Decision Making Model in Determining Prospective Scholarship Recipients with Analytic Network Process (ANP) Method

Muhamad Sidik Purba*[1], Erza Sofian[2]
[1,2]Sekolah Tinggi Ilmu Manajemen dan Ilmu Komputer ESQ
e-mail:*[1] m.sidik.p@students.esqbs.ac.id, [2]erza.sofian@esqbs.ac.id

Abstract : The low gross enrollment rate (GER) for high school graduates or equivalent to continue their education to a higher level makes the government or many private parties provide various types of scholarships, but there are several scholarships that are considered not right on target. Therefore, the ANP method is used as a method to solve the above problems, this method was chosen because of the ease of the concept and the resulting value is considered better than the AHP method.

This study shows that the criteria that influence the selection of prospective scholarship recipients are Extracurricular, Economic Disability Certificate and Parental Ownership. The most influential sub-criteria are academic achievement in the fields of science and technology and social welfare, ownership of orphaned parents and the next is international non-academic achievements. Then the recommended alternatives sequentially are A, C, and B. Then the impact that can be generated in this research can be seen from various perspectives, for scholarship providers can use the resulting criteria as reference material for decision making, And for the government, can provide the rule that every student from entering school is required to participate in at least one extracurricular, and besides that the government can also make it easier to manage the SKTM file for the benefit of scholarship preparation.

Keywords : Decision Support System, Scholarship, ANP, Analytical Network Process

1. INTRODUCTION

Indonesia is projected to transform into one of the developed countries, and to become one of the world's giants if it is supported by quality Human Resources (HR) and access to high education, said Effandy (2017). On the other hand, the condition of education in Indonesia, which is expected to be a driving force to produce superior human resources, is actually less relevant to the current conditions, this is evidenced by the Ministry of Education and Culture (Kemendikbud) through the Kompas News Portal saying that out of around 2-3 million graduates SMA and SMK each year, only 38 percent are submitted by universities (2020).

The many types of scholarships and the many options for prospective scholarship recipients make often the determination of scholarship recipients is not the same should be. Quoted from Republika (2015) states that there are still many cases of scholarship irregularities where prospective scholarship recipients who should not be eligible for scholarships can then get scholarships. Even in a report it was stated that there was an error in awarding scholarships at a campus in Bali, where 30 percent of scholarships at the campus were considered wrongly targeted, this was explained by Suadnyana (2019). In addition, the researchers also conducted interviews with one of the experts who have experience in determining the award of scholarships to high school graduates to continue their studies, they stated that the scholarship

provider would feel a loss if he made a mistake in determining the scholarship award, the loss could be tangible with the value of the loss equal to the amount funds that have been spent on the recipients of the scholarships that have been given, or intangible losses in the form of wrong agreements and opportunities. ANP which stands for Analytical Network Process is one of the decision-making methods that has many criteria or also known as Multi Criteria Decision Making which is widely applied as a way to solve various problems in the real world because of the consideration of complex and interrelated relationships between elements. decisions and the ability to apply quantitative and qualitative attributes simultaneously. Kheybari et al., (2020). Meanwhile, according to Saaty, ANP is a generalization of AHP that considers internal and external dependencies to prioritize alternatives (2005)

2. LITERATURE

ANP Basic Principles

The Analytical Network Process (ANP) is a generalization of the Analytical Hierarchy Process (AHP) which considers the dependencies both within (among elements in a cluster) and outside (among elements in different clusters) (saaty, 2005) to prioritize alternatives.

ANP is able to calculate complex relationships between decision elements by replacing the AHP structure with the ANP structure (Afzali et al., 2014). The ANP has all the positive features of the AHP, including simplicity, flexibility, simultaneous use of quantitative and qualitative criteria, and the ability to review consistency in assessments. ANP considers each problem as a network of criteria, sub-criteria and alternatives. All elements in a network can communicate with each other in any way. In other words, in a network, feedback and interconnection are possible between clusters (García-Melón et al., 2008)

2.1 The stages in ANP

In journals written (Syafei et al., 2016), ANP can be described in several steps as follows:

Step 1. Describe the problem to be solved and determine the various criteria of the expected solution.

Step 2. Create a weighting of each component. The table below is a weighting guideline that uses a quantitative scale of 1 to 9 to assess the comparison of the importance of an element to other elements (saaty & Vargas, 2013).

Table 1. Guidelines for scoring in pairwise comparisons

Level of Interest	**Meaning**	**Definition**
1	**Equally Important**	Both criteria have the same effect
3	**A Little More Important**	Favors one criterion over the other
5	**More Important**	The assessment is very partial to one of the criteria compared to its partner
7	**Very Important**	One of the criteria is very influentia and its dominance is clearly visible
9	**Absolute Very Important**	One of the criteria proved to be absolutly preferable compared to his partner
2,4,6,8		**If there is any doubt between the two adjacent Judgments**
Reverse	If criterion X has one of the above values when compared to criteria Y then criterion Y has opposite value when compared to criteria X	

Step 3. Then create a Pairwise Comparison Matrix which is shown in the table below describing the effect of each element on each criterion. Comparisons are made by decision makers by using the level of importance of a criterion as a reference. A scale of 1 to 9 is used for pairwise comparisons to measure the relative importance of one criterion with another.

Table 2 Matrix Pairwaise Comparison

C	A1	A2	A3	AN
A1	a11	a21	a13	a1N
A2	a12	a22	a32	a2N
AN	aN1	aN2	aN3	aNN

Matrix Pirwise Comparison is the result of a comparison between criteria against certain criteria (in this C)

Step 4. Determine the eigenvector of the matrix that was created in the third step. The eigenvectors are the priority weights of the matrix which are then used for the preparation of the supermatrix.

Step 5. Calculate the consistency ratio to state whether the assessment given is consistent or not. The consistency index (CI) of a comparison matrix is calculated using the formula:

CI = $CI = \frac{\boldsymbol{\lambda max - n}}{\mathbf{n-1}}$

$\boldsymbol{\lambda}$max= the largest eigenvalue of Matrix Pairwise Comparison n x n

n = number of items compared.

Consistency ratio is obtained by comparing the consistency index with the value of the random consistency index number (Random Index/RI, as follows:

Table 3. List of Random Consistency Index

Matirx Size	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
IR Value	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.59

A comparison matrix is said to be consistent if the CR value is not more than 10% (0.1). If the consistency ratio is getting closer to zero, it means the better the value and shows the consistency of the comparison matrix.

Step 6. Forming the Supermatrix, Supermatrix is composed of sub-matrix which is composed of a set of relationships between the two levels contained in the model. The eigenvectors obtained through pairwise comparison are placed in the supermatrix column which shows the effect by considering control criteria from the criteria of a component on a single element of the same or different components contained at the top of the supermatrix.

There are three stages of the supermatrix that must be completed in the ANP model, namely:

a. Unweighted supermatrix,

Contains the eigenvectors generated from the entire pairwise comparison matrix in the network. Each column in the unweighted supermatrix contains one eigenvector in each cluster, so that in total, one column will have an eigenvector sum of more than 1.

b. Weighted supermatrix

That is by multiplying each content of the unweighted supermatrix with their respective cluster weights.

c. Limiting supermatrix

By increasing the supermatrix continuously until the numbers in each column in one row are equal, then normalize the limiting supermatrix.

Step 7. Selection of the best alternative, after obtaining the value of each element in the limit matrix, the next step is to calculate the value of these elements according to the ANP model created.

2.2 Geometric Mean Calculation

To get one value from various assessments, we must unite the considerations with the calculation of the geometric mean/mean of the pairwise comparison assessment, with the formula: GM = $\sqrt[n]{X1xX2xX3x \ldots Xn}$

Information :

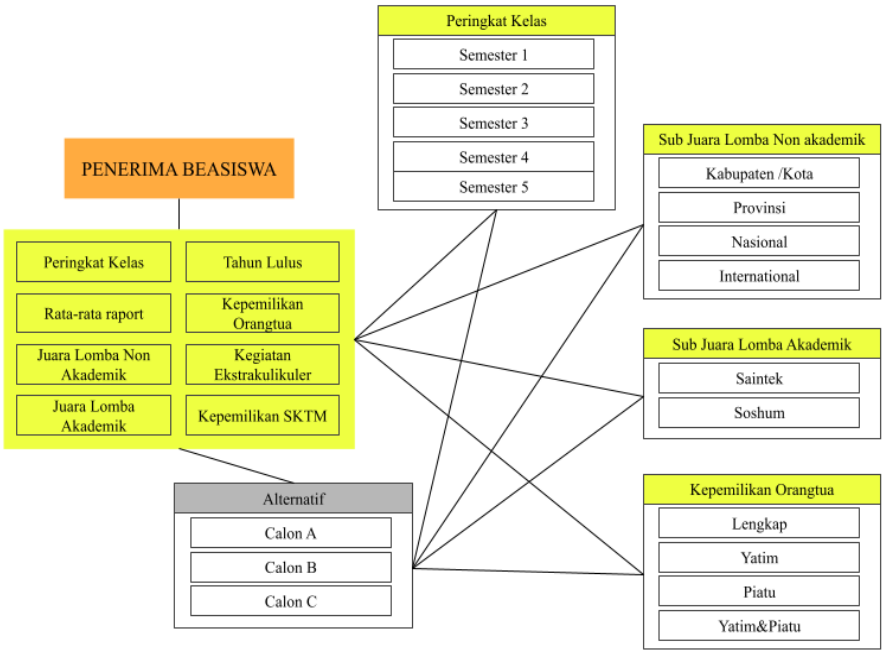
GM = Geometric Means
X = 1st Rating – n
N = Number of n (Order)

a. If a group participates in the assessment process, all members of the group should try to reach consensus in their assessment as much as possible. However, if the consensus cannot be reached, the Geometric Mean of can be used to find the value of agreement between them.

b. Geometric Mean calculation is carried out, of course reasonable, namely because the "reciprocality" characteristic of the matrix used in the network analysis process must be maintained.

3. METHOD

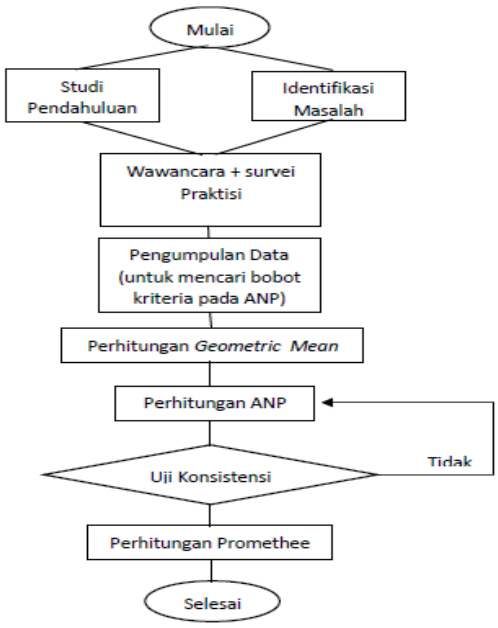
This ANP method uses a qualitative descriptive approach. Descriptive research method aims to describe then explain and validate social habits that are the object of research. Descriptive research method is a narrative research used to make qualitative or qualitative research Soendari (2010), besides that Hidayat (2017) also states that Descriptive Research is a method that aims to make a systematic, factual, and accurate description of the facts.
The figure below shows that the lines in the above relationship are alternating, or in ANP theory it is called feedback. From the model example above, it is shown that the goal is an orange box, the criteria are yellow, the sub criteria have a yellow header color and the sub has white color, and the alternative is gray and the alternative choice is white. After knowing the purpose of the criteria and its alternatives.



Pic 1. ANP Model

3.1 Research methodology

1. Preliminary Study & Problem Identification, 2. Practitioner Interview & Survey, 3. ANP Data Collection, 4. ANP Calculation, 5. Consistency Test, 6. Promethee Calculation



Pic 2. Research Steps

3.2 Data Sources

Informants in this study refer to people who participate in determining prospective scholarship recipients at universities, the number of informant used in this study were 5 people. And the determination of informants is based on involvement in decision-making considerations in choosing prospective students who will be given scholarships.

Table 4.Informan / Data resource

Kode	Nama	Institusi	Akreditasi Institusi	Lama Kerja
R1	Fakhry Barly	STIE Tazkia	B	2 Tahun
R2	Syaiful Anwar	STIE Dewantara	Baik	4 Tahun
R3	Sri Lestari Prasilowati	STIE IPWIJA	B	19 Tahun
R4	Fahrurozy Darmawan	Universitas Pancasila	A	6 Tahun
R5	Akhmad Mustaqim	Universitas Terbuka	B	2 Tahun

3.3 Data analysis techniques

Data analysis in this study uses the ANP calculation method which is operated through the Super Decision application.
The following is an example of a calculation to find the eigenvector and eigenvalue of the criteria cluster.

Table 5. Pairwise Comparison

Kluster	Elemen 1	Elemen 2	Elemen 3
Elemen 1	1/1	1/2	3/1
Elemen 2	2/1	1/1	4/1
Eelmen 3	1/3	1/4	1/1

Non-Academic is twice as important as Academic, Socio-Economic 1/3 times more important than Academic, and Socio-Economic 1/4 importance of Non-Academic. Then after that the value of the relationship between the pairwaise is converted to decimal, and the result is as below.

Table 6. Pairwise Desimal

Kluster	Elemen 1	Elemen 2	Elemen 3
Elemen 1	1.00	.500	3.00
Elemen 2	2.00	1.00	4.00
Eelmen 3	0.333	0.250	1.00

3.4 Determining Eigen Value

Then to make feedback on the network, the matrix needs to be multiplied by the matrix itself, and the result is as follows.

Table 7. Invers / feedback

Invers / Feedback			
Kluster	Elemen 1	Elemen 2	Elemen 3
Elemen 1	2.999	1.750	8.000
Elemen 2	5.332	3.000	14.000
Eelmen 3	1.166	0.667	2.999
Jumlah	9.497	5.417	24.999

Then to normalize the above matrix, we need to divide the values in the matrix by their sum. And from the table above, the following is the normalization form.

Table 8. Normalisation

Normalasasi			
Kluster	Elemen 1	Elemen 2	Elemen 3
Elemen 1	0.316	0.323	0.320
Elemen 2	0.561	0.554	0.560
Eelmen 3	0.123	0.123	0.120
Jumlah	1.000	1.000	1.000

After that we need to add them aside, and then divide by the sum of the results, and the result is called the Eigen value.

Table 9. Eigen Vector

Normalasasi				Jumlah	Eigen Value
Kluster	Elemen 1	Elemen 2	Elemen 3		
Elemen 1	0.316	0.323	0.320	0.959	0.320
Elemen 2	0.561	0.554	0.560	1.675	0.558
Eelmen 3	0.123	0.123	0.120	0.366	0.122
Jumlah	1.000	1.000	1.000	3.000	1.000

After that we have to do the same process for each cluster in the model above to get the Eigen value for each element from all clusters

3.5 Determining the Ratio Scale

At this stage there are several steps, the following are steps to calculate the maximum , by multiplying the paired matrix that has not been normalized by the eigenvector. Calculate the Maximum Eigen value, as follows:

1.00	0.500	3.000		0.320		0.9646
2.00	1.000	4.000	X	0.558	=	1.6854
0.333	0.250	1.000		0.122		0.3680

Then the product of the above is divided by the eigenvector.

0.9646	Div	0.320	= 3.0180
1.6854	Div	0.558	= 3.0180
0.3680	Div	0.122	= 3.0179

λmax = Number of Elements / n (Number of Criteria)

= 3.0180 + 3.0180 + 3.0179 / 3 = 3.0180

To state whether the assessment given is consistent or not. Consistency Index (CI) is a comparison matrix using the following formula :

$CI = \lambda max - n / n - 1$

CI = 3.0180 – 3 / 3 – 1 = 0.0090

Then after that we need to calculate the consistency ratio (CR) by dividing the CI by the Random Index, the random index table is in previous chapter. A comparison matrix is said to be consistent if the CR value is not more than 10% or 0.1. If the consistency ratio is getting closer to zero, it means the better the value and shows the consistency of the comparison matrix.

CR = CI / RI

CR = 0.0090 / 0.58 = 0.0173 . If the CR value has been met then we can arrange the supermatrix

3.6 Forming the Supermatrix

3.6.1 Unweighted supermatrix

Is a matrix with a complete set of eigenvectors from all pairwise comparison matrices in each relationship. Each column in this supermatrix contains one eigenvector in each cluster, so that one column will have an eigenvector sum of more than 1.

3.6.2 Weighted supermatrix ,

This supermatrix is generated by multiplying each unweighted content by its respective cluster weight.

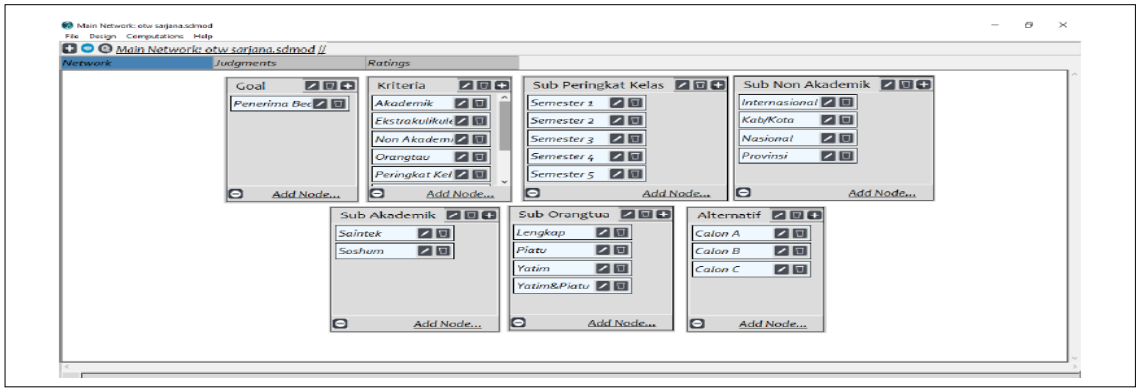
3.6.3 Limiting Supermatrix,

Is the result of the power of the supermatrix continuously so that the number from each column of the result is the same in one row, then we can normalize the limiting super matrix.

4. ANLYSIS AND DICUSSION

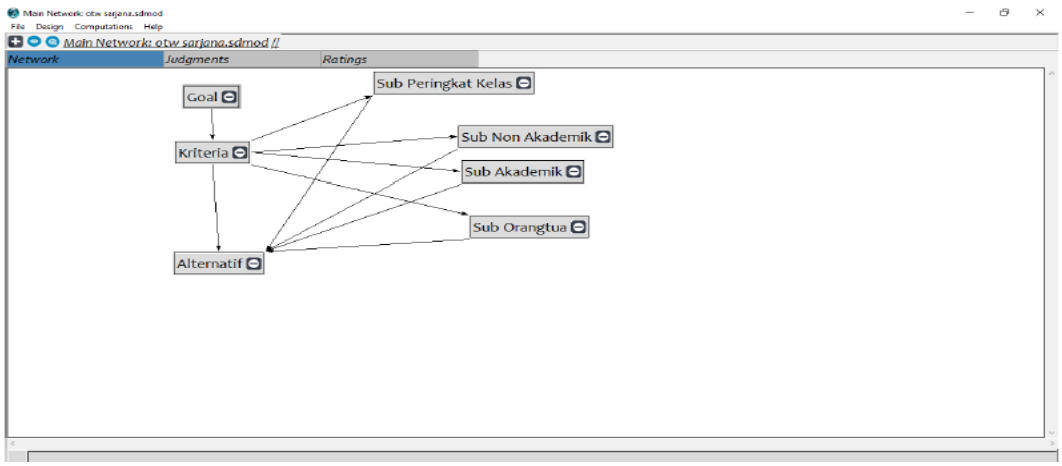
4.1 Pengisian data pada Super Decision

Untuk mengoperasikan *superdecison* pertama kita perlu mendownload dan menginstalnya pada laptop atau pc kita, kemudian diinstal, untuk membut data seperti pada tampilan diatas, kita perlu membuka aplikasi nyang telah kita install kemudian *create new cluster*, setelah itu pada bagian bawah kiri kluster klik tombol *add node* untuk menambahkan isinya.



Pic 4. Kluster Kriteria , Subkriteria dan Alternatif

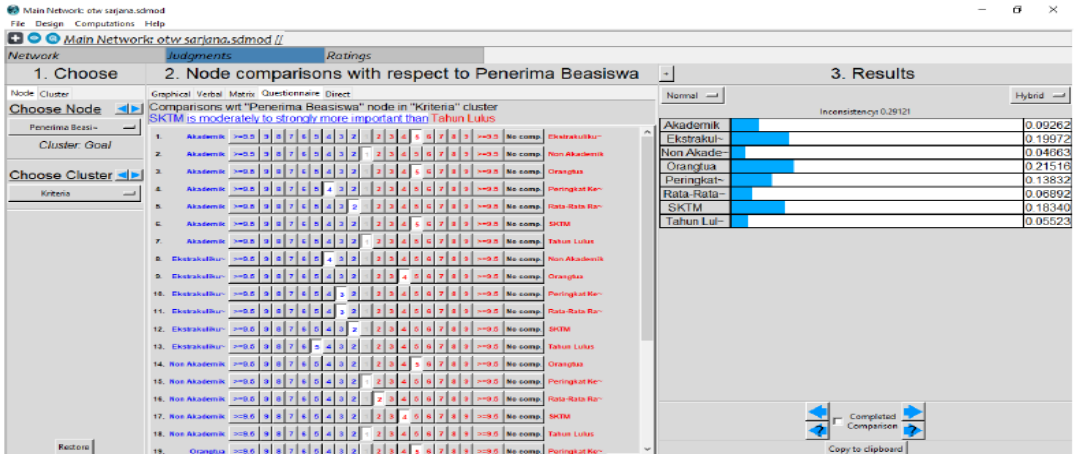
4.2 Design Network



Pic 5. Inter-Cluster Network

After creating the cluster and its various contents, be it criteria, sub-criteria and alternatives, we need to connect them by drawing lines between clusters that need to be connected.

4.3 Input Questioner



Pic 6. Filling out the questionaire in superdecision

After completing connecting between clusters, we need to go to the judgment section to fill in some comparison questions and their level of importance, we can fill this answer with the results of the geometric mean calculation from the experts that we have calculated previously.

4.4 Unweighted Supermatrix

Main Network: otw sarjana.sdmod: Unweighted Super Matrix

Clusters	Nodes	Calon A	Calon B	Calon C	Penerima Beasiswa	Akademik	Ekstrakulikuler	Non Akademik	Orangtua	Peringkat Kelas	Rata-Rata Raport	SKTM	Tahun Lulus	Swintek	Soshum	Internasional
Alternatif	Calon A	0.000000	0.000000	0.000000	0.000000	0.333333	0.200000	0.333333	0.333333	0.400000	0.259921	0.327480	0.000000	0.666667	0.166667	0.333333
	Calon B	0.000000	0.000000	0.000000	0.000000	0.333333	0.400000	0.333333	0.333333	0.200000	0.412599	0.259921	0.000000	0.166667	0.166667	0.333333
	Calon C	0.000000	0.000000	0.000000	0.000000	0.333333	0.400000	0.333333	0.333333	0.400000	0.327480	0.412599	0.000000	0.166667	0.666667	0.333333
Goal	Penerima Beasiswa	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Kriteria	Akademik	0.142857	0.142857	0.142857	0.092617	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Ekstrakulikuler	0.142857	0.142857	0.142857	0.199724	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Non Akademik	0.142857	0.142857	0.142857	0.046625	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Orangtua	0.142857	0.142857	0.142857	0.215161	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Peringket Kelas	0.142857	0.142857	0.142857	0.138320	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Rata-Rata Raport	0.142857	0.142857	0.142857	0.068918	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	SKTM	0.142857	0.142857	0.142857	0.183405	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Tahun Lulus	0.000000	0.000000	0.000000	0.055230	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sub Akademik	Swintek	0.500000	0.500000	0.500000	0.000000	0.500000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Soshum	0.500000	0.500000	0.500000	0.000000	0.500000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sub Non Akademik	Internasional	0.250000	0.250000	0.250000	0.000000	0.000000	0.000000	0.516715	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Kab/Kota	0.250000	0.250000	0.250000	0.000000	0.000000	0.000000	0.081279	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Nasional	0.250000	0.250000	0.250000	0.000000	0.000000	0.000000	0.260036	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Provinsi	0.250000	0.250000	0.250000	0.000000	0.000000	0.000000	0.141970	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sub Orangtua	Lengkap	0.250000	0.250000	0.250000	0.000000	0.000000	0.000000	0.000000	0.064746	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Piatu	0.250000	0.250000	0.250000	0.000000	0.000000	0.000000	0.000000	0.184316	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Yatim	0.250000	0.250000	0.250000	0.000000	0.000000	0.000000	0.000000	0.184316	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Yatim&Piatu	0.250000	0.250000	0.250000	0.000000	0.000000	0.000000	0.000000	0.566621	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sub Peringket Kelas	Semester 1	0.200000	0.200000	0.200000	0.000000	0.000000	0.000000	0.000000	0.000000	0.061767	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Semester 2	0.200000	0.200000	0.200000	0.000000	0.000000	0.000000	0.000000	0.000000	0.097254	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Semester 3	0.200000	0.200000	0.200000	0.000000	0.000000	0.000000	0.000000	0.000000	0.159923	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Semester 4	0.200000	0.200000	0.200000	0.000000	0.000000	0.000000	0.000000	0.000000	0.262518	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Pic 7. Unweighted Supermatrix

Contains the Eigen values of each pairwise comparison that has been done, then combined and the result is as shown above

5.4 Weigthed Supermatrix

Main Network: otw sarjana.sdmod: Unweighted Super Matrix

Clusters	Nodes	Calon A	Calon B	Calon C	Penerima Beasiswa	Akademik	Ekstrakulikuler	Non Akademik	Orangtua	Peringkat Kelas	Rata-Rata Raport	SKTM	Tahun Lulus	Saintek	Soshum	Internasional
Alternatif	Calon A	0.000000	0.000000	0.000000	0.000000	0.333333	0.200000	0.333333	0.333333	0.400000	0.259921	0.327480	0.000000	0.666667	0.166667	0.333333
	Calon B	0.000000	0.000000	0.000000	0.000000	0.333333	0.400000	0.333333	0.333333	0.200000	0.412599	0.259921	0.000000	0.166667	0.166667	0.333333
	Calon C	0.000000	0.000000	0.000000	0.000000	0.333333	0.400000	0.333333	0.333333	0.400000	0.327480	0.412599	0.000000	0.166667	0.666667	0.333333
Goal	Penerima Beasiswa	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Kriteria	Akademik	0.142857	0.142857	0.142857	0.092617	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Ekstrakulikuler	0.142857	0.142857	0.142857	0.199724	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Non Akademik	0.142857	0.142857	0.142857	0.046625	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Orangtua	0.142857	0.142857	0.142857	0.215161	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Peringkat Kelas	0.142857	0.142857	0.142857	0.138320	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Rata-Rata Raport	0.142857	0.142857	0.142857	0.068918	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	SKTM	0.142857	0.142857	0.142857	0.183405	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Tahun Lulus	0.000000	0.000000	0.000000	0.055230	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sub Akademik	Saintek	0.500000	0.500000	0.500000	0.000000	0.500000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Soshum	0.500000	0.500000	0.500000	0.000000	0.500000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sub Non Akademik	Internasional	0.250000	0.250000	0.250000	0.000000	0.000000	0.000000	0.516715	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Kab/Kota	0.250000	0.250000	0.250000	0.000000	0.000000	0.000000	0.081279	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Nasional	0.250000	0.250000	0.250000	0.000000	0.000000	0.000000	0.260036	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Provinsi	0.250000	0.250000	0.250000	0.000000	0.000000	0.000000	0.141970	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sub Orangtua	Lengkap	0.250000	0.250000	0.250000	0.000000	0.000000	0.000000	0.000000	0.064746	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Piatu	0.250000	0.250000	0.250000	0.000000	0.000000	0.000000	0.000000	0.184316	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Yatim	0.250000	0.250000	0.250000	0.000000	0.000000	0.000000	0.000000	0.184316	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Yatim&Piatu	0.250000	0.250000	0.250000	0.000000	0.000000	0.000000	0.000000	0.566621	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sub Peringkat Kelas	Semester 1	0.200000	0.200000	0.200000	0.000000	0.000000	0.000000	0.000000	0.000000	0.061767	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Semester 2	0.200000	0.200000	0.200000	0.000000	0.000000	0.000000	0.000000	0.000000	0.097254	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Semester 3	0.200000	0.200000	0.200000	0.000000	0.000000	0.000000	0.000000	0.000000	0.159923	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Semester 4	0.200000	0.200000	0.200000	0.000000	0.000000	0.000000	0.000000	0.000000	0.262518	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
	Semester 5	0.200000	0.200000	0.200000	0.000000	0.000000	0.000000	0.000000	0.000000	0.418539	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

Pic 8. Weighted Supermatrix

4.6 Limmiting Supermatrix

Main Network: otw sarjana.sdmod: Limit Matrix

Clusters	Nodes	Calon A	Calon B	Calon C	Penerima Beasiswa	Akademik	Ekstrakulikuler	Non Akademik	Orangtua	Peringkat Kelas	Rata-Rata Raport	SKTM	Tahun Lulus	Saintek	Soshum	Internasional
Alternatif	Calon A	0.188850	0.188850	0.188850	0.188850	0.188850	0.188850	0.188850	0.188850	0.188850	0.188850	0.188850	0.000000	0.188850	0.188850	0.188850
	Calon B	0.133620	0.133620	0.133620	0.133620	0.133620	0.133620	0.133620	0.133620	0.133620	0.133620	0.133620	0.000000	0.133620	0.133620	0.133620
	Calon C	0.163641	0.163641	0.163641	0.163641	0.163641	0.163641	0.163641	0.163641	0.163641	0.163641	0.163641	0.000000	0.163641	0.163641	0.163641
Goal	Penerima Beasiswa	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Kriteria	Akademik	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.000000	0.013889	0.013889	0.013889
	Ekstrakulikuler	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.000000	0.013889	0.013889	0.013889
	Non Akademik	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.000000	0.013889	0.013889	0.013889
	Orangtua	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.000000	0.013889	0.013889	0.013889
	Peringkat Kelas	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.000000	0.013889	0.013889	0.013889
	Rata-Rata Raport	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.000000	0.013889	0.013889	0.013889
	SKTM	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.013889	0.000000	0.013889	0.013889	0.013889
	Tahun Lulus	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sub Akademik	Saintek	0.052083	0.052083	0.052083	0.052083	0.052083	0.052083	0.052083	0.052083	0.052083	0.052083	0.052083	0.000000	0.052083	0.052083	0.052083
	Soshum	0.052083	0.052083	0.052083	0.052083	0.052083	0.052083	0.052083	0.052083	0.052083	0.052083	0.052083	0.000000	0.052083	0.052083	0.052083
Sub Non Akademik	Internasional	0.027894	0.027894	0.027894	0.027894	0.027894	0.027894	0.027894	0.027894	0.027894	0.027894	0.027894	0.000000	0.027894	0.027894	0.027894
	Kab/Kota	0.024870	0.024870	0.024870	0.024870	0.024870	0.024870	0.024870	0.024870	0.024870	0.024870	0.024870	0.000000	0.024870	0.024870	0.024870
	Nasional	0.026111	0.026111	0.026111	0.026111	0.026111	0.026111	0.026111	0.026111	0.026111	0.026111	0.026111	0.000000	0.026111	0.026111	0.026111
	Provinsi	0.025291	0.025291	0.025291	0.025291	0.025291	0.025291	0.025291	0.025291	0.025291	0.025291	0.025291	0.000000	0.025291	0.025291	0.025291
Sub Orangtua	Lengkap	0.024755	0.024755	0.024755	0.024755	0.024755	0.024755	0.024755	0.024755	0.024755	0.024755	0.024755	0.000000	0.024755	0.024755	0.024755
	Piatu	0.025586	0.025586	0.025586	0.025586	0.025586	0.025586	0.025586	0.025586	0.025586	0.025586	0.025586	0.000000	0.025586	0.025586	0.025586
	Yatim	0.025586	0.025586	0.025586	0.025586	0.025586	0.025586	0.025586	0.025586	0.025586	0.025586	0.025586	0.000000	0.025586	0.025586	0.025586
	Yatim&Piatu	0.028240	0.028240	0.028240	0.028240	0.028240	0.028240	0.028240	0.028240	0.028240	0.028240	0.028240	0.000000	0.028240	0.028240	0.028240
Sub Peringkat Kelas	Semester 1	0.019873	0.019873	0.019873	0.019873	0.019873	0.019873	0.019873	0.019873	0.019873	0.019873	0.019873	0.000000	0.019873	0.019873	0.019873
	Semester 2	0.020120	0.020120	0.020120	0.020120	0.020120	0.020120	0.020120	0.020120	0.020120	0.020120	0.020120	0.000000	0.020120	0.020120	0.020120
	Semester 3	0.020555	0.020555	0.020555	0.020555	0.020555	0.020555	0.020555	0.020555	0.020555	0.020555	0.020555	0.000000	0.020555	0.020555	0.020555
	Semester 4	0.021267	0.021267	0.021267	0.021267	0.021267	0.021267	0.021267	0.021267	0.021267	0.021267	0.021267	0.000000	0.021267	0.021267	0.021267
	Semester 5	0.022351	0.022351	0.022351	0.022351	0.022351	0.022351	0.022351	0.022351	0.022351	0.022351	0.022351	0.000000	0.022351	0.022351	0.022351

Pic 9. Limiting Super Matriz

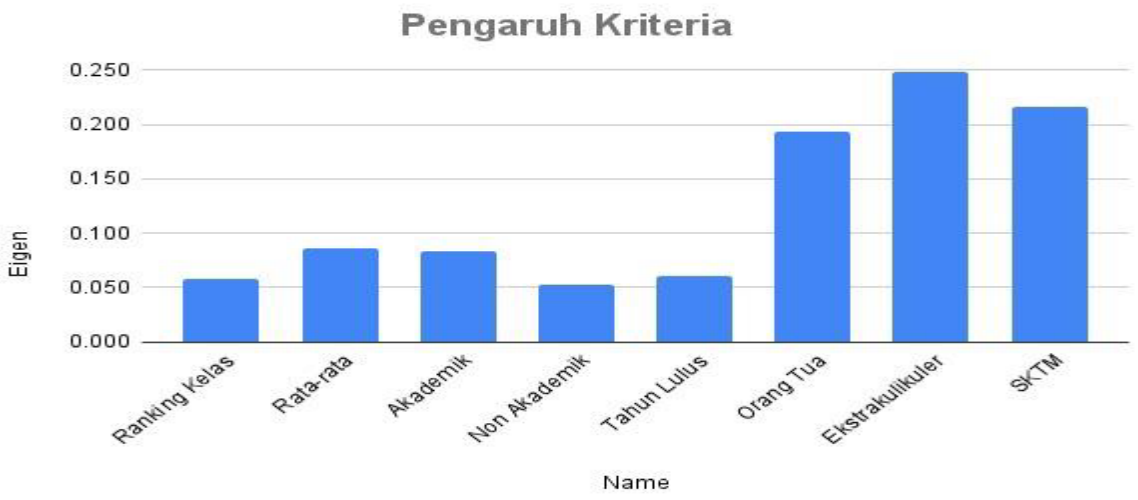
By increasing the unweighted super matrix continuously until the numbers in each column in one row are equal, then normalize the limiting super matrix

Table 10. Result Sintesa

Name	***Normalized By Cluster***	***Limiting***
Calon A	0.38849	0.188850
Calon B	0.27488	0.133620
Calon C	0.33663	0.163641
Penerima Beasiswa	0.00000	0.000000
Akademik	0.14286	0.013889
Ekstrakulikuler	0.14286	0.013889
Non Akademik	0.14286	0.013889
Orangtua	0.14286	0.013889
Peringkat Kelas	0.14286	0.013889
Rata-Rata Raport	0.14286	0.013889
SKTM	0.14286	0.013889
Tahun Lulus	0.00000	0.000000
Saintek	0.50000	0.052083

Soshum	0.50000	0.052083
Internasional	0.26778	0.027894
Kab/Kota	0.23875	0.024870
Nasional	0.25067	0.026111
Provinsi	0.24280	0.025291
Lengkap	0.23765	0.024755
Piatu	0.24562	0.025586
Yatim	0.24562	0.025586
Yatim&Piatu	0.27110	0.028240
Semester 1	0.19078	0.019873
Semester 2	0.19315	0.020120
Semester 3	0.19733	0.020555
Semester 4	0.20416	0.021267
Semester 5	0.21457	0.022351

4.7 Result Sintesa

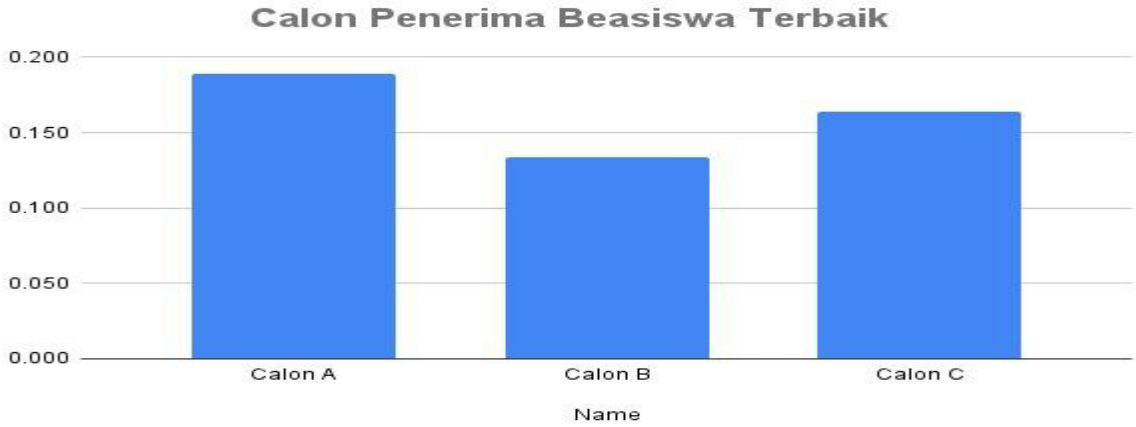


Pic 10. Magnitude of Influence Criteria

From the results above, we can see that the highest criteria are extracurricular, followed by SKTM ownership and parental ownership.

Pic 11. Magnitude of Influence Subcriteria

From the above results, we can see that the highest sub-criteria is academic achievement, both in science and technology and social welfare, followed by ownership of orphaned parents, and the third is international non-academic achievement.

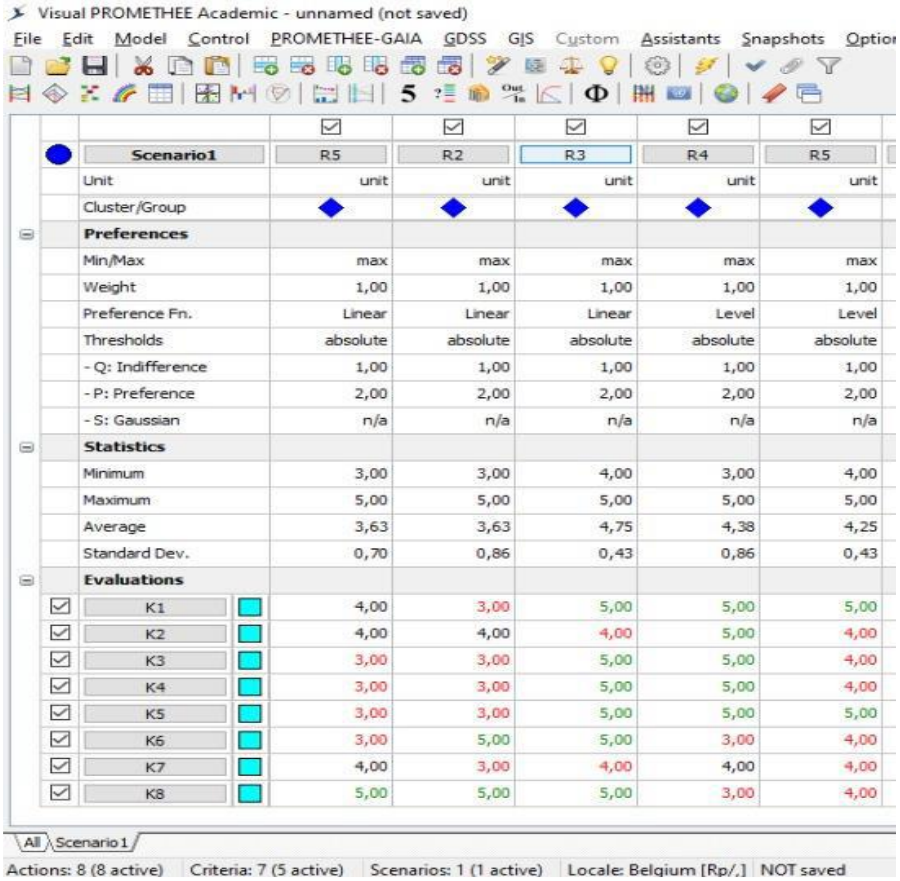


Pic 12. Candidata scholarship recepint

While the recommended results in this study were the three candidates tested were candidate A, then candidate C and the last candidate was candidate B.

4.8 Promethee Analysis

In this promethee calculation, the researcher uses the Visual Promethee application, first we can download this application via a web browser, then install it, after that we can open the application and fill in the data according to the data we have



Pic 13. Promethee Data Filling

And here are the ranking results of the 8 criteria being compared, K8 means SKTM ownership, K2 means average report cards, while K1 is class rank.

PROMETHEE Flow Table

Rank	action	Phi	Phi+	Phi-
1	K8	0,1143	0,2571	0,1429
2	K2	0,0571	0,0571	0,0000
3	K1	0,0000	0,0571	0,0571
4	K3	-0,0286	0,0571	0,0857
4	K4	-0,0286	0,0571	0,0857
4	K5	-0,0286	0,0571	0,0857
7	K6	-0,0286	0,1429	0,1714
8	K7	-0,0571	0,0000	0,0571

Pic 13. The Best Ranking Visual

5 CONCLUSION

Based on the results of the discussion in chapter IV, then a conclusion and suggestions will be drawn that relate to the problems discussed. The conclusions that can be drawn after performing calculations and data processing are as follows:

1. From this study, it can be concluded that the ANP (Analytical Network Process) method can be applied to support decision making in the selection of prospective scholarship recipients, by determining the main priority of several criteria and alternatives available for making a decision. Calculations using the ANP method to determine the priority of choice are very dependent on giving weights to the existing criteria and alternatives, at the stage of evaluating the criteria and alternatives that will produce priority values.
2. Results The criteria factors that influence the selection of scholarship recipients are Extracurricular with a weight of = 0.249, then SKTM with a weight of 0.216, and the third is Parental Ownership with a weight of = 0.194.
3. Then the sub-criteria with the highest weight is academic achievement with a weight of = 0.520 for both the field of science and technology and social welfare, then followed in the next position is the sub-criteria for ownership of orphaned & orphaned parents with a weight of = 0.028 and the next is international non-academic achievement with a weight of = . 027.
4. Then based on the candidate who made the alternative in the ANP calculation, the best candidate who is most suitable to get the scholarship is candidate A with a weight of = 0188, then candidate C = 0.163 and the last candidate B with a weight of = 0.133.

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