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# Comparison of the Waspas Method with the OCRA Method in Determining Web-Based Aid Recipients

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Abstract

*The determination of scholarship aid recipients at Pangeran Antasari High School has long relied on a manual and subjective process, leading to inefficiencies, inaccuracies, and potential biases in decision-making. To address this issue, this research aims to develop and compare the effectiveness of two multi-criteria decision-making (MCDM) methods—the Weighted Aggregated Sum Product Assessment (WASPAS) and the Operational Competitiveness Rating Analysis (OCRA)—within a web-based Decision Support System (DSS) for determining scholarship recipients. The study applies both methods using nine evaluation criteria, including socioeconomic and academic factors, to rank eligible students objectively. The results reveal that the WASPAS method produces more consistent, stable, and transparent outcomes, with scores that decline gradually and proportionally across alternatives, while the OCRA method demonstrates higher sensitivity to minor data variations, resulting in less stable rankings. Consequently, WASPAS proves to be more suitable for decision contexts that prioritize fairness, stability, and comprehensive evaluation of multiple criteria. The implementation of this method in an automated DSS enhances the objectivity, efficiency, and accountability of scholarship distribution processes. The study's findings contribute to the advancement of decision-support frameworks in educational institutions and provide a methodological reference for future applications of MCDM models in resource allocation and policy decision-making.*

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## 1. Introduction

Education serves as a foundation for shaping human character and intelligence, fostering creativity, discipline, and responsibility in students. It functions as a medium for developing intellectual and moral integrity, essential for national progress. In Indonesia, education is recognized as a fundamental human right as enshrined in the 1945 Constitution, which mandates that every citizen is entitled to access quality education. To realize this mandate, the government and private institutions have implemented numerous programs, such as scholarships and tuition subsidies, to improve educational equality. Scholarships are financial aids granted to students who demonstrate academic excellence or financial need, aiming to reduce economic barriers and promote educational inclusivity. They are often

provided by governmental bodies, corporations, or nonprofit organizations to assist students in achieving their academic goals (Rahmawati et al., 2024). Scholarship distribution not only reflects educational fairness but also contributes to human capital development, as it encourages academic competitiveness and meritocracy among students (Kumar, Singh, & Mishra, 2023).

At Pangeran Antasari High School, located in Helvetia, Deli Serdang Regency, North Sumatra, scholarships are distributed annually to eligible students. However, the current scholarship management system is still performed manually through data collection forms and Microsoft Excel sheets, which often leads to inefficiency, data redundancy, and human error. The process of determining scholarship recipients has also faced challenges related to subjectivity, favoritism, and nepotism, resulting in unfair allocation of educational aid. The school uses multiple criteria to determine eligibility, including transportation, parental education, occupation, income, academic grades, and attendance. Despite these criteria being well-defined, the absence of an automated and data-driven system has made decision-making inconsistent and time-consuming. Manual data storage through student master books is prone to damage, loss, and delayed updates, reducing the credibility of scholarship administration. Therefore, there is an urgent need for a structured and transparent decision support system that minimizes bias and enhances accountability in scholarship selection (Ramadhan, Fadhilah, & Hidayat, 2024).

A decision support system (DSS) is an information system designed to assist decision-makers in selecting the most appropriate alternative based on predefined criteria (Zavadskas, Turskis, Antucheviciene, & Zakarevicius, 2012). In the context of scholarship distribution, DSS can optimize decision-making by integrating quantitative and qualitative data into a systematic evaluation model. Multi-Criteria Decision-Making (MCDM) methods are particularly useful in this regard, as they enable the evaluation of multiple factors simultaneously, each weighted according to its relative importance. Among the various MCDM approaches, the Weighted Aggregated Sum Product Assessment (WASPAS) and Operational Competitiveness Rating Analysis (OCRA) methods have gained prominence due to their computational efficiency and robustness (Sharma & Thakur, 2023). The WASPAS method, introduced by Zavadskas et al. (2012), is a hybrid of the Weighted Sum Model (WSM) and the Weighted Product Model (WPM), which combines the additive and multiplicative aggregation of performance indicators. This hybridization improves accuracy and provides a more balanced decision outcome (Kumar et al., 2023). Meanwhile, the OCRA method, introduced by Parkan (1996), is based on a nonparametric model that measures the relative performance of alternatives without requiring statistical assumptions, making it suitable for educational contexts with diverse evaluation criteria (Gorener & Toker, 2022).

In recent years, several studies have demonstrated the effectiveness of WASPAS and OCRA in improving decision accuracy in various domains, including education, supply chain management, and performance evaluation. For instance, Gorener and Toker (2022) applied OCRA to measure institutional performance and found it to be effective in ranking alternatives with heterogeneous attributes. Similarly, Rahmawati et al. (2024) implemented OCRA to rank student performance in academic institutions, resulting in higher objectivity and reduced subjectivity in selection outcomes. The WASPAS method, on the other hand, has been utilized in multi-criteria educational decision systems to assess student performance and allocate resources efficiently (Ramadhan et al., 2024). Comparative studies, such as that by Sharma and Thakur (2023), suggest that WASPAS often outperforms traditional MCDM techniques like SAW and AHP in terms of accuracy, sensitivity, and ranking stability. Consequently, both WASPAS and OCRA demonstrate strong potential for integration into scholarship selection systems to enhance fairness, reliability, and decision quality in educational institutions.

Despite these advancements, the majority of scholarship decision systems developed in previous studies rely solely on single-method approaches such as SAW or AHP, which tend to produce less precise results when multiple correlated criteria are present. Furthermore, few studies have directly compared WASPAS and OCRA to determine their relative effectiveness in the context of scholarship distribution. This represents a notable research gap, particularly in Indonesian educational

settings where data-driven decision models are still underutilized. Addressing this gap, the present study proposes a comparative analysis of the WASPAS and OCRA methods to develop a web-based decision support system for scholarship determination at Pangeran Antasari High School. The objectives of this research are to (1) design a DSS that facilitates efficient and transparent scholarship selection; (2) compare the performance and accuracy of the WASPAS and OCRA methods; and (3) identify the most suitable approach for ranking scholarship recipients based on multiple criteria. It is expected that this system will not only enhance decision accuracy but also reduce human bias, promoting equity and accountability in educational financial assistance programs (Sharma & Thakur, 2023; Zavadskas et al., 2012).

## 2. Research Methodolgy

The stages in this research can be modeled using the Fishbone research methodology. The stages used in this research are as follows:

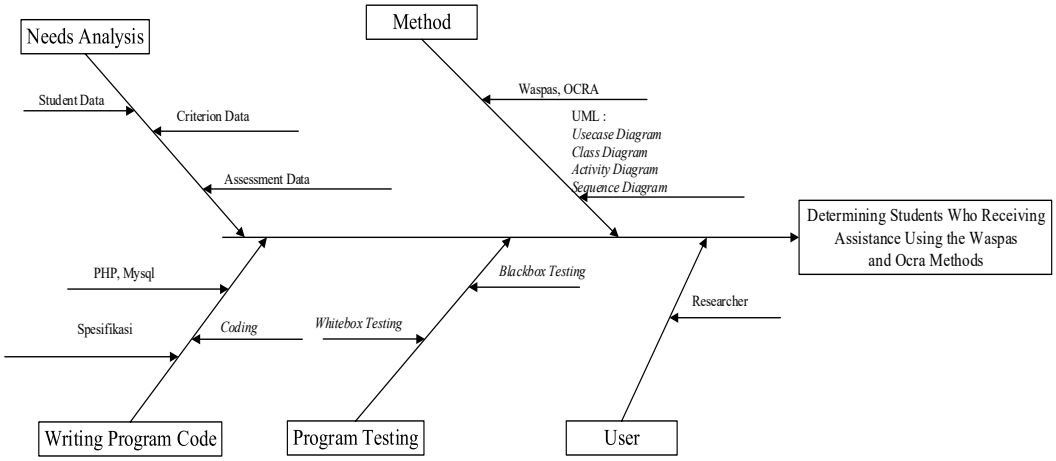


Figure 1. Fishbone Framework

Description:

1. Needs Analysis
   The researcher analyzed the research needs, namely collecting student data and data on assistance at Pangeran Antasari High School. The data collection techniques used in this study were:
   a) Field Research
      This research is conducted by directly observing the object of study to obtain data. In this stage, the researcher conducted observations at Pangeran Antasari High School to obtain data on students receiving assistance.
   b) Interviews
      Interviews are data collection methods conducted face-to-face or through direct discussions with the Principal of Pangeran Antasari High School, Mr. Safrudin, SS. The questions asked are as follows:
   a. How is the scholarship award process at Pangeran Antasari High School?
      Answer: Scholarships are awarded annually and according to the required quota.
   b. What are the obstacles encountered in awarding scholarships at Pangeran Antasari High School?
      Answer: The obstacle encountered in awarding scholarships at Pangeran Antasari High School is the inaccurate distribution process, resulting in errors in awarding scholarships.
   c. Are scholarships awarded at Pangeran Antasari High School evenly distributed?
      Answer: This has been done in accordance with the school's assessment and data collection.
   d. What are the criteria used in awarding scholarships at Pangeran Antasari High School?

Answer: The criteria used in awarding scholarships at Pangeran Antasari High School include transportation, father's education, father's occupation, father's income, mother's education, mother's occupation, mother's income, student academic grades, and student attendance.

c) Sampling
In this stage, the researcher collected several research samples useful for this study, including student and support data from Pangeran Antasari High School. The data used was student data from the 2023/2024 academic year.

d) Literature Review
This study involved reading books and journals related to the research, which had a specific purpose, such as collecting the necessary data.

2. Method
This stage can be considered the method testing phase for the system designed by the author. The method used to determine students receiving assistance at Pangeran Antasari High School is the Waspas and OCRA methods.
3. Program Code Writing
The researcher wrote program code using PHP and MySQL to manage the data for determining students receiving assistance at Pangeran Antasari High School.
4. Testing
The implementation of the Waspas and OCRA methods was tested by testing all predetermined data input and systematically storing it in the database.
5. Users
The system design phase involved implementing the Waspas and OCRA methods to determine students receiving scholarships. Changes are likely to occur during user use of the system. The users are Pangeran Antasari High School and the researcher.

## 3. Results and Discussion

Pangeran Antasari High School is an educational institution located on Jl. Veteran No.1060/19, Helvetia, Labuhan Deli District, Deli Serdang Regency, North Sumatra 20116. Data collection for scholarship assistance at Pangeran Antasari High School is still done manually by summarizing student data using a form and then inputting it using Microsoft Excel. The current system in determining the provision of educational funding assistance often becomes a polemic because some of the parties involved in the process of determining the provision of educational funding assistance often turn away from the established procedures or rules.

A common form of fraud involves the use of family connections or nepotism, where scholarships are awarded based on personal relationships or connections, rather than merit or academic achievement, leading to misuse of scholarships. The criteria used by schools include parental income, dependents, parental occupation, and student grades and attendance. These criteria are inaccurate in the selection process for scholarship recipients, so the criteria used instead are transportation, father's education, father's occupation, father's income, mother's education, mother's occupation, mother's income, academic grades, and student attendance.

The following is a case study in the Comparison of the Waspas Method with the OCRA Method in the Web-Based Decision Support System for Determining Aid Recipients at Pangeran Antasari High School:

1. Determination of Criteria

Table 1. Criteria Data

| Code | Criteria Name | weight | Weight Normalization |
|---|---|---|---|
| C1 | Means of Transportation | 5 | 0.05 |
| C2 | Father's Education | 10 | 0.1 |
| C3 | Father's Occupation | 15 | 0.15 |
| C4 | Father's Income | 20 | 0.20 |
| C5 | Mother's Education | 5 | 0.05 |
| C6 | Mother's Occupation | 15 | 0.15 |

| | | | |
|---|---|---|---|
| C7 | Mother's Income | 10 | 0.1 |
| C8 | Academic Grades | 10 | 0.1 |
| C9 | Student Absenteeism | 10 | 0.1 |

2. Implementation of the WASPAS Method

The following is the implementation of the Waspas Method in a web-based Decision Support System for Determining Aid Recipients at Pangeran Antasari High School for 11th grade science majors. Based on Table III-11, the alternatives listed in Table 2 can be seen in the following table.

Table 2. Weighted rating table

| No | Name | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Imam Budi Raharjo | 4 | 2 | 2 | 2 | 5 | 5 | 5 | 4 | 5 |
| 2 | Hendra Gunawan Manurung | 3 | 2 | 3 | 2 | 5 | 3 | 1 | 1 | 1 |
| 3 | Supiadi | 3 | 2 | 2 | 1 | 1 | 4 | 5 | 4 | 4 |
| 4 | Yonathan Adi Putra Simanungkalit | 2 | 4 | 3 | 2 | 2 | 5 | 3 | 3 | 2 |
| 5 | Gabe Martua Simanjuntak | 3 | 2 | 3 | 1 | 4 | 3 | 3 | 4 | 4 |
| 6 | M Yusuf Rivai | 1 | 2 | 1 | 2 | 3 | 2 | 4 | 2 | 5 |
| 7 | Nova Riyansyah Julianto | 3 | 2 | 1 | 2 | 5 | 3 | 5 | 2 | 5 |
| 8 | Nuriyanti | 3 | 2 | 1 | 1 | 3 | 4 | 5 | 2 | 4 |
| 9 | Zulkifli Dalimunthe | 4 | 2 | 2 | 2 | 1 | 4 | 2 | 2 | 4 |
| 10 | Fachrul Fazri | 1 | 2 | 1 | 2 | 4 | 3 | 3 | 2 | 5 |
| Max | | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 4 | 5 |

1. Calculate the normalized matrix X

$$\bar{x}ij = \frac{Xij}{MaxiXij}$$

Imam Budi Raharjo

$X_{11} = 4/5 = 0.8$

$X_{21} = 2/5 = 0.4$

$X_{31} = 2/5 = 0.4$

$X_{41} = 2/5 = 0.4$

$X5_1 = 5/5 = 1$

$X6_1 = 5/5 = 1$

$X7_1 = 5/5 = 1$

$X8_1 = 4/4 = 1$

$X9_1 = 5/5 = 1$

Hendra Gunawan Manurung

$X_{11} = 3/5 = 0.6$

$X_{21} = 2/5 = 0.4$

$X_{31} = 3/5 = 0.6$

$X_{41} = 2/5 = 0.4$

$X5_1 = 5/5 = 1$

$X6_1 = 3/5 = 0.6$

$X7_1 = 1/5 = 0.2$

$X8_1 = 1/4 = 0.25$

$X9_1 = 1/5 = 0.2$ Etc

Step 2. Calculate the Preference Value (Q).

$Qi = 0{,}5\ \Sigma^{n}_{j=1} X_{ij} w_j + 0{,}5 \Pi_{j=1} (X_{ij}) w_j$

Imam Budi Raharjo

Q1= 0.5 x ((0.8x0.05)+ (0.4x0.1) + (0.4x0.15) +(0.4x0.2) +(1x0.05)+ (1x0.15)+ (1x0.1) + (1x0.1)+(1x0.1)) + 0.5 x ((0.8^0.05) x (0.4^0.1) x(0.4^0.15) x (0.4^0.2) x (1^0.05)x(1^0.15) x (1^0.1)x(1^0.1) x (1^0.1))

Q1 = 0.6853

Hendra Gunawan Manurung
Q2= 0.5 x
((0.6x0.05)+(0.4x0.1)+(0.6x0.15)+(0.4x0.2)+(1x0.05)+(0.6x0.15)+(0.2x0.1)+(0.25x0.1)+(0.2x0.1)) +
0.5 x
((0.6^0.05)x(0.4^0.1)x(0.6^0.15)x(0.4^0.2)x(1^0.05)x(0.6^0.15)x(0.2^0.1)x(0.25^0.1)x(0.2^0.1))
Q2 = 0.4217 dan seterusnya
The following are the final calculation results, ranked from highest to lowest.
The following are the ranking results with a quota of 5 people using the WASPAS method:

Table 3. Q-Score

| Name | Nilai Q | Ranking | Information |
|---|---|---|---|
| Boy Sandy Sinaga | 0.9503 | 1 | Eligible for Assistance |
| Pandu Arya Ramadhan Lubis | 0.8311 | 2 | Eligible for Assistance |
| Robinhot Pardamean Sagala | 0.8140 | 3 | Eligible for Assistance |
| Ricki Nadeak | 0.8110 | 4 | Eligible for Assistance |
| Faris Alfarizi | 0.7765 | 5 | Eligible for Assistance |
| Ihwan Munandar | 0.7680 | 6 | Not Eligible for Assistance |
| M Ramadhan Siregar | 0.7553 | 7 | Not Eligible for Assistance |
| Rizky Gunawan | 0.7375 | 8 | Not Eligible for Assistance |
| Rizki Noel Pardamean Panjaitan | 0.7356 | 9 | Not Eligible for Assistance |
| Rama Yuda | 0.7304 | 10 | Not Eligible for Assistance |

3. OCRA Method Analysis
The following is the application of the OCRA method in the web-based Decision Support System for Determining Aid Recipients at Pangeran Antasari High School. This table can be seen below.
Then in this step calculate each priority in relation to a particular criterion (if the criterion is more favorable, then the alternative with the higher value is better).
Imam Budi Raharjo

$$\boldsymbol{\theta 1} = \mathbf{0.05}\frac{5-4}{1} + \mathbf{0.10}\frac{5-2}{1} + \mathbf{0.15}\frac{5-2}{1} + \mathbf{0.2}\frac{5-2}{1} + \mathbf{0.05}\frac{5-5}{1} + \mathbf{0.1}\frac{5-5}{1} + \mathbf{0.1}\frac{5-4}{1} + \mathbf{0.1}\frac{4-4}{1} + \mathbf{0.1}\frac{5-4}{1}$$

$\boldsymbol{\theta 1}$ = 0.05 + 0.3 + 0.45 + 0.06 + 0 + 0 + 0 + 0 + 0
$\boldsymbol{\theta 1}$ = 1.4
Hendra Gunawan Manurung

$$\boldsymbol{\theta 2} = \mathbf{0.05}\frac{5-3}{1} + \mathbf{0.10}\frac{5-2}{1} + \mathbf{0.15}\frac{5-3}{1} + \mathbf{0.2}\frac{5-2}{1} + \mathbf{0.05}\frac{5-5}{1} + \mathbf{0.1}\frac{5-3}{1} + \mathbf{0.1}\frac{5-1}{1} + \mathbf{0.1}\frac{4-1}{1} + \mathbf{0.1}\frac{5-1}{1}$$

$\boldsymbol{\theta 2}$ = 0.1+ 0.3 + 0.3 + 0.6 + 0+ 0.15 + 0.4 + 0.3 + 0.4
$\theta 2$ = 2.7
The following are the ranking results using the OCRA method.

Table 4. OCRA Ranking

| Name | Linear Preference Ranking | Ranking | Information |
|---|---|---|---|
| Hendra Gunawan Manurung | 2.450 | 1 | Eligible for Assistance |
| M Yusuf Rivai | 2.300 | 2 | Eligible for Assistance |
| Antonius Sibarani | 2.250 | 3 | Eligible for Assistance |
| Fachrul Fazri | 2.200 | 4 | Eligible for Assistance |
| Fachrul Rozi | 2.150 | 5 | Eligible for Assistance |
| Mhd Daud | 2.100 | 6 | Not Eligible for Assistance |
| Nuriyanti | 2.100 | 7 | Not Eligible for Assistance |
| Zulkifli Dalimunthe | 2.100 | 8 | Not Eligible for Assistance |
| M Arshaf Pradana | 2.000 | 9 | Not Eligible for Assistance |
| Rio Jonathan Siahaan | 1.950 | 10 | Not Eligible for Assistance |

The comparative results of the WASPAS and OCRA methods are as follows:

1. Differences in Ranking Results
   The two methods produced significantly different rankings of aid recipients, especially for the top positions. For example:

| Ranking | OCRA | WASPAS |
|---|---|---|
| 1 | Hendra Gunawan | Boy Sandy Sinaga |
| 2 | M. Yusuf Rivai | Pandu Arya Ramadhan Lubis |
| 3 | Antonius Sibarani | Robinhot Pardamean Sagala |

   It was discovered that Hendra Gunawan, who was ranked number one by OCRA, was ranked 50th in the WASPAS method. Conversely, Boy Sandy Sinaga, who was ranked number one in WASPAS, was ranked 50th in OCRA. This indicates that the calculation algorithms and criteria emphasized by the two methods are very different.
2. Stability and Consistency of Results
   The WASPAS and OCRA methods show differences in ranking consistency between participants:
   a) WASPAS: Tends to produce scores that gradually and steadily decrease.
   OCRA: Although scores also decrease, several participants with identical scores receive different rankings.
3. Interpretation of Results and Decision Relevance
   WASPAS is more suitable when decisions are based on a combination of maximum and average scores (linear weighted summation and multiplicative). This gives more even weight to all criteria. OCRA is more suitable for decision-making based on optimization ratios and criteria deviations from reference values.

The following conclusions can be drawn:

| Aspect | OCRA | WASPAS |
|---|---|---|
| Ranking Accuracy | Many identical values → overlapping ratings | Stable and consistently decreasing scores |
| Assessment Consistency | Tends to have inconsistent results in the "eligible" label | More consistent in score-based classification |
| Interpretation | More complex, based on deviation from the reference value | Combination of aggregate and ratio scores → more balanced |
| Result Eligibility | 5 people (different names from WASPAS) | 5 people (different names from OCRA) |
| Recommended Use | Suitable for systems with benchmarks for determining decision-making | Suitable for multi-criteria evaluation systems |

This form displays the Analysis data report. When the admin selects a report from the Analysis report option, the program will display the Analysis report. An image of the Analysis report form can be seen in Figure IV.18:

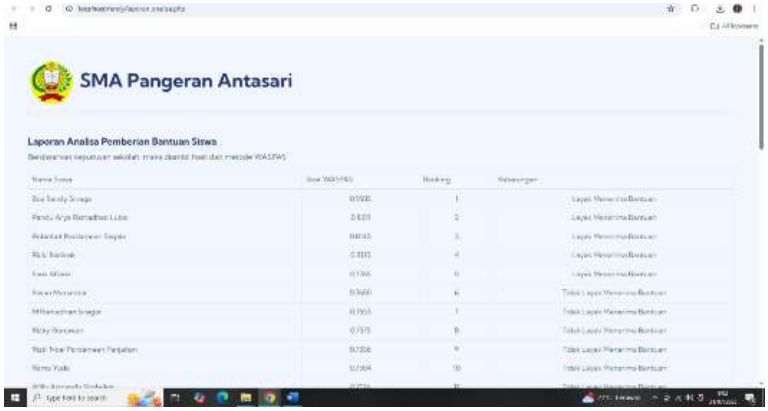


Figure 2. Analysis Report Form Display

Discussion

The comparison between the WASPAS and OCRA methods in determining scholarship aid recipients at Pangeran Antasari High School demonstrates distinct differences in computational logic, ranking stability, and decision reliability. The WASPAS method, which combines the Weighted Sum Model (WSM) and Weighted Product Model (WPM), produced results with a gradual decline in scores, indicating higher consistency in assessing multi-criteria decision-making problems. This characteristic suggests that WASPAS offers more balanced consideration among all criteria — transportation, parents' education, parents' income, and academic performance — ensuring that no single criterion disproportionately influences the decision outcome. In contrast, the OCRA method, which emphasizes optimization through criterion deviation analysis, revealed several inconsistencies, particularly with multiple identical scores resulting in overlapping rankings. These findings indicate that OCRA tends to be sensitive to minor fluctuations in normalized values, making it less stable for datasets with close or uniform performance indicators. Thus, WASPAS provides a more reliable structure for decision-making when equitable weighting and stable ranking are prioritized in social or educational aid assessments.

Furthermore, the divergent ranking results between both methods reflect their different mathematical foundations and decision emphases. The WASPAS method's linear-multiplicative integration captures both additive and proportional performance effects, yielding a comprehensive evaluation that better aligns with the practical objectives of fairness in scholarship allocation. Conversely, OCRA's reliance on relative preference deviations highlights extreme variations, making it advantageous in optimization scenarios that demand differentiation from a reference standard rather than balanced aggregation. From a policy perspective, the results imply that for educational institutions like Pangeran Antasari High School, which seek transparency and consistency in scholarship distribution, WASPAS represents a more dependable decision support framework. Future implementations could integrate hybrid models or sensitivity analysis to further enhance accuracy, ensuring that the selection of scholarship recipients aligns with both merit-based and socio-economic equity considerations.

## 4. Conclusion

The comparative analysis between the WASPAS and OCRA methods in the web-based Decision Support System for determining scholarship recipients at Pangeran Antasari High School reveals that the WASPAS method provides a more consistent, stable, and equitable outcome across all evaluation criteria. By integrating both additive and multiplicative approaches, WASPAS ensures that each criterion—ranging from socioeconomic background to academic performance—contributes proportionally to the final decision, minimizing potential bias and enhancing transparency. In contrast, the OCRA method, while effective in emphasizing deviations and optimization relative to a benchmark, exhibits a higher degree of sensitivity to small data fluctuations, leading to ranking inconsistencies and

overlapping results. These findings underscore that for institutional decision-making processes requiring fairness and clarity, such as educational aid distribution, WASPAS offers a more reliable and interpretable methodological foundation than OCRA. Based on the results, it is recommended that educational institutions adopt the WASPAS method as a core component of their decision-support frameworks for scholarship allocation. This method's robustness and computational balance make it particularly suitable for multi-criteria evaluations involving both qualitative and quantitative indicators. Moreover, integrating WASPAS into automated web-based systems enhances data management efficiency, minimizes human error, and promotes accountability in scholarship distribution. Future research is encouraged to expand on this study by applying hybrid decision-making models—such as combining WASPAS with AHP, TOPSIS, or VIKOR—to further improve the precision and adaptability of selection systems in diverse educational and organizational contexts. By advancing towards more transparent, data-driven decision models, educational institutions can strengthen governance practices and ensure that resource allocation aligns effectively with principles of equity and academic merit.

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