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Decision Support System for Permanent Lecturer Recruitment at STMIK Mulia Darma Using the Simple Additive Weighting (SAW) Method

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ABSTRACT

Selecting qualified academic personnel is critical for higher education institutions to maintain academic excellence and accreditation standards. At STMIK Mulia Darma, the recruitment process for permanent lecturers historically faced challenges related to multi-criteria evaluation complexity, administrative delays, and potential subjective bias when handled manually. This study aims to develop and implement a web-based Decision Support System (DSS) utilizing the Simple Additive Weighting (SAW) method to streamline and objective candidate screening. The evaluation incorporates five key criteria: Educational Background C1, Microteaching Score C2, Publication and Research Record C3, Interview Performance C4, and Expected Salary C5. Through matrix normalization and weighted aggregation, the system calculates final preference scores to rank applicants. In empirical trials, Candidate A3 achieved the highest preference score V3 = 0.940, demonstrating the method's effectiveness in balancing academic competencies against cost parameters. System testing via Black-Box Testing yielded a 100% functional success rate, while algorithmic accuracy verification confirmed 100% alignment between automated system outputs and manual calculations. Ultimately, the developed system effectively minimizes subjective bias, enhances decision-making efficiency, and provides a reliable framework for faculty recruitment at STMIK Mulia Darma.

INTRODUCTION

The quality of a higher education institution is fundamentally driven by the competence and qualifications of its academic faculty. Lecturers play a pivotal role as the primary pillar in fulfilling the Tridharma Perguruan Tinggi—the Three Pillars of Higher Education: teaching, research, and community service (Kurnia et al., 2021). Consequently, the recruitment and selection of permanent lecturers at STMIK Mulia Darma represent a strategic process that directly impacts academic excellence, program accreditation status, and institutional reputation (Suryanto & Safrizal, 2020).

In practice, evaluating candidates for permanent faculty positions involves navigating complex, multi-criteria decision-making scenarios. Decision-makers must assess applicants across a variety of criteria, including educational qualifications, teaching competency (microteaching), research productivity, organizational experience, and interview performance (Saputra & Wardani, 2022). When conducted manually, this evaluation process is vulnerable to subjective bias, cognitive error, and extended processing times—particularly when handling a large volume of applicants (Pratama et al., 2023).

To overcome these limitations, a structured, objective, and transparent evaluation mechanism is required. A Decision Support System (DSS) offers a computer-based framework that assists decision-makers by processing complex criteria into quantitative and actionable decision recommendations (Turban et al., 2021). Among various Multi-Criteria Decision Making (MCDM) approaches, the Simple Additive Weighting (SAW) method is particularly effective and well-suited for recruitment problems.

The SAW method, commonly known as the weighted addition method, operates by calculating the weighted sum of performance ratings for each candidate across all evaluated criteria (Haswan, 2021). Its key strengths lie in its algorithmic simplicity, computational efficiency, and ability to deliver clear, accurate candidate rankings based on pre-established criteria weights (Nofriansyah & Defit, 2020).

By implementing a SAW-based Decision Support System at STMIK Mulia Darma, the recruitment workflow can become more efficient, objective, and aligned with institutional quality standards (Fitriani et al., 2024). Based on these considerations, this study develops a system titled "Decision Support System for Permanent Lecturer Recruitment at STMIK Mulia Darma Using the Simple Additive Weighting (SAW) Method.".

METHODS

Research Design and Approach

This study adopts a Research and Development (R&D) design with a quantitative approach. A quantitative methodology is utilized because the evaluation and decision-making processes rely on mathematical computations involving weighted criteria, decision matrices, and normalized data across candidate alternatives.

Research Framework

The step-by-step procedures in conducting this research are structured in the following framework:

1. Problem Identification & Literature Review: Initial Phase.
   Identifying existing issues in the permanent lecturer recruitment process at STMIK Mulia Darma and studying fundamental theories regarding Decision Support Systems (DSS) and the Simple Additive Weighting (SAW) algorithm from academic journals and relevant literature.
2. Data Collection: Data Collection Phase
   Conducting direct observations of the lecturer recruitment workflow, interviewing the selection committee and management, and collecting evaluation documents related to candidate qualifications.
3. Analysis & SAW Modeling: System Analysis Phase
   Determining the evaluation criteria (C_j), criteria types (benefit/cost), criteria weights (W_j), and formulating equations for matrix normalization (R) and final preference scores (V_i).
4. System Design & Implementation: Design & Development Phase
   Designing the system architecture, database structure (ERD/UML), and user interface (UI), followed by implementing the SAW algorithm into a web-based application.
5. Testing & Evaluation: Final Phase
   Evaluating the system using Black-Box Testing to verify the functionality of system features and validating the mathematical accuracy of the system outputs by comparing them with manual SAW calculations.

Data Collection Methods

The data utilized in this study are categorized into two types:

1. Primary Data
   a. Interviews: Direct question-and-answer sessions with the HR Department and Management of STMIK Mulia Darma to obtain detailed information regarding system requirements, selection criteria, and weighting factors used in the permanent lecturer selection process.
   b. Observations: Direct monitoring of administrative procedures and applicant document screening workflows to understand the existing lecturer recruitment and selection process.
2. Secondary Data
   Secondary data were obtained from institutional profile documents, sample applicant datasets, and national higher education standards and regulations related to lecturer qualifications. These data were used as supporting references in determining the criteria and requirements for permanent lecturer selection at STMIK Mulia Darma.

Simple Additive Weighting (SAW) Algorithm

The SAW method requires normalizing the decision matrix (X) to a comparable scale across all evaluated candidate attributes.

The normalized performance rating (r_{ij}) for alternative i on criterion j is calculated as follows:

1. Decision Matrix Formation (X)
   The decision matrix (X) can be formulated as follows:

$$R=\begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix}$$

2. The element (x_{ij}) is normalized into (r_{ij}) using the following equation:

$$\boldsymbol{r_{ij}} = \begin{cases} \dfrac{x_{ij}}{max_i(x_{ij})}, & if\ j\ is\ a\ benefit\ criterion \\ \dfrac{min_i(x_{ij})}{x_i}, & if\ j\ is\ a\ cost\ criterion \end{cases}$$

r_{ij} = The normalized performance rating of alternative (i) on criterion (j)..
$max_i(x_{ij}) =$ The maximum value of criterion j
$min_i(x_{ij}) =$ The minimum value of criterion j

Perhitungan Nilai Preferensi (V_i)

The final preference value V_i for each alternative is calculated by summing the products of the normalized decision matrix values r_{ij} and the corresponding criterion weights w_j (Pratama & Putra, 2022):

$$V_i = \sum_{j=1}^{n} w_j * r_{ij}$$

The alternative with the highest (V_i) value is considered the best recommendation for selection as the Industrial Work Practice (Prakerin) placement.

System Testing Methods

Black-Box Testing: Conducted to verify functional operations, ensuring forms, input fields, navigation controls, and outputs operate according to system specifications without execution errors.Algorithm Accuracy Testing: Performed by comparing manual calculation results (computed via Microsoft Excel) with system-generated results to ensure 100% calculation accuracy.

RESULT AND DISCUSION

Results

Data Analysis and SAW Calculation

To evaluate prospective lecturers, STMIK Mulia Darma utilizes five key criteria: Educational Background C1, Microteaching Score C2, Publication and Research Record C3, Interview Performance C4, and Expected Salary C5. These criteria are used as the basis for constructing the decision matrix and calculating the final preference values using the Simple Additive Weighting (SAW) method.

Criteria Determination and Weighting

Table 1 presents the evaluation criteria used in the lecturer selection process, including their attribute types benefit or cost and assigned weights W.

Table 1. Evaluation Criteria and Weights

Code	Criterion Name	Attribute Type	Weight (W)	Percentage
C1	Educational Background	Benefit	0.25	25%
C2	Microteaching Score	Benefit	0.25	25%
C3	Publication & Research	Benefit	0.20	20%
C4	Interview Performance	Benefit	0.20	20%
C5	Expected Salary	Cost	0.10	10%
	Total		**1.00**	**100%**

The first four criteria are classified as benefit attributes because higher values indicate better candidate performance. In contrast, Expected Salary C5 is classified as a cost attribute because a lower expected salary is considered more favorable. The total weight of all criteria is 1.00 or 100%.

Candidate Sample and Decision Matrix (X)

For the SAW calculation, three lecturer candidates are considered: A1 Dr. Andi, A2 Budi, M.Kom , and A3 Chitra, M.T. Table 2 presents the initial decision matrix containing the scores of each candidate for all evaluation criteria.

Table 2. Initial Candidate Decision Matrix X

Candidate Ai	C1 Education)	C2 Microteaching	C3 Research	C4 Interview	(C_5) Salary IDR/Month)
(A1) Dr. Andi	90 Doctorate	80	85	88	8,000,000
(A2)Budi, M.Kom.	80 Master's	90	75	85	6,500,000
(A3) Chitra, M.T.	80 (Master's)	85	90	80	6,000,000
Max/Min Value	Max = 90	Max = 90	Max = 90	Max = 88	Min = 6,000,000

Based on Table 2, the maximum values are used for the benefit criteria C1–C4, while the minimum value is used for the cost criterion C5. These maximum and minimum values serve as the reference values for normalizing the decision matrix in the next stage of the SAW calculation.

Decision Matrix Normalization ((R))

Using the SAW normalization formula, the decision matrix X is transformed into a normalized decision matrix R. For the benefit criteria C1, C2, C3 and C4, each candidate's criterion value xij is divided by the maximum value of the corresponding criterion maxi xij. Meanwhile, for the cost criterion C5, the minimum value of the criterion mini xij is divided by each candidate's criterion value xij. The normalization process ensures that all criterion values are converted to a comparable scale ranging from 0 to 1, where a higher normalized value indicates a more favorable performance. The normalized values are subsequently used to calculate the final preference value for each lecturer candidate.

Candidate A1 (Dr. Andi):

$$r_{11} = \frac{90}{90} = 1.00$$

$$r_{12} = \frac{80}{90} = 0.889$$

$$r_{13} = \frac{85}{90} = 0.944$$

$$r_{14} = \frac{88}{90} = 1.000$$

$$r_{15} = \frac{6000000}{8000000} = 0.750$$

Candidate A2 (Budi, M.Kom.):

$$r_{11} = \frac{80}{90} = 0.889$$

$$r_{12} = \frac{90}{90} = 1.000$$

$$r_{13} = \frac{75}{90} = 0.833$$

$$r_{14} = \frac{85}{88} = 0.966$$

$$r_{15} = \frac{6000000}{6500000} = 0.923$$

Candidate A3 (Chitra, M.T.):

$$r_{11} = \frac{80}{90} = 0.889$$
$$r_{12} = \frac{85}{90} = 0.944$$
$$r_{13} = \frac{90}{90} = 1.000$$
$$r_{14} = \frac{80}{88} = 0.909$$
$$r_{15} = \frac{6000000}{6000000} = 1.000$$

Normalized Matrix (R):

$$R=\begin{bmatrix} 1.00 & 0.889 & 0.944 & 1.00 & 0.750 \\ 0.889 & 1.00 & 0.833 & 0.966 & 0.923 \\ 0.889 & 0.944 & 1.00 & 0.909 & 1.00 \end{bmatrix}$$

Final Preference Score Calculation Vi and Ranking

The final preference score Vi for each lecturer candidate is calculated by multiplying each normalized criterion value rij by its corresponding criterion weight wj and then summing the weighted values. The criterion weight vector used in this study is:

V1 (Dr. Andi):
V1 = (1.00 x 0.25) + (0.889 x 0.25) + (0.944 x 0.20) + (1.00 x 0.20) + (0.750 x 0.10) = 0.936
V2 (Budi, M.Kom.):
V2 = (0.889 x 0.25) + (1.00 x 0.25) + (0.833 x 0.20) + (0.966 x 0.20) + (0.923 x 0.10) = 0.924
V3 (Chitra, M.T.):
V3 = (0.889 x 0.25) + (0.944 x 0.25) + (1.00 x 0.20) + (0.909 x 0.20) + (1.00 x 0.10) = 0.940

Table 3. Final Ranking Results

Candidate Ai	Final Preference Score Vi	Rank	Selection Status
(A3) (Chitra, M.T.)	0.940	1	Accepted
(A1) (Dr. Andi)	0.936	2	Recommended
(A2) (Budi, M.Kom.)	0.924	3	Backup

System Testing and Accuracy Verification

System testing was conducted to evaluate the functionality and computational accuracy of the developed Decision Support System (DSS). The testing process consisted of two main approaches: Black-Box Testing and Algorithm Accuracy Testing.

1. Black-Box Testing
   Black-box testing was performed to verify whether each system function operated according to the specified requirements without examining the internal source code. The testing covered major system functionalities, including user authentication, data input forms, candidate and criteria management, SAW calculation processes, ranking results, and data export features. The testing results showed that all tested functionalities operated successfully and produced the expected outputs. Therefore, the system achieved a 100% functional success rate, indicating that the implemented features functioned in accordance with the system requirements.
2. Algorithm Accuracy Testing
   Algorithm accuracy testing was conducted to verify the correctness of the SAW calculations implemented in the web-based system. The preference scores generated automatically by the developed application

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were compared with manual calculations performed using Microsoft Excel. The comparison produced identical preference scores for all evaluated candidates, namely (V3 = 0.940) for Chitra, M.T., (V1 = 0.936) for Dr. Andi, and (V2 = 0.924) for Budi, M.Kom. The ranking order generated by the system was also identical to the manual calculation results.

Based on this comparison, the developed system achieved 100% computational accuracy for the tested dataset, demonstrating that the SAW algorithm was implemented correctly and consistently with the manual calculation procedure. Thus, the system can reliably support the lecturer candidate selection process based on the predefined criteria and weights.

Discussion

The implementation of the Simple Additive Weighting (SAW) method within the decision support system at STMIK Mulia Darma successfully addresses the critical limitations of traditional lecturer recruitment. Prior to system implementation, the faculty recruitment workflow at the institution relied heavily on manual scoring sheets and subjective evaluations. As highlighted by Pratama et al. (2023), manual multi-criteria evaluations in academic environments are highly susceptible to cognitive bias, evaluator fatigue, and extended administrative delays particularly when processing large applicant pools. The integration of a computer-based Decision Support System (DSS) mitigates these issues by providing a structured, quantifiable evaluation framework (Turban et al., 2021).

By converting qualitative candidate assessments into standardized quantitative weights, the SAW method ensures an objective, transparent, and reproducible ranking process. The empirical trial demonstrated that candidate A3 achieved the highest preference score (V3 = 0.940), primarily due to exceptional performance across key educational benefit criteria combined with optimal cost efficiency regarding expected salary. This aligns with findings by Haswan (2021), who noted that the SAW method's linear additivity effectively balances multiple competing criteria into a clear prioritization hierarchy without imposing high computational complexity.

Furthermore, integrating the SAW method into a web-based platform streamlines administrative procedures, allowing the selection committee to make data-driven hiring decisions swiftly (Fitriani et al., 2024). Ultimately, the system provides decision-makers at STMIK Mulia Darma with a reliable, objective decision-support tool that accelerates candidate screening while ensuring that appointed permanent lecturers consistently meet the university's academic quality standards (Suryanto & Safrizal, 2020).

CONCLUSION

In conclusion, this study successfully developed a web-based Decision Support System using the Simple Additive Weighting (SAW) method to streamline permanent lecturer recruitment at STMIK Mulia Darma across five key criteria: Educational Background, Microteaching Score, Publication & Research, Interview Performance, and Expected Salary. The empirical evaluation successfully prioritized candidates through matrix normalization and weighted aggregation—with Candidate A3 achieving the highest preference score 0.940 while functional Black-Box testing and algorithmic verification confirmed 100% accuracy against manual calculations. Ultimately, the system effectively mitigates subjective bias and accelerates evaluation processing, and it is recommended for future integration with the institution's Human Resource Information System alongside dynamic criteria weighting features to adapt to evolving accreditation standards.

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