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Comparative Analysis of Simple Additive Weighting and Weighted Product Methods for Faculty Integrity Zone Ranking

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Abstract

Abstract: Evaluating and ranking Faculty Integrity Zone units is a crucial process to support governance quality, transparency, and accountability in higher education institutions. However, manual evaluation processes are often time-consuming and prone to subjectivity. Therefore, this study aims to design and implement a Decision Support System (DSS) using the Simple Additive Weighting (SAW) and Weighted Product (WP) methods to perform an objective and systematic ranking of Faculty Integrity Zone units. The system was developed using the System Development Life Cycle (SDLC) with the Waterfall model, consisting of requirement analysis, system design, implementation, testing, and deployment stages. Research data were obtained from Integrity Zone assessment criteria applied to faculty units at Universitas Negeri Medan. The results indicate that both SAW and WP methods are capable of generating consistent and reliable ranking outcomes, with the Faculty of Education (FIP) achieving the highest rank in both methods. While SAW provides stable and easily interpretable results through linear weighted aggregation, WP demonstrates higher sensitivity to variations in criterion values due to its multiplicative approach. Overall, the developed DSS effectively supports decision-making in evaluating Faculty Integrity Zones and can be utilized as a strategic tool to enhance institutional governance performance.

Keywords: *Decision Support System, SAW, WP, Integrity Zone.*

I. INTRODUCTION

Decision-making is a crucial element in the managerial process in various organizations, including higher education institutions (Farid et al., 2025). Effective decision support can improve the quality of evaluations and recommendations based on complex and sometimes conflicting criteria (Sudipa, 2023). Decision Support Systems (DSS) are invaluable tools due to their ability to process data and criteria into a system that can assist in objective and systematic decision-making (Aurelia et al., 2022).

DSS are designed to transform data into relevant information so decision-makers can make the best decisions when dealing with semi-structured and unstructured problems. These systems integrate information technology with quantitative methods to produce valid and transparent recommendations (Dewi et al., 2025).

One approach to solving multi-criteria decision-making problems is to use the Multi-Attribute Decision-Making (MADM) method (Hadad et al., 2024), (Arifin & Fadillah, 2016). This method is useful for evaluating and ranking alternatives based on performance values for each established criterion. In the MADM family, Simple Additive Weighting (SAW) is one of the simplest yet widely used methods due to its easy calculation process and clear interpretation in combining criteria weights and alternative scores to produce a final ranking (Zain & Purniawati, 2020), (Simanullang et al., 2021).

The SAW method calculates the total value of each alternative by adding up the results of multiplying the alternative performance values on each criterion by the weight of that criterion (Ningtyas & Diartono, 2024). This approach allows for systematic comparisons between alternatives, so that the alternative with the highest score is considered the best choice in the decision-making process (Nisa et al., 2023).

Besides SAW, Weighted Product (WP) is also an effective MADM method and is often used in DSS (Mukhlis et al., 2024). Unlike SAW which uses addition operations, WP uses multiplication operations on the values of each criterion raised to a power according to its weight (Setiawan et al., 2021). The multiplication structure in WP offers the advantage of overcoming the problem of imbalance in units and dimensions of data because the values raised to the power of each weight contribute directly to the final ranking without complicated data normalization (Mardian et al., 2023), (Zaelani et al., 2025).

The application of SAW and WP methods in DSS has been widely carried out in various application cases, such as employee selection, vendor determination, scholarship selection and so on, which shows the flexibility of both in solving multi-criteria problems objectively and measurably (Hidayat et al.,

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2018), (Adiputra & Mulyawan, 2019), (Amalia, 2019).

However, studies combining these two methods in the context of Faculty Unit Integrity Zone ranking are still relatively limited. The Integrity Zone is a crucial indicator in assessing unit performance within a university because it encompasses aspects of transparency, accountability, and public service. Therefore, a DSS approach based on SAW and WP is necessary to produce reliable rankings based on predetermined criteria weighting.

Based on the description, this study aims to design and implement a decision support system that uses the SAW and WP methods to rank Faculty Integrity Zone Units effectively, objectively, and systematically.

II. RESEARCH METHODOLOGY

This study uses an applied research approach with the Waterfall System Development Life Cycle (SDLC) model. The Waterfall model was selected because it provides structured and sequential stages for system development. The methodology consists of requirements analysis, system design, implementation, testing, and deployment.

The Waterfall method is a system development model included in the Systems Development Life Cycle (SDLC) framework (Hasibuan, 2025). This approach emphasizes a linear and sequential development process, where each phase must be fully completed before the next phase begins (Dewi et al., 2023). This model is analogous to a waterfall, because the workflow moves unidirectionally from top to bottom without systematically returning to previous stages (Telaumbanua et al., 2025).

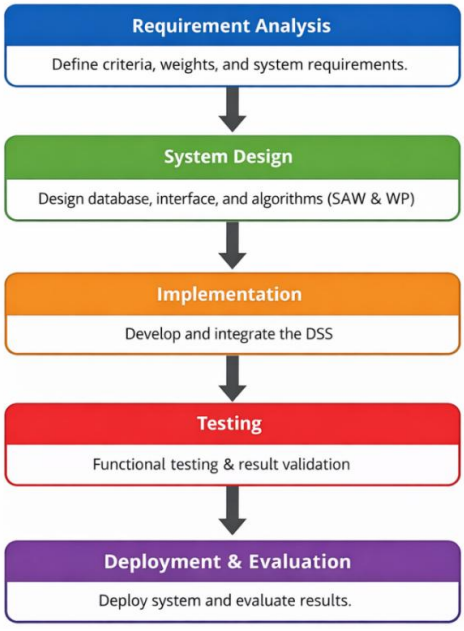


Figure 1. Waterfall Method for DSS Development

The decision-making process begins by identifying the alternatives and criteria, followed by assigning and normalizing criterion weights. The normalized decision matrix is then processed using SAW and WP. The resulting preference values are used to rank the faculty units. The system framework therefore links the Waterfall development process with the MADM calculation process.

A. Simple Additive Weighting Method (SAW)

SAW is one of the widely used MADM methods in decision support systems. The method begins with normalization of the decision matrix so that criterion values can be compared on a common scale. The normalized values are then multiplied by the corresponding criterion weights and summed to obtain the preference value of each alternative.

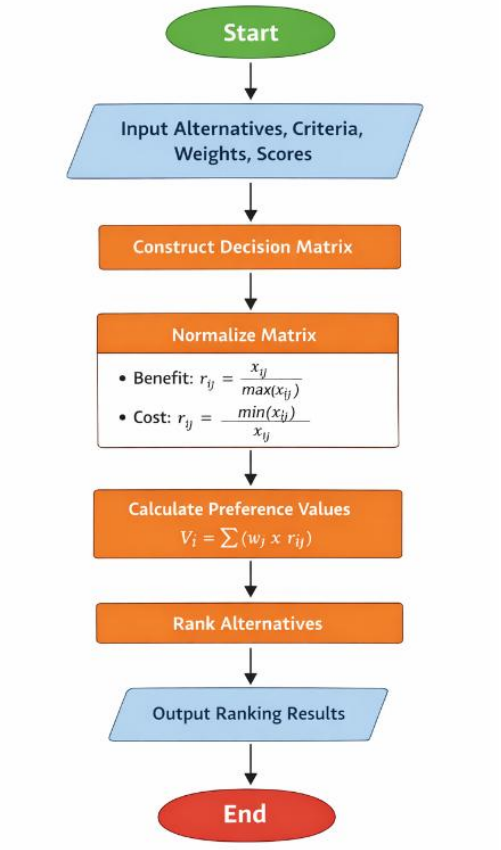


Figure 2. Simple Additive Weighting (SAW) Method

The main advantages of SAW are its relatively simple calculation, ease of implementation, and results that can be readily interpreted by decision-makers. In this study, the SAW procedure follows the formulation and sequence reported in the source article.

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B. Weighted Product Method (WP)

WP is a MADM method that uses a multiplicative approach to calculate alternative preference values. Each criterion value is raised to the power of its corresponding normalized weight. The resulting vector S values are then normalized by the total vector S to obtain the final preference vector V.

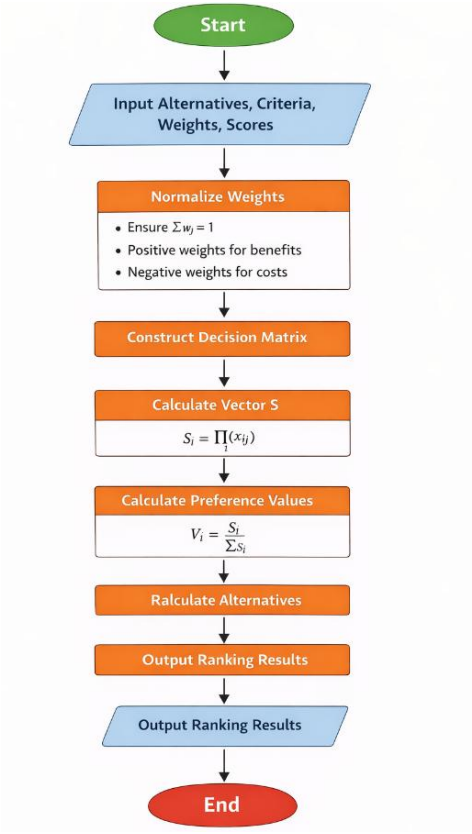


Figure 3. Weighted Product (WP) Method

The advantage of WP is its ability to represent the proportional influence of criterion weights through multiplication. The source study uses the same criteria and normalized weights for WP as for SAW so that the two methods can be compared on the same evaluation basis.

III. RESULTS AND DISCUSSION

A. Results of Simple Additive Weighting (SAW)

The SAW method is employed as a MADM approach to determine the ranking of faculty alternatives based on predefined Integrity Zone criteria. The alternatives represent faculty units assessed in the study.

Table 1. Alternative

Code	Faculty
A1	FMIPA
A2	FIK
A3	FIS
A4	FBS
A5	FE
A6	FT
A7	FIP

Table 2. Criteria and Initial Weights

Code	Criteria	Weight
C1	Manajemen Perubahan	4
C2	Penataan Tatalaksana	3
C3	Penataan SDM	3
C4	Penguatan Akuntabilitas	2
C5	Penguatan Pengawasan	2
C6	Peningkatan Kualitas Layanan	4

Table 3. Weight Normalization

Criteria	Weight Normalization
C1	4/18 = 0.2222
C2	3/18 = 0.1667
C3	3/18 = 0.1667
C4	2/18 = 0.1111
C5	2/18 = 0.1111
C6	4/18 = 0.2222

The performance scores of each alternative against each criterion are compiled into a decision matrix. The matrix serves as a numerical representation of the condition of each faculty unit. The source article reports the following six complete rows; the Faculty of Education (FIP) is included in the final ranking table but its raw criterion row is not displayed in the source decision matrix.

Table 4. Decision Matrix Reported in the Source Article

Faculty	C1	C2	C3	C4	C5	C6
FMIPA	80	85	90	85	90	95
FIK	70	80	85	80	85	90
FIS	80	85	88	85	88	92
FBS	60	70	75	75	80	85
FE	70	78	80	80	82	88
FT	85	88	90	85	90	92

Table 5. Matrix Normalization

Faculty	C1	C2	C3	C4	C5	C6
FMIPA	0.9412	0.9444	0.9783	0.9444	0.9783	1.0000
FIK	0.8235	0.8889	0.9239	0.8889	0.9239	0.9474
FIS	0.9412	0.9444	0.9565	0.9444	0.9565	0.9684
FBS	0.7059	0.7778	0.8152	0.8333	0.8696	0.8947
FE	0.8235	0.8667	0.8696	0.8889	0.8913	0.9263
FT	1.0000	0.9778	0.9783	0.9444	0.9783	0.9684

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Table 6. Preference Values of SAW

Rank	Fakultas	Value SAW
1	FIP	95.0000
2	FMIPA	95.6683
3	FIS	95.1127
4	FIK	94.5882
5	FE	92.9216
6	FT	92.4444
7	FBS	90.9804

Based on the source article, the Faculty of Education (FIP) is stated as the first-ranked faculty, followed by FMIPA, FIS, FIK, FE, FT, and FBS. The table above is reproduced as reported in the source. Because the source table contains values that do not numerically align with its stated rank order, the values have not been silently recalculated in this migration.

B. Results of Weighted Product (WP)

The WP method is calculated using the same alternatives and criteria weights as SAW, with the criterion weights first normalized so that their sum is one. The source article reports the following normalized weights and decision matrix.

Table 7. Weight Normalization for WP

Criteria	Weight WP
C1	0.2222
C2	0.1667
C3	0.1667
C4	0.1111
C5	0.1111
C6	0.2222

Table 8. Decision Matrix for WP

Faculty	C1	C2	C3	C4	C5	C6
FMIPA	80	85	90	85	90	95
FIK	70	80	85	80	85	90
FIS	80	85	88	85	88	92
FBS	60	70	75	75	80	85
FE	70	78	80	80	82	88
FT	85	88	90	85	90	92

Table 9. Vector S

Faculty	Vector S
FMIPA	33.2847
FIK	32.9124
FIS	33.0216
FBS	30.8432
FE	31.7819
FT	31.4095
FIP	33.7421

Table 10. Vector V and Final WP Ranking

Rank	Faculty	Value WP
1	FIP	0.1538
2	FMIPA	0.1519
3	FIS	0.1507
4	FIK	0.1489
5	FE	0.1416
6	FT	0.1398
7	FBS	0.1333

The source article reports FIP as the highest-ranked alternative in WP with a preference value of 0.1538, followed by FMIPA and FIS. FBS is reported as the lowest-ranked alternative. The ranking order is therefore consistent with the source article's overall discussion.

C. Comparative Discussion of SAW and WP

Based on the results reported in the source article, the top and bottom rankings of the two methods are consistent: FIP is identified as the highest-ranked faculty and FBS as the lowest-ranked faculty. This consistency indicates that both approaches can provide a comparable decision basis for the Integrity Zone evaluation.

The two methods nevertheless have different characteristics. SAW tends to produce values that are easier to interpret because the final preference is obtained through linear weighted aggregation. WP uses a multiplicative mechanism, so variations in criterion values can have a stronger proportional effect on the resulting preference.

Using both methods together provides a broader perspective for decision-makers. SAW can support transparency and straightforward interpretation, while WP can provide additional sensitivity information. In the context of Faculty Integrity Zone evaluation, the combined use of both methods can therefore strengthen the analytical basis for ranking decisions.

D. System Implementation

After the system design phase, the design was implemented as a web-based application supporting the Faculty Integrity Zone ranking process. The system provides a public home page and an administrator dashboard. The dashboard functions as a control center for managing alternatives, criteria, weights, and assessment values, as well as displaying the ranking results.

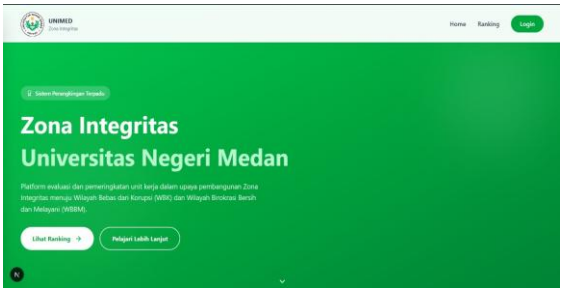


Figure 4. Home Page

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The home page provides an entry point to the Faculty Integrity Zone information and ranking application. The source article presents the interface as part of the implementation of the developed DSS.

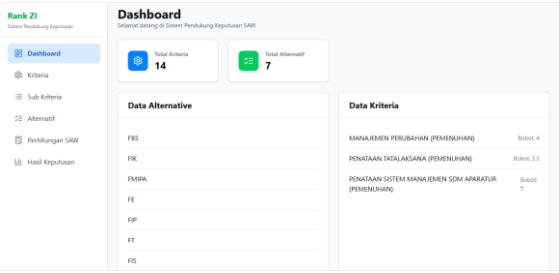


Figure 5. Admin Dashboard

The administrator dashboard provides menus for managing the data used in the ranking process. The implementation demonstrates that the SAW and WP calculations are integrated into a web-based DSS rather than being performed only as manual calculations.

IV. CONCLUSION

This study successfully implemented a Decision Support System for ranking Faculty Integrity Zone units using the Simple Additive Weighting (SAW) and Weighted Product (WP) methods. Based on the results reported in the source article, FIP achieved the highest ranking in both methods, while FBS achieved the lowest ranking.

Although the ranking order produced by SAW and WP is relatively consistent, each method demonstrates different characteristics. SAW provides stable and easily interpretable results through linear weighted aggregation, whereas WP is more sensitive to variations in criterion values because of its multiplicative approach. The combination of both methods can therefore provide a broader decision perspective for institutional governance.

A limitation that should be retained for subsequent checking is that the source article does not display the raw decision-matrix row for FIP, although FIP is included in the final ranking tables. In addition, the reported SAW preference values and stated rank order are not fully numerically aligned. These points are retained in this migration rather than being altered without the original data.

V. RECOMMENDATIONS

Further development can focus on completing and validating the assessment data for all faculty alternatives, particularly the raw criterion values used for FIP, and on rechecking the numerical consistency between the decision matrix, normalization, preference values, and final ranking. Subsequent work can also improve the DSS interface and provide systematic testing of the implemented calculation module so that the displayed rankings can be traced directly to the underlying assessment data

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