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Optimizing Scholarship Selection: A Decision Support System Approach Using the Analytical Hierarchy Process

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ABSTRACT

Scholarship is the provision of financial assistance to individuals, which aims to be used for the continuity of the education pursued. Per the scholarship provider's regulations, criteria are needed to determine who will be selected to receive the scholarship. Scholars are distributed by schools or other parties that organize scholarships to help someone who is underprivileged or who has achieved something during his studies. A decision support system is needed to help determine someone who deserves a scholarship. This system can analyze academic performance, financial needs, extracurricular activities, and personal statements to determine the most deserving candidates. By using a decision support system, scholarship providers can ensure that the scholarships are given to individuals who benefit the most from the financial assistance and are dedicated to their education. Ultimately, scholarships aim to help individuals overcome financial barriers and achieve their academic and career goals.

Keywords: Scholarship Determination; Decision Support System; Analytical Hierarchy Process (AHP) Method

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1. INTRODUCTION

Good Good universities generally have assistance programs in the form of scholarships for students who lack funds to get a proper education. Scholarships are a form of financial assistance provided to individuals to help them obtain an education. Scholarship recipients are generally underprivileged people but have achievements in academic and non-academic activities held during their studies. With the existence of scholarships, it is hoped that all students can complete their studies on time without funding obstacles.
Scholarships must be given to the right people by measuring various criteria each prospective scholarship recipient must meet. The problem is that determining which students deserve a scholarship takes work. This is due to the large number of applicants and specific criteria the institution has determined. On the other hand, the funds provided to support the scholarship program are usually limited according to the institution's provisions. Slow data collection because it must be inputted manually by the institution is also an obstacle in measuring scholarship criteria.

In this digital era, to overcome the problems that occur, a system is needed that can help prospective scholarship recipients who can process the inputted data precisely and quickly and make it easier for institutions to make decisions. Previous research can be used as inspiration in making new research. The first research conducted by Ridlan (2018) in a study entitled "Use of a Decision Support System Using the Analytical Hierarchy Process (A.H.P.) Method in Selecting Scholarship Recipient Eligibility" in this study produced a decision support system where this system can assist in making decisions to select scholarship recipients using

the A.H.P. method. The A.H.P. method is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology. Second, research conducted by Risa Helilintar et al. (2016) in a study entitled "Application of S.A.W. and Fuzzy Methods in Scholarship Acceptance Decision Support Systems" resulted in a decision support system that uses two methods, namely Fuzzy Tahani and S.A.W. where Tahani Fuzzy Logic as an input value in S.A.W. and the output recommends scholarship recipients. The Fuzzy Logic method is a form of many-valued logic that deals with approximate reasoning. Both studies highlight the importance of decision support systems in selecting scholarship recipients, as they can provide a structured and objective approach to decision-making. By incorporating methods such as A.H.P. and Fuzzy Logic, scholarship committees can ensure that their selection process is fair, transparent, and based on relevant criteria. These systems ultimately aim to optimize the distribution of scholarships to deserving candidates, maximizing the impact of financial aid in the academic community. A 2016). The third research conducted by Prince (2010) in this study produced a decision support system using the A.H.P. and T.O.P.S.I.S. methods. The T.O.P.S.I.S. method, or Technique for Order Preference by Similarity to Ideal Solution, is a multi-criteria decision analysis method. The resulting SPK can solve multicriteria problems effectively, but these two methods have their difficulty levels (Manurung 2010).

Based on various existing problems, this research proposes using a decision support system (SPK) to determine prospective scholarship recipients using the analytical hierarchy process (A.H.P.) method

2. RESEARCH METHOD

The method that will be used in making this SPK is the Analytical Hierarchy Process (AHP). AHP is a technique to support the decision-making process that aims to determine the best choice from several alternatives that can be taken. AHP is a method developed by Thomas L. Saaty, a mathematician at the University of Pittsburgh in the United States around the 1970s, and has undergone many improvements and developments to date. The advantage of AHP is that it can provide a comprehensive and rational framework in structuring decision-making problems. In addition, AHP is also one of the methods that can be used to solve Multi Criteria Decision Making (MCDM) problems. Zimmermann suggests that MCDM is a decision-making method to determine the best alternative from a number of alternatives based on several specific criteria (Ahmad 2018).

The structure of the AHP method is divided into 3 hierarchies, namely objectives, criteria, and alternatives. The calculation concept of AHP uses a paired comparison matrix to produce weighted values of criteria and alternatives.

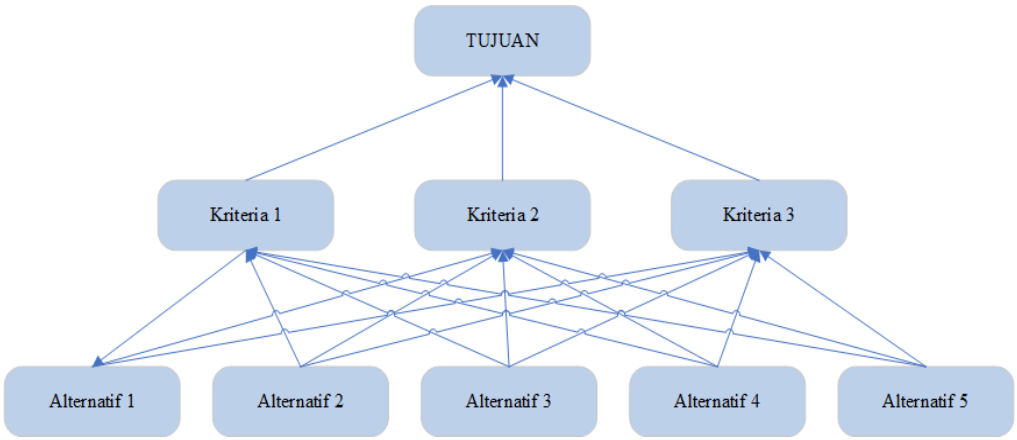

Figure 1. Hierarchical structure of AHP method

3.1. AHP Method Steps

In using the AHP method there are principles that must be understood, namely.

1. Creating a Hierarchy

Hierarchies are complex systems that can be understood by breaking them down into supporting elements and combining them.

2. Criteria and Alternative Assessment

Criteria and alternatives will be compared in pairs and determined the priority of elements using a scale of 1 to 9 to give an opinion on how important the compared elements are, the rating scale also has the following meaning:

Table 1. Element Comparison Scale

Intensity of Interest	Description
1	Both Elements Are Equally Important
3	One element is less important than the others
5	One element is more important than the others
7	One element is clearly more absolutely essential than the others
9	One element is more important than the other
2,4,6,8	Values between two adjacent considerations

3. Determining Priorities

Each criterion and alternative will be pairwise compared, weights and values will be calculated with a matrix.

4. Calculating Consistency

When making decisions it is important to pay attention to how good the level of consistency is because low consistency will only make it difficult to make the right decision, as for what is done in calculating consistency, namely:

a. Multiply the value in the first column by the priority of the first element and so on.
b. Summarize each row in 1 column.
c. Row sum value divided by relative priority elements.
d. The quotient is then divided by the number of criteria and will result in λ max or maximum eigen.

5. Find the *Consistency Index (CI*) value

Calculating the *Consistency Index* is done using the formula.

$$CI = (\lambda\, maks - n)/(n-1)$$

6. Finding the *Consistency Ratio (CR)* value

Calculate the *Consistency Ratio* using the formula.

$$CR = CI/IR$$

IR is the *random consistency index.*

The value of IR can be seen in the following table.

Number of criteria	IR Value
1,2	0,00
3	0,58
4	1,90
5	1,12
6	1,24
7	1,32
8	1,41
9	1,45
10	1,49
11	1,51
12	1,48
13	1,56
14	1,57
15	1,59

The value of IR is determined by the number of criteria used.

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7. Checking Hierarchy Consistency

After getting the CR value, then check the CR value where if the CR value is <0.1 then the calculations and assessments made are correct and consistent, if the CR value> 0.1 then the calculations and assessments are correct and consistent.
The one at was wrong and had to be repeated (Sutoyo n.d.).

3.2. System Design

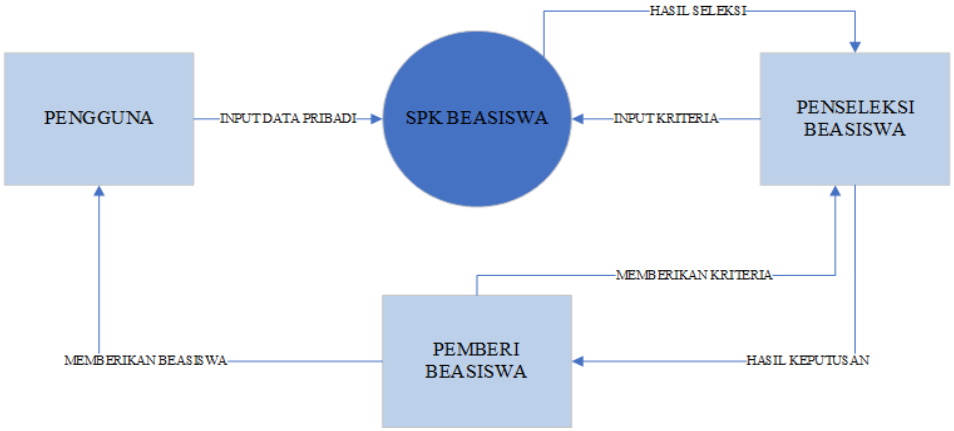

Figure 2. AHP System Design

The system starts from data input by students in the form of personal data or student profiles.

3. RESULTS AND DISCUSSION

The main view of the Analytical Hierarchy Process (AHP) method decision support system.

Figure 3. Main View

On the main display there is edited to change student data, add to add student data and delete to delete data then process data to process data. Furthermore, input student data and input criteria data

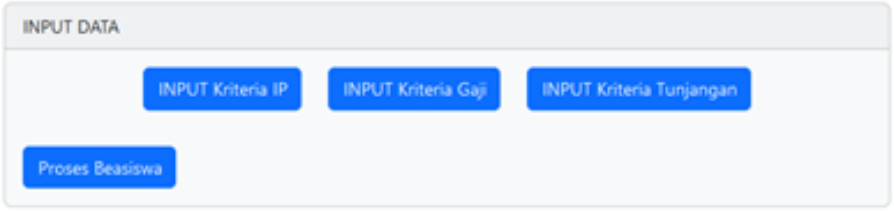

Figure 4. Input student data and criteria.

In the data input menu, each criterion inputs a comparison value related to the existing data.

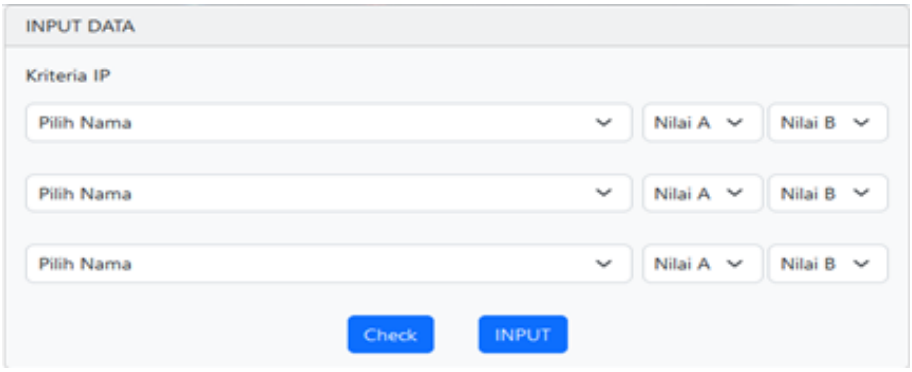

Figure 5. Input of names and pairwise comparison values.

After the data is inputted, then check to see whether the data we input is consistent or not, if so, then we input it. After filling in all the data on the criteria, then process the data, first look for the sum of the pairwise comparison values.

Jumlah Dari Nilai Perbandingan Berpasangan

#	Nama	IP	Gaji	Tunjangan
1	Nurul	3.33	4.5	1.83
2	Andi	11	10	6
3	Agus	1.642857143	1.476190476	3.5

Figure 6. Result of pairwise comparison sum value

Next, find the *Eigen* value*,* sum and average *of* each criterion.

Nilai EIGEN IP

#	Nama	Nilai EIGEN		Jumlah	Rata-rata
1	Nurul	0.300300	0.272727	0.304348	0.877375	0.292458
2	Andi	0.099099	0.090909	0.086957	0.276965	0.092322
3	Agus	0.600601	0.636364	0.608696	1.845660	0.615220

Nilai EIGEN GAJI

#	Nama	Nilai EIGEN		Jumlah	Rata-rata
1	Nurul	0.222222	0.200000	0.225806	0.648029	0.216010
2	Andi	0.111111	0.100000	0.096774	0.307885	0.102628
3	Agus	0.666667	0.700000	0.677419	2.044086	0.681362

Nilai EIGEN TUNJANGAN

#	Nama	Nilai EIGEN		Jumlah	Rata-rata
1	Nurul	0.546448	0.500000	0.571429	1.617877	0.539292
2	Andi	0.180328	0.166667	0.142857	0.489852	0.163284
3	Agus	0.273224	0.333333	0.285714	0.892272	0.297424

Figure 7. Eigen value results for each criterion

Next, add up the average *eigenvalue* of each criterion with the average value of the AHP method.

Penjumlahan Nilai Rata-rata Peserta dengan Rata-rata Kriteria

#	Nama	Nilai IP	Nilai GAJI	Nilai Tunjangan	Total
1	Nurul	0.189497	0.049654	0.065892	0.305043
2	Andi	0.059820	0.023591	0.019950	0.103361
3	Agus	0.398630	0.156625	0.036340	0.591595

Figure 8. The result of the summation of the average value of the criteria with the average value of the AHP method

The result is the order of students who are eligible for scholarships.

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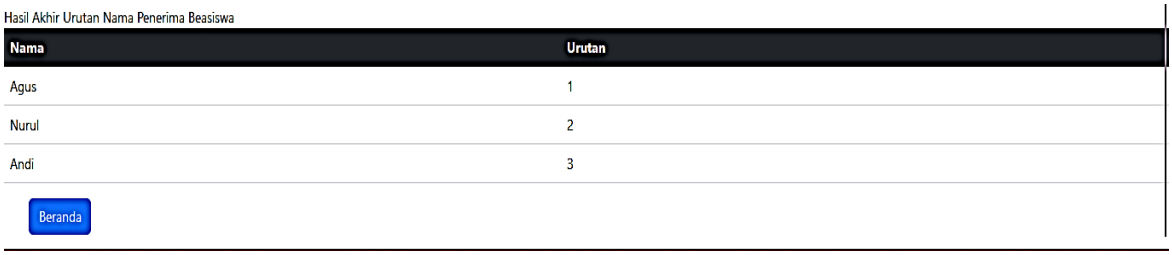
Hasil Akhir Urutan Nama Penerima Beasiswa

Nama	Urutan
Agus	1
Nurul	2
Andi	3

Beranda

Figure 9. Order of scholarship recipients

4. CONCLUSION

From the results of the research that has been done, it can be concluded that this scholarship recipient decision support system can make it easier to process data and shorten the time for data input, this system also helps make choices of decisions to be taken for scholarship recipients.

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