

A DECISION SUPPORT SYSTEM MODEL FOR SELECTING SCHOLARSHIP RECIPIENTS USING A COMBINATION OF THE AHP AND TOPSIS METHODS

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Abstract

The selection of scholarship recipients is a critical process in determining which students are eligible for educational assistance based on specific criteria. The selection process, which is still conducted manually, often leads to issues such as subjectivity, inaccurate assessments, and significant time consumption. This study aims to develop a Decision Support System model for scholarship recipient selection using a combination of the Analytical Hierarchy Process (AHP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). The AHP method is used to determine the priority weights of each criterion, while the TOPSIS method is used to rank scholarship candidates based on the highest preference scores. The results of the study indicate that the combination of these two methods is capable of producing a more objective, effective, and accurate selection process. The developed system is expected to assist educational institutions in determining scholarship recipients in a targeted and transparent manner.

Keywords: Decision Support Systems, AHP, TOPSIS, Scholarships, Student Selection

INTRODUCTION

Scholarships constitute a type of educational aid offered to students to facilitate the learning experience and bolster academic motivation (Soro et al., 2025). The scholarship recipient selection procedure frequently encounters difficulties owing to the high volume of candidates and the multitude of parameters that need to be evaluated (Ramadhianti & Soegoto, n.d.). The selection procedure, now executed manually, is often time-consuming, inefficient, and susceptible to subjective decision-making. Consequently, a system is required to facilitate the objective, rapid, and precise identification of scholarship recipients. The advancement of Information Technology provides a remedy via the deployment of a Decision Support System (DSS) (Ramadhianti & Soegoto, n.d.). A Decision Support System can aid scholarship administrators in assessing potential winners according to multiple factors, including cumulative grade point average, parental income, number of dependents, and both academic and non-academic accomplishments (Sianturi, 2025). A Decision Support System (DSS) facilitates a more systematic and transparent selection procedure (Ulrich et al., 2021).

One method that can be used in DSS is the Analytical Hierarchy Process (AHP). The AHP method is used to determine the weight of each criterion based on its level of importance through pairwise comparisons (Wati, 2021). In addition, the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method is used to rank alternatives based on their proximity to the positive ideal solution and the negative ideal solution (Rusnedy et al., 2025). The combination of these two methods is considered capable of producing more accurate and effective decisions. This study aims to develop a Decision Support System model for

selecting scholarship recipients using a combination of the AHP and TOPSIS methods (Sadali et al., 2023). The resulting system is expected to assist educational institutions in determining scholarship recipients objectively, efficiently, and effectively, thereby improving the selection process and making it more transparent (Sani et al., n.d.).

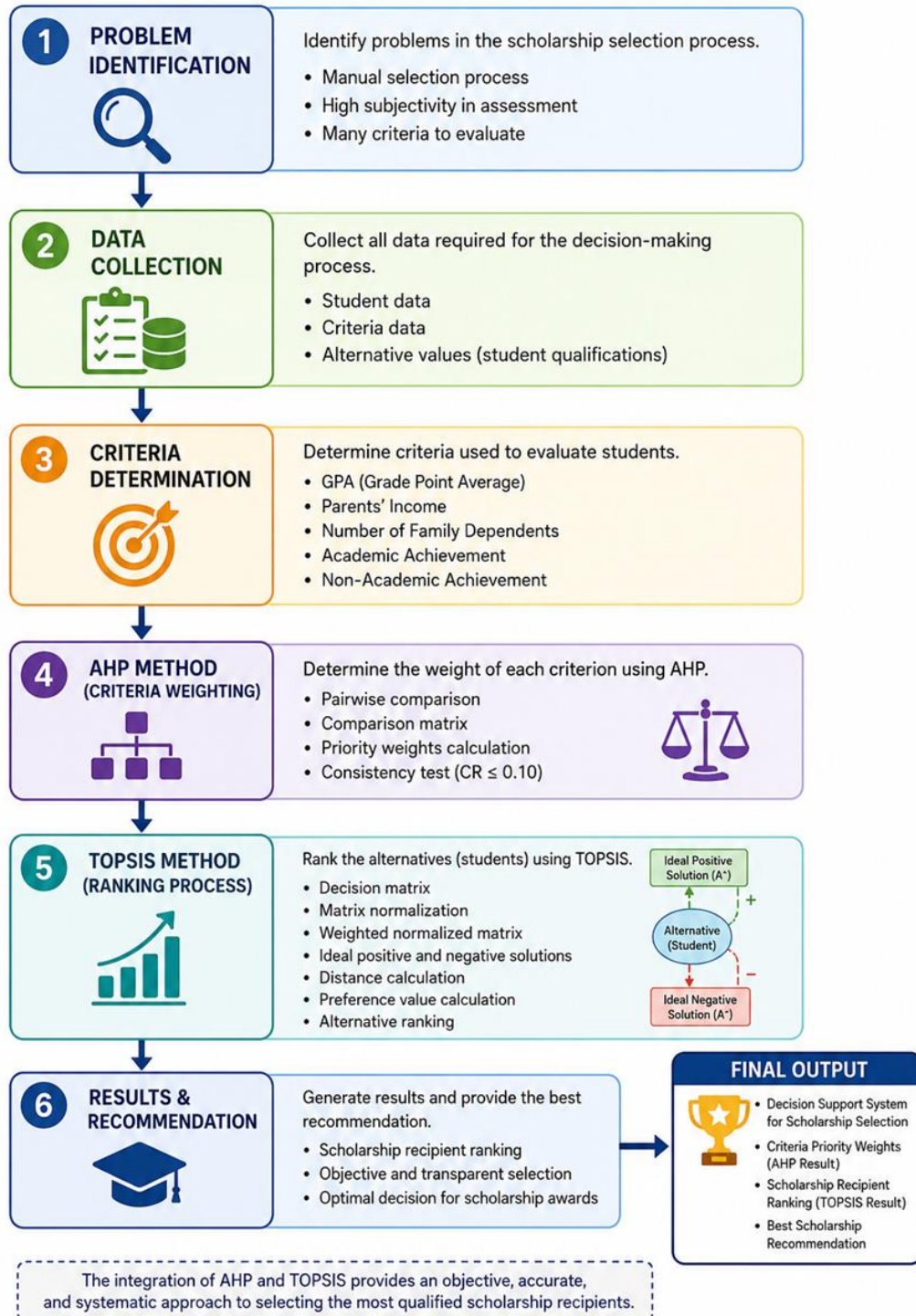


Figure 1. AHP–TOPSIS-Based Decision Support System Framework for Scholarship Recipients

The framework shown in Figure 1 illustrates the research process for developing a Decision Support System for selecting scholarship recipients using a combination of the Analytical Hierarchy Process (AHP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). The process begins with problem identification, data collection, and the determination of scholarship recipient criteria. Next, the AHP method is used to determine the priority weights of each criterion, while the TOPSIS method is used to rank prospective recipients based on the highest preference scores. The final output of this framework is a recommendation for scholarship recipients that is more objective, accurate, transparent, and targeted.

METHOD

This study applies a Sistem Pendukung Keputusan approach to support the selection process of scholarship recipients using a combination of the Analytical Hierarchy Process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) methods. The proposed method consists of six main stages: criteria identification, data collection, criteria weighting using AHP, alternative ranking using TOPSIS, result analysis, and recommendation generation. The framework emphasizes objective multi-criteria evaluation and ranking to determine the most eligible scholarship recipients.

The first stage involves identifying the criteria used in scholarship selection. The criteria include Grade Point Average (GPA), parents' income, number of family dependents, academic achievements, and non-academic achievements. These criteria are selected because they represent both academic performance and economic conditions of the applicants. After determining the criteria, data collection is conducted by gathering student data and alternative scores from scholarship applicants.

The AHP method is applied to determine the priority weight of each criterion through pairwise comparison matrices. The normalization process is calculated as:

$$a_{ij} = \frac{x_{ij}}{\sum_{i=1}^n x_{ij}}$$

where a_{ij} represents the normalized comparison value and x_{ij} represents the pairwise comparison value between criteria.

The consistency of the comparison matrix is evaluated using the Consistency Ratio (CR) formula:

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

where CI is the Consistency Index and RI is the Random Index. A matrix is considered consistent if $CR < 0.1$.

Furthermore, the TOPSIS method is used to rank scholarship candidates. The normalization matrix is calculated as:

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

The preference value is then obtained by calculating the distance between each alternative and the positive and negative ideal solutions. Candidates with the highest preference values are recommended as scholarship recipients.

RESULTS AND DISCUSSION

Criteria Weight Analysis Using AHP

The Analytical Hierarchy Process (AHP) was employed to ascertain the priority weight of each parameter utilised in the scholarship selection process. This study employs factors such as Grade Point Average (GPA), parental income, number of dependents, academic performance, and non-academic accomplishments. The pairwise comparison method reveals that GPA holds the utmost priority, as academic performance is deemed the primary criterion in scholarship assessment. Concurrently, parental income and the number of dependents serve as significant factors for evaluating the economic status of applicants. Presents the results of criteria weighting using the AHP method, as shown in the table 1.

Table 1. Criteria Weight Results Using AHP

Criteria	Weight	Priority
GPA	35%	Very High
Parents' Income	25%	High
Number of Dependents	20%	Medium
Academic Achievement	12%	Medium
Non-Academic Achievement	8%	Low

The results show that GPA has the highest weight value of 0.35, followed by parents' income with a weight of 0.25. This indicates that academic performance and economic condition are the primary considerations in scholarship selection. The consistency ratio calculation also shows that the comparison matrix is consistent because the CR value is less than 0.1.

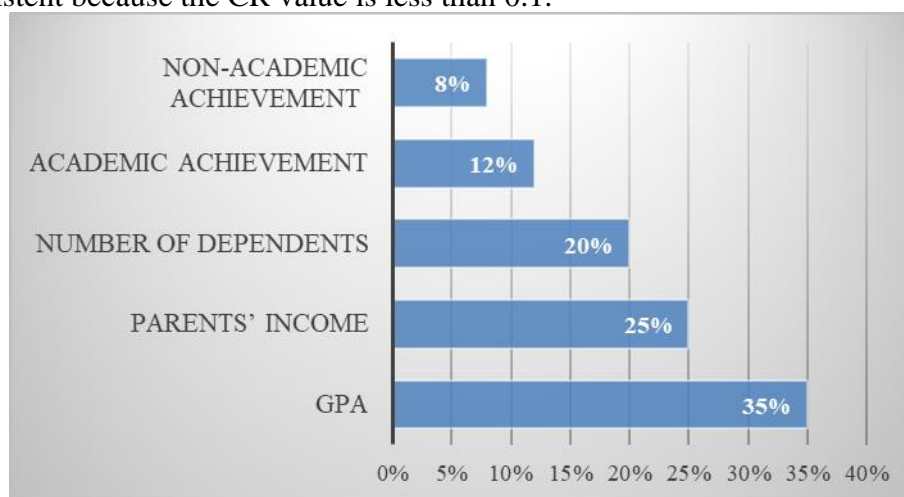


Figure 2. Criteria Weight Distribution

The graph in Figure 2 above shows that GPA plays the most significant role in the evaluation process, while non-academic achievements account for the smallest portion. However, all criteria remain important because the selection process applies the principle of multi-criteria decision-making.

Scholarship Candidate Ranking Using TOPSIS

After obtaining the criteria weights from AHP, the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method was applied to rank scholarship candidates. TOPSIS calculates the distance of each alternative from the positive ideal solution and the negative ideal solution to determine the preference value of each candidate. Candidates with higher preference values are considered more eligible for scholarships. Table 2 presents the TOPSIS ranking results.

Table 2. Scholarship Candidate Ranking Results

Candidate	Preference Value	Ranking
Student A	91	1
Student B	84	2
Student C	76	3
Student D	69	4
Student E	58	5

The results indicate that Student A obtained the highest preference value of 91 and was therefore recommended as the most eligible scholarship recipient. The ranking results demonstrate that the integration of AHP and TOPSIS can effectively support objective and transparent decision-making.

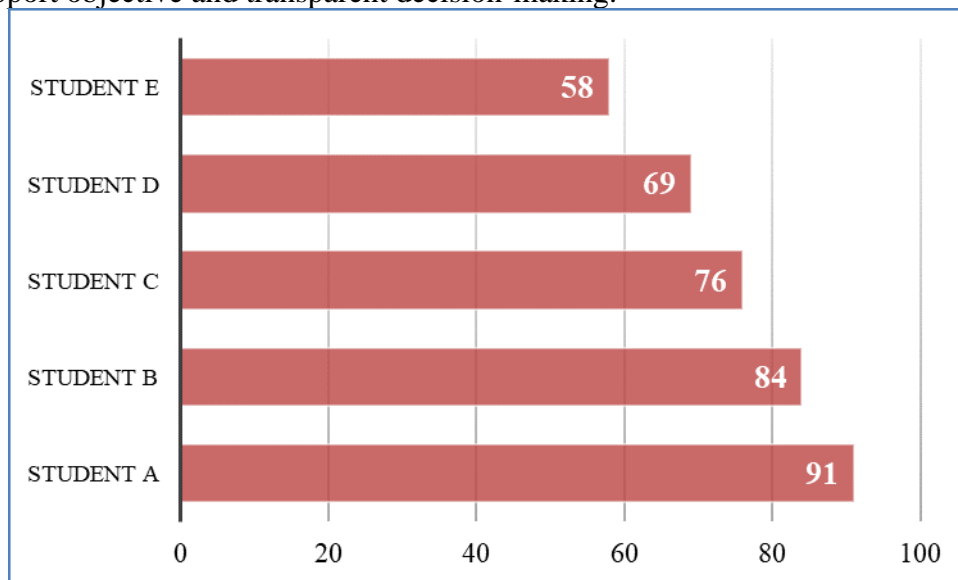


Figure 3. Preference Value Comparison

The graph in Figure 3 above shows significant differences among the candidates, indicating that the TOPSIS method can clearly distinguish the levels of eligibility among scholarship applicants.

System Evaluation and Decision Accuracy

The developed Decision Support System provides a more efficient, objective, and systematic scholarship selection process compared with conventional manual evaluation methods. The integration of the Analytical Hierarchy Process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) methods successfully minimizes subjectivity in decision-making because the assessment process is based on weighted criteria and mathematical calculations (Khatimah & Gustalika, 2024). In addition, the system is capable of accelerating data processing, improving transparency, and increasing consistency in scholarship recipient evaluation.

The evaluation results demonstrate that the proposed model can accurately identify the most eligible scholarship recipients according to both academic and economic criteria (Siregar & Furqan, 2025). The application of AHP allows the system to ascertain the relative significance of each criterion, whereas TOPSIS proficiently ranks candidates according to their proximity to the optimal solution. This amalgamation establishes a more dependable and equitable assessment framework.

Furthermore, the use of the system provides certain tangible advantages for educational institutions. The approach reduces administrative overhead, enhances decision-making efficiency, and minimises human mistake in assessments. The rankings produced by the system are more readily justified, as each decision is supported by quantitative analysis and clear evaluation criteria.

The experimental results indicate that persons with higher academic proficiency and strong economic qualifications consistently achieved higher preference scores. This confirms that the proposed methodology can enable equitable and targeted scholarship distribution. The integration of AHP and TOPSIS represents an effective method for improving the quality, accuracy, and transparency of scholarship selection processes inside higher education institutions.

CONCLUSION

This work formulates a Decision Support System model for the selection of scholarship recipients by integrating the Analytical Hierarchy Process (AHP) with the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) approaches. The AHP approach was effectively employed to ascertain the priority weights for each selection criterion, whilst the TOPSIS method proficiently rated scholarship candidates according to preference scores derived from positive and negative ideal solutions.

The findings indicate that the suggested technique can generate a more objective, systematic, and transparent scholarship selection process than traditional manual methods. The amalgamation of AHP and TOPSIS mitigates subjectivity in decision-making and enhances the precision of recipient selection by accounting for academic performance and economic circumstances. The ranking results indicate that individuals with superior qualifying scores consistently attain higher preference scores.

Moreover, the implemented system enhances data processing efficiency and facilitates expedited decision-making for educational institutions. The implementation of this technique can assist administrators in identifying scholarship recipients with greater accuracy and equity. Consequently, the integration of AHP and TOPSIS is an efficacious method for facilitating the scholarship selection procedure within higher education institutions.

It is advisable to conduct further research to incorporate additional criteria, expand data sets, and use web-based or mobile solutions to enhance the system's performance and usability.

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