random Consistency Index

Checking the consistency of the hierarchy, the statement is considered true if the value of CR is less than 10% or 0.1, and if the value is more than 10% then the calculation process is repeated until the value is below 10%.

2.4 The testing phase

The testing phase is done by analyzing conformity to calculate the degree of conformity (Tki) on each method by using the formula [6]:

$$Tki = \frac{Xi}{Data FMADM (100\%)}$$

(10)

To search for Xi using the formula

$$Xi = \frac{\sum data metode}{n}$$

(11)

Information :

Tki = Level of Compliance

Xi = The average score of the data method

Table 2

Table Percentage level of conformity

Persentase Tingkat Kesesuaian	Kategori
31% - 45%	Tidak Sesuai
46% - 60%	Kurang Sesuai
61% - 75%	Cukup Sesuai
76% - 85%	Sesuai
86% - 100%	Sangat Sesuai

3. Results And Discussion

3.1 The testing phase with the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

Masukan Rata-rata Nilai Raport

Nilai Bahasa Indonesia	91
Nilai Bahasa Inggris	89
Nilai Matematika	87
Nilai Sejarah	80
Nilai Biologi	81

HITUNG





Figure 3. Input Data Value

In Figure 3 the data that must be entered and then be used as a new criterion for the program.

HASIL REKOMENDASI PROGRAM STUDI

Matrik Program Studi					
Alternatif	C1 (Benefit)	C2 (Benefit)	C3 (Benefit)	C4 (Benefit)	C5 (Benefit)
A1	3	4	2	4	1
A2	4	4	2	3	2
A3	3	3	4	3	2
A4	4	3	2	4	1
A5	4	4	2	2	2
A6	4	4	3	3	2
A7	4	4	2	3	2

Figure 4. Matrix Program

In Figure 4 displays the initial matrix used in the program.

Matriks ternormalisasi, R:

Matriks Normalisasi "R"					
Alternatif	C1 (Benefit)	C2 (Benefit)	C3 (Benefit)	C4 (Benefit)	C5 (Benefit)
A1	0.176777	0.236525	0.132745	0.306786	0.085126
A2	0.235702	0.236525	0.132745	0.230089	0.170251
A3	0.176777	0.177394	0.265489	0.230089	0.170251
A4	0.235702	0.177394	0.132745	0.306786	0.085126
A5	0.235702	0.236525	0.132745	0.153393	0.170251
A6	0.235702	0.236525	0.199117	0.230089	0.170251
A7	0.235702	0.236525	0.132745	0.230089	0.170251

Figure 5. Normalization matrix

In Figure 5 is a normalization matrix of the initial matrix resulting from the formula (1).

BOBOT (W)

BOBOT (W)				
Value Kriteria Bahasa Indonesia	Value Kriteria Bahasa Inggris	Value Kriteria Matematika	Value Kriteria Sejarah	Value Kriteria Biologi
5	4	4	2	3

Figure 6. Weights

In Figure 6 is a weight value or the value of new criteria that have previously been fed into the program.

Matriks ternormalisasi terbobot, Y:

Matriks Normalisasi terbobot "Y"					
Alternatif	C1 (Benefit)	C2 (Benefit)	C3 (Benefit)	C4 (Benefit)	C5 (Benefit)
A1	0.883883	0.9461	0.530979	0.613572	0.255377
A2	1.178511	0.9461	0.530979	0.460179	0.510754
A3	0.883883	0.709575	1.061957	0.460179	0.510754
A4	1.178511	0.709575	0.530979	0.613572	0.255377
A5	1.178511	0.9461	0.530979	0.306786	0.510754
A6	1.178511	0.9461	0.796468	0.460179	0.510754
A7	1.178511	0.9461	0.530979	0.460179	0.510754

Figure 7. Normalization Matrix Weighted

In Figure 7 is a normalized weighted matrix resulting from the formula (2)





Matrik Solusi ideal positif dan negatif

Matrik Solusi ideal positif "A+" dan negatif "A-"					
	Y1 (Benefit)	Y2 (Benefit)	Y3 (Benefit)	Y4 (Benefit)	Y5 (Benefit)
Y+	0.589256 (min)	0.9461 (max)	1.061957 (max)	0.613572 (max)	1.021508 (max)
Y-	1.178511 (max)	0.709575 (min)	0.530979 (min)	0.306786 (min)	0.255377 (min)

Figure 8. Ideal Solution Matrix Positive and Negative

In Figure 8 is the largest and smallest values of each criterion weighted matrix using the formula (3) and Equation (4).

Jarak antara nilai terbobot setiap alternatif terhadap solusi ideal positif

D+		D-	
D1	0.9776	D1	0.4867
D2	0.9558	D2	0.3804
D3	0.6536	D3	0.6764
D4	1.1279	D4	0.3068
D5	0.992	D5	0.3481
D6	0.8379	D6	0.4639
D7	0.9558	D7	0.3804

Figure 9. Distance Value Weighted with Positive and Negative Ideal Solution

In Figure 9 is the distance weighted value of each alternative produced from the matrix normalized weighted against positive and negative ideal matrix using the formula (5) and Equation (6).

Nilai Preferensi untuk Setiap alternatif (V)

Nilai Preferensi "V"	Nilai
V1	0.33237724510005
V2	0.28468792096991
V3	0.50857142857143
V4	0.21384261518087
V5	0.25975673457205
V6	0.35635274235674
V7	0.28468792096991

Figure 10. Preference Value Of Any Alternatives

Figure 10 is a proximity of each alternative value resulting from the formula (7).

Nilai Preferensi tertinggi

Nilai Preferensi tertinggi	Alternatif HP terpilih	
V18	0.60877849128502	Biologi
V19	0.60877849128502	Agroteknologi
V22	0.60877849128502	Keperawatan

Figure 11. Top Preference Values

In Figure 11 is the highest closeness value of each alternative.

3.2 Testing Phase with Analytical Hierarchy Process (AHP)

In this study, using five criteria, namely, Indonesian (C1), English (C2), Mathematics (C3), History (C4) and Biology (C5).

Table 3
Pairwise Comparison Matrix





	C1	C2	C3	C4	C5
C1	1,00	1,00	3,00	4,00	4,00
C2	1,00	1,00	3,00	5,00	5,00
C3	0,33	0,33	1,00	3,00	3,00
C4	0,25	0,20	0,33	1,00	1,00
C5	0,25	0,20	0,33	1,00	1,00

The first step to do is to develop a pairwise comparison matrix using the concept of Saaty scale.

Table 4
Priority calculation Every Criteria

	C1	C2	C3	C4	C5	RATA-RATA
C1	0,35	0,37	0,39	0,29	0,29	0,34
C2	0,35	0,37	0,39	0,36	0,36	0,36
C3	0,12	0,12	0,13	0,21	0,21	0,16
C4	0,09	0,07	0,04	0,07	0,07	0,07
C5	0,09	0,07	0,04	0,07	0,07	0,07

Then from the data comparison matrix in normalizing each criterion and compute the average of each line.

Table 5
Priority calculation Each Alternatives

	C1	C2	C3	C4	C5
A1	0,04	0,08	0,01	0,10	0,01
A2	0,03	0,11	0,01	0,08	0,03
A3	0,02	0,04	0,05	0,02	0,01
A4	0,05	0,03	0,01	0,18	0,03
A5	0,05	0,06	0,01	0,04	0,02
A6	0,05	0,06	0,02	0,07	0,01
A7	0,07	0,12	0,01	0,03	0,01
A8	0,07	0,04	0,01	0,03	0,01
A9	0,06	0,02	0,01	0,03	0,01
A10	0,06	0,03	0,01	0,03	0,01
A11	0,02	0,03	0,06	0,01	0,01
A12	0,02	0,03	0,06	0,01	0,01
A13	0,03	0,08	0,02	0,04	0,05
A14	0,01	0,01	0,08	0,01	0,02
A15	0,01	0,01	0,08	0,01	0,02
A16	0,01	0,01	0,08	0,01	0,02
A17	0,01	0,01	0,08	0,01	0,02
A18	0,04	0,02	0,02	0,05	0,14
A19	0,04	0,02	0,03	0,05	0,14
A20	0,01	0,04	0,13	0,01	0,01
A21	0,01	0,04	0,13	0,01	0,01
A22	0,12	0,03	0,02	0,06	0,17
A23	0,12	0,03	0,02	0,06	0,17
A24	0,06	0,05	0,04	0,06	0,04

Table 6
The calculation results

Konsistensi Matriks	Consistency Index	Ratio Index	Consistency Ratio	KETERANGAN
0,2	0,05	1,12	0,04	KONSISTEN

Calculate the consistency of the matrix by summing the average each line and divided by the number of criteria used. After getting the results of subsequent matrix consistency is the consistency index calculating formula (8) and then for the index ratio in accordance with the existing provisions in Table 1, because it uses five criteria of the index ratio used is 1.12.

After calculating the Consistency Index and Ratio Index Ratio Consistency further into the calculation formula (9), if the result is 0-1 then considered "consistent" when it is more than that "inconsistent" [7].

Table 7
Results ranking





DATA ALTERNATIF		NILAI	RANK
SASTRA INGGRIS	A7	0,07	1
KEPERAWATAN	A22	0,07	2
KEBIDANAN	A23	0,07	3
HUBUNGAN INTERNASIONAL	A2	0,06	4
PERHOTELAN	A24	0,05	5
ILMU POLITIK	A1	0,05	6
ILMU HUKUM	A6	0,05	7
PARIWISATA	A13	0,05	8
ILMU KOMUNIKASI	A5	0,05	9
SOSIOLOGI	A4	0,04	10
SASTRA INDONESIA	A8	0,04	11
TEKNIK INFORMATIKA	A20	0,04	12
SISTEM INFORMASI	A21	0,04	13
AGROTEKNOLOGI	A19	0,04	14
BAHASA KOREA	A10	0,04	15
BIOLOGI	A18	0,03	16
SASTRA JEPANG	A9	0,03	17
ILMU ADMINISTRASI NEGERA	A3	0,03	18
AKUNTANSI	A12	0,03	19
MANAGEMENT	A11	0,03	20
FISIKA	A14	0,02	21
TEKNIK FISIKA	A15	0,02	22
TEKNIK ELEKTRO	A16	0,02	23
TEKNIK MESIN	A17	0,02	24

3.3 Testing phase

Ranking criteria are sorted by the greatest weight value to the smallest. Here is a ranking of each respective methods:

Table 8
Results of ranking each criterion

HASIL PERANKINGAN AHP				HASIL PERANKINGAN TOPSIS			
DATA ALTERNATIF		NILAI	RANK	DATA ALTERNATIF		NILAI	RANK
SASTRA INGGRIS	A7	0,07	1	AGROTEKNOLOGI	V19	0,58	1
KEPERAWATAN	A22	0,07	2	BIOLOGI	V18	0,58	2
KEBIDANAN	A23	0,07	3	KEPERAWATAN	V22	0,58	3
HUBUNGAN INTERNASIONAL	A2	0,06	4	KEBIDANAN	V23	0,54	4
PERHOTELAN	A24	0,05	5	AKUNTANSI	V12	0,53	5
ILMU POLITIK	A1	0,05	6	ILMU ADMINISTRASI NEGERA	V3	0,48	6
ILMU HUKUM	A6	0,05	7	MANAGEMENT	V11	0,48	7
PARIWISATA	A13	0,05	8	FISIKA	V14	0,42	8
ILMU KOMUNIKASI	A5	0,05	9	TEKNIK ELEKTRO	V16	0,42	9
SOSIOLOGI	A4	0,04	10	TEKNIK FISIKA	V15	0,42	10
SASTRA INDONESIA	A8	0,04	11	TEKNIK INFORMATIKA	V20	0,42	11
TEKNIK INFORMATIKA	A20	0,04	12	TEKNIK MESIN	V17	0,42	12
SISTEM INFORMASI	A21	0,04	13	ILMU HUKUM	V6	0,39	13
AGROTEKNOLOGI	A19	0,04	14	ILMU POLITIK	V1	0,38	14
BAHASA KOREA	A10	0,04	15	BAHASA KOREA	V10	0,33	15
BIOLOGI	A18	0,03	16	HUBUNGAN INTERNASIONAL	V2	0,33	16
SASTRA JEPANG	A9	0,03	17	PARIWISATA	V13	0,33	17
ILMU ADMINISTRASI NEGERA	A3	0,03	18	SASTRA INDONESIA	V8	0,33	18
AKUNTANSI	A12	0,03	19	SASTRA INGGRIS	V7	0,33	19
MANAGEMENT	A11	0,03	20	SASTRA JEPANG	V9	0,33	20
FISIKA	A14	0,02	21	SISTEM INFORMASI	V21	0,33	21
TEKNIK FISIKA	A15	0,02	22	PERHOTELAN	V24	0,32	22
TEKNIK ELEKTRO	A16	0,02	23	SOSIOLOGI	V4	0,32	23
TEKNIK MESIN	A17	0,02	24	ILMU KOMUNIKASI	V5	0,27	24

Perankingan Setiap Metode





Figure 12. Comparison chart ranking Delivery Methods

Based on Table 8 and Figure 12 it can be seen that the same ranking in both of these methods in the data that is of Informatics alternative 20, and then to determine a more precise method by using a concordance rate calculation. To find out the result of the level of compliance (Tki), the first step is to find the average of each method using the formula (11)

$$X_i \text{TOPSIS} = \frac{9,88}{24} = 0,412$$

(1)

$$X_i \text{AHP} = \frac{1}{24} = 0,042$$

(2)

From the first step to get the result that for the smaller AHP method compared with TOPSIS method, then to find the percentage of these two methods are then followed by the second step is to calculate the level of conformity using the formula (10) as follows:

Table 9. The result of the level of conformity

Hasil Tingkat Kesesuaian	
METODE	NILAI
AHP	10,12%
TOPSIS	98,84%

Based on Table IX using the comparative results of testing the suitability level is 10.12% for and 98.84% AHP method for TOPSIS method. With provision for AHP smaller the percentage, the better and for the TOPSIS method the greater the percentage, the better [8]. This provision results from comparison of both methods is very appropriate, but more precise method to be used is TOPSIS method for conformance results higher due to approaching 100% the value of the percentage required is 1.16% while the AHP to be close to 0% value percentage needed is 10.12%.

3.4 Results Design

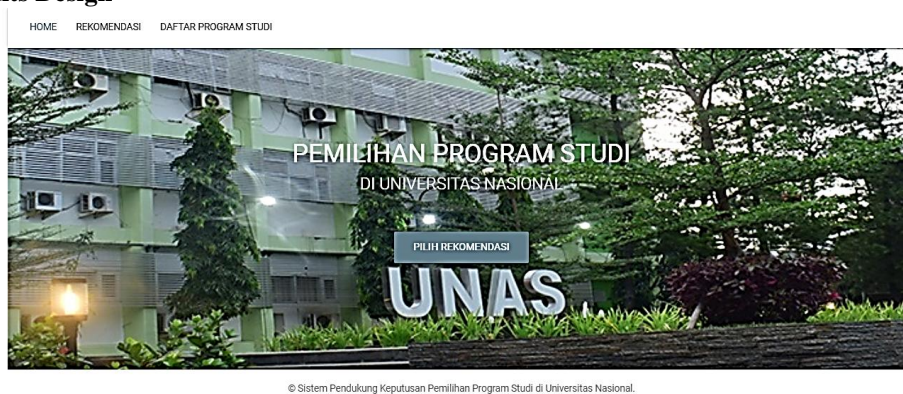


Figure 8. Main page

In figure 3 is the main view of the program that there are three main menu and the buttons, which display the Home, Recommendations, List button Select Program and Recommendations.





HOME REKOMENDASI DAFTAR PROGRAM STUDI

Masukan Rata-rata Nilai Raport

Nilai Bahasa Indonesia _____

Nilai Bahasa Inggris _____

Nilai Matematika _____

Nilai Sejarah _____

Nilai Biologi _____

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Figure 9. Recommended page

Figure 9 is a view from the menu on the button or select a recommendation, which is used to input data value obtained from the average value of the prospective student report cards.

HOME REKOMENDASI DAFTAR PROGRAM STUDI

Daftar Program Studi

Search: _____

No	Nama Program Studi	Bahasa Indonesia	Bahasa Inggris	Matematika	Sejarah	Biologi	Edit
1	Ilmu Politik	85	86	75	88	70	✖
2	Hubungan Internasional	88	89	80	83	75	✖
3	Ilmu Administrasi Negara	85	85	86	81	78	✖
4	Sosiologi	86	84	75	89	70	✖
5	Ilmu Komunikasi	88	88	80	78	75	✖
6	Ilmu Hukum	88	89	83	85	78	✖
7	Sastra Inggris	89	89	78	83	78	✖
8	Sastra Indonesia	89	88	78	84	78	✖
9	Sastra Jepang	87	86	78	83	75	✖

Figure 10. Page Program

In figure 7 is a list of courses page contains data minimum value of each of the courses are in the National University.

4. Conclusion

Based on the results of a comparative analysis between AHP and TOPSIS method for selecting a course at the National Universitas can be concluded:

- a. From manual calculations using AHP get consistent results, so that the data criteria can be used.
- b. TOPSIS of calculation applied to the program to get results that match the criteria of data that has been fed.

Of calculating the level of compatibility of the two metode this get comparative results are 98.84% for and 10.12% TOPSIS method for AHP. With provision for AHP the smaller the better, and to methods of TOPSIS the bigger the better. So that in this study a more precise method to be used is TOPSIS method for conformance results higher due to approaching 100% the value of the percentage required is 1.16% while the AHP to be close to 0% value of the required percentage is 10.12%.

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