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Decision Support System For Scholarship Candidate Selection

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ABSTRACT *– System used by the university. Soetomo surabaya for the selection of prospective students who are eligible to receive a scholarship is still using the manual way. Given the enormous number of submissions by scholarship recipients will make it difficult for universities in selecting students who are eligible to receive scholarships. Therefore it is necessary that there is a system that can be used as supporting decision-making to determine the students who are eligible to get a scholarship at the University Dr Soetomo Surabaya in order to facilitate the University. The problem that occurs is the absence of a system used for the selection process of scholarship recipients at Dr. University. Soetomo Surabaya. This selection is done using Analytical Hierarcy Process (AHP) method, it will simplify the way the system to perform the selection, the work concept of Analytical Hierarcy Process (AHP) is able to determine the best alternative choice in determining a goal. Analytical Hierarcy Process (AHP) will determine the right student to get a scholarship viewed from several attributes that exist. With this decision support system, it will facilitate the University's work to determine the students who are eligible for a scholarship in terms of some existing attributes. The result of this decision support system is the obtaining of scholarship recommendation data in the form of value with percent form where this value which will be the management consideration to determine the scholarship recipient.*

Keywords *- Student, Scholarship, AHP, Decision Support System*

Sistem Pendukung Keputusan Penentuan Calon Penerima Beasiswa

ABSTRAK *– Sistem yang digunakan pihak universitas Dr. Soetomo surabaya untuk pemilihan calon mahasiswa yang berhak menerima beasiswa saat ini masih menggunakan cara manual. Dengan adanya jumlah pengajuan yang sangat banyak oleh para peserta penerima beasiswa tentu akan mempersulit pihak universitas dalam memilih mahasiswa yang berhak menerima beasiswa. Oleh sebab itu diperlukan adanya sistem yang dapat dijadikan sebagai penunjang pengambilan keputusan untuk menentukan mahasiswa yang berhak mendapat beasiswa di Universitas Dr Soetomo Surabaya guna mempermudah pihak Universitas. Permasalahan yang terjadi adalah tidak adanya sistem yang digunakan untuk proses seleksi penerima beasiswa di Universitas Dr. Soetomo Surabaya. Penyeleksian ini dilakukan dengan menggunakan metode Analytical Hierarcy Proses(AHP) maka akan mempermudah cara sistem untuk melakukan penyeleksian tersebut, konsep kerja Analytical Hierarcy Proses(AHP) adalah mampu menentukan pilihan alternatif terbaik dalam menentukan sebuah tujuan. Analytical Hierarcy Proses(AHP) akan menentukan mahasiswa yang tepat untuk mendapatkan beasiswa dilihat dari beberapa atribut yang ada. Dengan adanya sistem pendukung keputusan ini, maka akan mempermudah kerja pihak Universitas untuk menentukan mahasiswa yang berhak mendapatkan beasiswa ditinjau dari beberapa atribut yang telah ada. Hasil dari sistem pendukung keputusan ini adalah diperolehnya data rekomendasi beasiswa berupa nilai dengan bentuk persen dimana nilai ini yang akan menjadi pertimbangan manajemen untuk menentukan penerima beasiswa.*

Kata Kunci *– Mahasiswa, Beasiswa, AHP, Sistem Pendukung Keputusan.*

1. INTRODUCTION

Along with the advancement of technology today, various existing problems can be solved by utilizing technology. The continuous improvement of human performance has enabled the creation of technology-based solutions to help address issues in daily life. One of the implementations of technology utilization is the development of decision support system applications, which can assist in improving

performance at work or in solving problems. A Decision Support System within an institution or university can also be used in the selection process for students eligible to receive scholarships.

Scholarship awards can be categorized as either free grants or grants with work obligations (commonly referred to as service bonds) after the completion of education [1]. The manual determination of scholarship recipients leads to inefficient scholarship data management, especially in terms of time and repetitive processes that could otherwise be streamlined. This results in delays in the determination process, since students' data must be compared one by one against numerous scholarship criteria. In accordance with the regulations of the Ministry of Higher Education, scholarship eligibility requires a minimum Grade Point Average (GPA) of 3.0 for PPA scholarships and 2.75 for BBM scholarships. For undergraduate (Bachelor/Diploma IV) students, applicants must be at least in the second semester and at most in the eighth semester, while Diploma III students must be at least in the second semester and at most in the sixth semester. Other criteria include parental income, number of dependents, and number of siblings.

If the number of applicants exceeds the predetermined quota, universities may determine scholarship recipients according to the following order of priority: students with the highest GPA, students with the most completed credit units (with the fewest semesters), students with achievements in co/extra-curricular activities (sports, technology, arts/culture at international/world, regional/Asia/ASEAN, and national levels), and students from the least economically capable families [2]. In addition to these five attributes, there is an additional criterion: creative works. Students are not only required to submit documents but also works they have created, which will be evaluated by competent lecturers. The criteria are designed to be dynamic to facilitate scholarship selection each year in case of changes.

In previous studies, the developed system was still in the form of a standalone application. Furthermore, additional criteria are needed to optimize the results of calculations using the AHP method.

The AHP (Analytical Hierarchy Process) method is an approach capable of breaking down an unstructured complex situation into several components within a hierarchical structure by assigning subjective values to the relative importance of each variable, and then determining which variables have the highest priority to influence the outcome of the situation [11].

2. LITERATURE REVIEW

Decision Support Systems (DSS) are a part of information systems designed to assist in decision-making for complex problems by considering multiple criteria (Kusrini, 2007). According to Kendall (2003; 2006), DSS falls under the category of management information systems, aiming to provide support to decision-makers through data analysis, modeling, and systematic system design.

In the context of scholarship recipient selection, various approaches have been employed by previous researchers. Putra & Hardiyanti (2011) used the Fuzzy Multiple Attribute Decision Making (FMADM) method in scholarship selection. This method can handle uncertainty in criteria assessment but requires relatively more complex calculations. Sumarlin (2015) proposed using the K-Nearest Neighbor (K-NN) algorithm for scholarship recipient classification, which is effective when a sufficient historical database is available, but sensitive to the quality of the training data used.

On the other hand, Ardiyanto (2013) applied the Analytical Hierarchy Process (AHP) method in a web-based decision support system. AHP is considered more flexible in handling multi-criteria problems, as it can structure problem hierarchies, compare criteria pairwise, and calculate decision consistency. This makes AHP an appropriate method for prioritizing scholarship recipients based on both academic and non-academic criteria.

Beyond scholarship-related research, DSS development has also been widely applied in other areas. Adelia (2011) developed a web- and desktop-based Customer Relationship Management (CRM) system for hotel reservations. This study demonstrated that DSS implementation can improve the effectiveness of interactions between users and information systems. Rezanaldy & Lili (2011) designed a conceptual and physical data model editor useful in supporting software design processes. Syarif (2008) emphasized the importance of PHP-based software development, while Daqiqil Id (2010) introduced the CodeIgniter framework as a guideline and best practice for building web-based applications.

In the context of higher education in Indonesia, the Ministry of Higher Education (2015) has issued general guidelines for awarding PPA and BBM scholarships. The criteria used include Cumulative Grade Point Average (CGPA), student level and semester, parental economic condition, number of dependents, and co-/extracurricular achievements. These regulations serve as an important reference for universities in conducting selection processes and highlight the need for efficient systems to manage complex selection procedures.

From the literature review, it is evident that

various DSS methods have been applied to assist scholarship recipient selection as well as decision support systems in other fields. The AHP method stands out due to its ability to provide consistent, dynamic results and is suitable for multi-criteria cases such as determining scholarship recipients.

3. RESEACH METHODOLOGY

The method used in this article assists in the process of admitting prospective students eligible for scholarships by breaking down complex multifactor or multicriteria problems into a hierarchy.

The stages that need to be considered when using the AHP method are as follows:

1. **Defining the problem and determining the desired solution**, then structuring a hierarchy of the issues at the top level.
2. **Determining the priority of elements**
   a. The first step is to perform pairwise comparisons, which involves comparing elements in pairs according to the given criteria.
   b. The pairwise comparison matrix is filled using numbers to represent the relative importance of one element over another.
3. **Synthesizing** – The considerations from the pairwise comparisons are synthesized to obtain overall priorities.
   a. Sum the values of each column in the matrix.
   b. Divide each column value by the total of its respective column to obtain the normalized matrix.
   c. Sum the values of each row and divide by the number of elements to obtain the average value.
4. **Measuring consistency** – In decision-making, it is important to determine how consistent the judgments are, as decisions based on low consistency are undesirable.
   a. Multiply each value in the first column by the relative priority of the first element, the values in the second column by the relative priority of the second element, and so on.
   b. Sum each row.
   c. Divide the result of each row sum by the corresponding relative priority element.
   d. Sum the results from the divisions above and divide by the number of elements; the result is called λ_max
5. **Calculating the Consistency Index (CI)**, using the formula : CI = (λ maks – n) / n,
6. **Calculating the Consistency Ratio (CR)**, using the formula: CR = CI / IR, where IR values are shown in Table 1.
7. If the value is greater than 10%, the judgment data needs to be revised. If the consistency ratio (CI / CR) is less than or equal to 0.1, the calculation results can be considered valid.
8. **Calculating the percentage value** is done using the following formula:
   Percentage=n criteria for the scholarship type10 0%×number of criteria met.

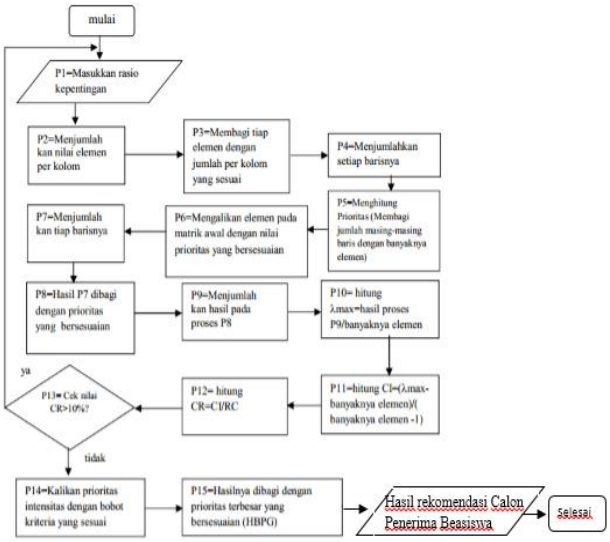

Figure 1. Scholarship Determination Flowchart

SYSTEM ANALYSIS AND DESIGN

System Description

The Decision Support System for selecting prospective scholarship recipients is a system capable of providing information about students who are eligible to receive scholarships according to predetermined criteria, using the AHP method as the underlying principle in the selection process. This is intended to avoid misalignment in scholarship allocation.

With this decision support system, the goal is to ensure that scholarship recipients are accurately selected, meaning the scholarships are awarded to those who truly qualify. Additionally, the system provides detailed information about students who are eligible for scholarships. The system is designed with dynamic criteria to facilitate adjustments in the future if changes occur.

System Usage Testing

This testing is conducted to determine how closely the system's summary results align using the AHP method. The process of using the Analytical Hierarchy Process (AHP) method is as follows:

1. **Users input all predetermined criteria along with their parameters.** For example, the criterion "parental income" has the parameters: Very Good, Good, Fair, Poor. "Very Good" refers to a parental income < 1,500,000 – 1,500,000, "Good" <= 1,500,000 – 2,500,000, "Fair" < 2,500,000 – <= 3,500,000, and "Poor" >= 3,500,000 – > 3,500,000.

2. **Users input scholarship type data along with the predetermined criteria.** The columns to be entered on the scholarship type data page include: Scholarship Name, Description, Year, Quota, and Criteria.
3. **Users provide comparison values for each criterion in every scholarship type.** Each scholarship type has different criteria. For example, the PPA scholarship has five criteria, while the Bidikmisi scholarship has three. The PPA scholarship criteria are GPA, Co-/extracurricular achievements/activism, Loyalty to faculty/university, Non-academic achievements, and Academic achievements. The Bidikmisi scholarship criteria are Parental income, Number of dependents, and Academic achievements.
4. **Figure 2 shows the printed results of the calculations using the system.**

Figure 2. Calculation of Scholarship Recipient SPK

4. Result and Discussion

The implementation of a decision support system for determining scholarship recipients using the Analytical Hierarchy Process (AHP) method has been successfully carried out at Dr. Soetomo University, Surabaya. This system is capable of processing various selection criteria, including: Grade Point Average (GPA), parents' income, number of dependents, academic and non-academic achievements, loyalty to the university, as well as students' creative works.

The system produces scholarship recipient recommendations in the form of percentage values, enabling the university to easily determine which students are most deserving of the scholarship. The system is also dynamic, allowing criteria to be added or modified as needed.

Based on the user acceptance test, the results are obtained as shown in Table 1 below:

Table 1. System Acceptance Test Results

No	Aspects being assessed	Agree	Disagree
1	The system assists the scholarship selection process	78%	34%
2	The system provides relevant recommendations	45%	67%
3	The system helps manage data	100%	-
4	The system provides detailed information about students	23%	78%

From the test results, it can be concluded that the system is well accepted by users because the majority of respondents stated agree and strongly agree with the system's performance.

The research results show that the application of the AHP method in the decision support system is able to improve the efficiency and effectiveness of the scholarship recipient selection process. The previously time-consuming manual selection process can be accelerated with this system, as all data are automatically processed based on the predetermined criteria weights.

The main advantage of the AHP method lies in its ability to solve multi-criteria problems in a structured manner. By performing pairwise comparisons on each criterion, the system can produce consistent priority weights. This is important to ensure that the decisions made are objective, transparent, and unbiased.

From the user acceptance test results (Table 1), it can be seen that most respondents considered the system to be well-targeted, efficient, and capable of providing detailed information that was previously difficult to obtain through manual methods. In addition, the dynamic nature of the criteria allows the system to adapt to changes in scholarship policies from year to year.

Nevertheless, there are still several aspects that can be further developed, including:

- Integration with the university's academic system so that student data can be retrieved automatically without manual input.
- Addition of selection criteria such as organizational involvement, social contributions, and soft skills.
- Web-based development, enabling students to apply for scholarships and monitor their selection status online.

Overall, this study demonstrates that the AHP method can be effectively implemented in a decision support system for scholarship recipient selection.

The recommendations generated are objective and can serve as a basis for university management in the decision-making process.

5. CONCLUSION

The developed system is able to assist the scholarship recipient selection process, as shown in the acceptance test results, where 78% of respondents agreed and 34% strongly agreed with the system.

The decision support system for determining prospective scholarship recipients is capable of providing information/recommendations on scholarship candidates at Dr. Soetomo University, Surabaya. The AHP method works effectively in this decision support system, as indicated by the acceptance test results, where 45% of respondents agreed and 67% strongly agreed with the system. The developed system can also assist in monitoring material stock in the warehouse, as indicated by the acceptance test results for question number 2, where 100% of respondents agreed with the system. The developed system is able to provide detailed information about students eligible to receive scholarships, as shown in the acceptance test results, where 23% of respondents agreed and 78% strongly agreed with the system.

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