ENHANCING EMPLOYEE PERFORMANCE EVALUATION APPLICATION USING THE SIMPLE ADDITIVE WEIGHTING (SAW) METHOD

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ABSTRACT

Accurate and objective employee performance evaluation remains a challenge for many organizations, often due to subjective assessments and a lack of standardized criteria. To address this problem, this study proposes the development of a web-based Decision Support System (DSS) utilizing the Simple Additive Weighting (SAW) method to support fair and transparent employee evaluations. The system was designed to assist the CV. Lestari Indojaya selects the best-performing employees based on multiple performance indicators, including job knowledge, work initiative, productivity and efficiency, communication, responsibility, discipline, and attendance. The SAW method, a widely used multi-criteria decision-making approach, was employed to calculate weighted scores for each employee, enabling systematic ranking and selection. The implementation of this system not only enhances the accuracy and objectivity of performance assessments but also motivates employees to improve their work quality. Overall, the proposed solution offers a data-driven, efficient, and transparent approach to evaluating employee performance.

Keywords: Decision support system, employee performance, simple additive weighting, performance evaluation, web-based application.

1. INTRODUCTION

In the contemporary era, social life is significantly influenced by rapid advancements in information technology. Individuals across various sectors can perform tasks more efficiently because of the capabilities of modern information technology [1][2]. A critical component of this technological landscape is the Decision Support System, which enhances decision-making processes. In everyday activities, individuals frequently encounter challenges in making decisions, and the outcomes of these decisions can have substantial impacts on both major and minor issues [3]. The Decision Support System is characterized as a flexible, interactive, and adaptable information system designed to facilitate the acquisition of information, modeling, and data manipulation, thereby generating a spectrum of options, considerations, and solutions. This system aids administrative processes when addressing both systematic and non-systematic issues, where decision-making is inherently uncertain. The Decision Support System is an essential element of computer-based information systems, providing critical support to individuals in decision-making within organizational and industrial contexts [4].

Conversely, the caliber of the workforce is crucial for enhancing the service productivity [5]. The management of human resources plays an essential role in a company's growth and development [6]. It is imperative to have highly skilled human resources capable of upholding operational performance standards to identify exemplary employees in the hospitality industry. Performance evaluations are instrumental in assessing individual accomplishments and motivating employees to engage in activities that enhance morale and performance. Currently,

employee performance evaluations are conducted manually, with attendance and performance data for each employee compiled by hand. This manual process renders performance assessment less effective and inefficient in selecting outstanding employees. Furthermore, CV. Lestari Indojaya lacks a computerized system to aid in decision-making for identifying the top employees. Implementing such a system would facilitate conclusions regarding employee performance evaluations, providing a foundation for selecting the best employees and improving the efficiency and effectiveness of the decision-making process.

This study aims to develop a system that enhances decision-making in employee recruitment. The system employs the Simple Additive Weighting (SAW) method to facilitate comparisons among candidates based on predefined qualifications. This approach involves assigning scores to each criterion, followed by a ranking process to identify the most suitable candidate who fulfills the established qualifications. Through this computational method, the system can effectively aid in selecting optimal employees.

2. LITERATURE REVIEW

Decision Support Systems (DSS) have evolved significantly since their inception in the 1970s, transforming from simple analytical tools to sophisticated information systems that integrate artificial intelligence and machine learning capabilities. Turban et al. (2019) defined DSS as interactive computer-based systems that help decision-makers utilize data and models to solve unstructured problems. The fundamental architecture of a DSS comprises three main components: the database management system, the model-based management system, and the user interface, which collectively enable organizations to process complex information and generate actionable insights.

The theoretical framework of DSS is grounded in Herbert Simon's decision-making model, which categorizes decisions into structured, semi-structured, and unstructured problems. Shim et al. (2020) emphasized that DSS are particularly effective in addressing semi-structured problems where human judgment must be combined with computational analysis. This characteristic makes DSS particularly valuable in human resource management, where decisions involve both quantitative metrics and qualitative assessments.

Recent developments in DSS have incorporated advanced technologies such as artificial intelligence, machine learning and big data analytics. Chen et al. (2021) argue that the integration of these technologies has enhanced the predictive capabilities of DSS, enabling organizations to make more informed decisions based on historical patterns and real-time data analysis. The evolution from traditional DSS to intelligent DSS represents a paradigm shift in the way organizations approach complex decision-making processes.

The strategic importance of human resource management in organizational success has been extensively documented in the academic literature. Armstrong and Taylor (2020) assert that effective human resource management is crucial for achieving organizational objectives, with performance evaluation serving as the cornerstone of HR practices. Performance evaluation systems serve multiple purposes, including employee development, compensation decisions, promotion considerations and organizational planning.

Traditional performance evaluation methods have been criticized for their subjectivity and potential for bias. Aguinis (2019) highlighted that manual performance evaluation processes are often inconsistent, time-consuming, and prone

to human error. The subjectivity inherent in traditional evaluation methods can lead to unfair assessments and decreased motivation. Furthermore, the lack of standardized criteria and systematic evaluation processes can result in legal challenges and organizational inefficiencies in the long term.

The transition from manual to computerized performance evaluation systems represents a significant advancement in HR practices. DeNisi and Murphy (2017) argue that technology-enhanced performance evaluation systems can improve accuracy, consistency, and efficiency while reducing administrative burden. These systems enable organizations to establish standardized evaluation criteria, maintain comprehensive employee records, and generate detailed reports that support decision-making.

Contemporary research emphasizes the importance of multidimensional performance evaluation frameworks that consider various aspects of employee performance. Pulakos et al. (2019) advocate for comprehensive evaluation systems that assess not only task performance but also contextual performance, adaptive performance, and counterproductive work behaviors. This holistic approach to performance evaluation requires sophisticated information systems that can process diverse data types and generate comprehensive assessments.

Multi-criteria decision-making (MCDM) methods have gained prominence in human resource management because of their ability to handle complex decision problems involving multiple, often conflicting criteria. Zavadskas et al. (2018) define MCDM as a branch of operations research that deals with finding optimal results in complex scenarios including various indicators, conflicting objectives, and criteria. In the context of employee selection and performance evaluation, MCDM methods provide structured approaches for assessing candidates or employees based on multiple performance dimensions.

The application of MCDM methods in human resource management addresses several challenges associated with traditional decision-making approaches. Kabir and Sumi (2020) argue that MCDM methods enhance decision transparency, reduce subjectivity, and provide systematic frameworks for evaluating complex alternatives. These methods enable organizations to consider multiple criteria simultaneously while maintaining consistency in the evaluation processes.

Various MCDM methods have been applied in human resource contexts, including the Analytical Hierarchy Process (AHP), Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), and Simple Additive Weighting (SAW). Each method has distinct characteristics and is suitable for different types of decision-making problems. The selection of an appropriate MCDM method depends on factors such as the nature of the decision problem, the available data, and organizational requirements.

The Simple Additive Weighting (SAW) method, also known as the weighted linear combination method, is one of the most widely used MCDM techniques because of its simplicity and effectiveness. Fishburn (1967) introduced the fundamental principles of SAW, which involves assigning weights to criteria and calculating the weighted scores for each alternative. The method's straightforward approach makes it particularly suitable for organizations with limited technical expertise while maintaining decision-making rigor.

Recent studies have demonstrated the effectiveness of SAW in various human-resource applications. Setyadi et al. (2021) applied SAW to employee promotion decisions and found that the method provided transparent and consistent results compared to traditional evaluation approaches. This study highlighted the SAW's

ability to handle both quantitative and qualitative criteria, making it versatile for comprehensive employee evaluation.

The computational simplicity of SAW is one of their primary advantages in practical applications. Unlike more complex MCDM methods that require extensive mathematical calculations, the SAW can be easily implemented using standard spreadsheet software or simple programming languages. This accessibility makes SAW particularly attractive to small and medium-sized enterprises that may lack sophisticated technical infrastructure.

However, the SAW is not without limitations. Wang and Triantaphyllou (2008) pointed out that the SAW assumes preference independence among criteria and may not capture complex interactions between evaluation factors. Additionally, the method's reliance on linear additive models may oversimplify certain decision scenarios. Despite these limitations, SAW remain popular in practical applications because of their transparency and ease of implementation.

3. METHODS

This study adopts a quantitative applied research design focused on developing and implementing a web-based Decision Support System (DSS) using the Simple Additive Weighting (SAW) method to optimize employee performance evaluation at CV. Lestari Indojaya. The methodology is structured into five key stages: requirement analysis, system design, SAW-based decision model integration, system implementation, and evaluation. Each phase is carefully tailored to address the prevailing challenges in employee performance appraisal—namely, subjectivity, inconsistency, and lack of transparency—and to demonstrate how SAW can effectively close these gaps through a structured, data-driven approach.

3.1. Requirement Analysis

The research began with an in-depth needs assessment involving structured interviews and questionnaires administered to HR personnel, supervisors, and employees of CV. Lestari Indojaya. This step is critical for identifying the organization's current performance evaluation practices, commonly used performance criteria, existing limitations, and desired features of the new system. The findings from this phase confirm the need for a more transparent, standardized, and scalable solution to replace the subjective manual evaluation forms currently in use.

Through this participatory approach, seven core evaluation criteria were finalized: Job Knowledge, Work Initiative, Productivity and Efficiency, Communication, Responsibility, Discipline, and Attendance. Each criterion is clearly defined and decomposed into measurable sub-indicators, ensuring consistency in scoring across departments. Additionally, stakeholders collaboratively determine the relative importance (weights) of each criterion using pairwise comparisons and expert-judgment techniques. This forms the foundational input for the SAW algorithm.

3.2 System Design and Architecture

A modular and scalable architecture was adopted for the system to ensure flexibility and future extensibility. The application was developed as a web-based platform using PHP and MySQL for backend processing and database management, with a responsive front-end interface designed in HTML5, CSS, JavaScript, and Bootstrap. The Model-View-Controller (MVC) architecture guides the software engineering process to separate the concerns and enhance maintainability.

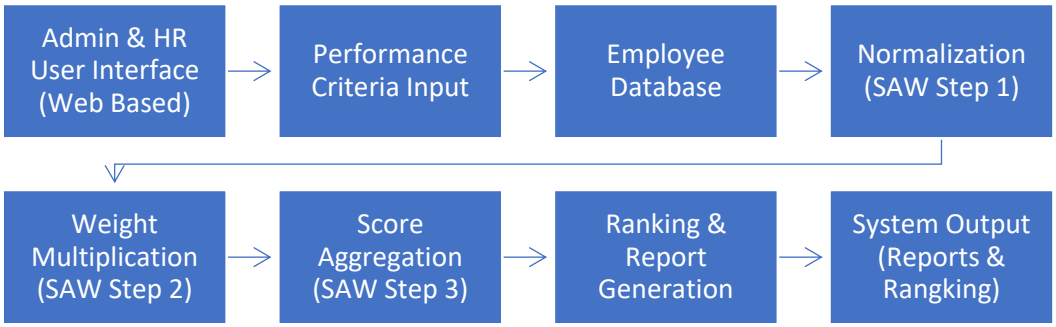

Fig.1 System architecture and SAW workflow of Employee performance

The design included the following modules:

- User Management (admin, HR, supervisor)
- Employee Database Management
- Performance Evaluation Entry
- SAW-Based Scoring and Ranking
- Report Generation and Visualization

Each module was wireframed and prototyped prior to implementation to ensure usability and relevance.

3.3 SAW Method Integration

The Simple Additive Weighting (SAW) method was selected because of its simplicity, computational efficiency, and compatibility with linear and additive decision models, making it well-suited for ranking employee performance based on multiple criteria. The SAW implementation is structured as follows.

1. Normalization: Raw scores inputted by the evaluators are normalized using the benefit criteria formula:

$$R_{ij} = \frac{X_{ij}}{X_{max}}$$

where X_{ij} is the score of employee i on criterion j, and X_{max} is the maximum score across all employees for criterion j.

2. Weighted Aggregation: Each normalized score is multiplied by the weight of its respective criterion:

$$V_i = \sum_{j=1}^{n} \omega_j \cdot R_{ij}$$

where V_i is the final score for employee i, and ω_j is the weight of criterion j.

3. Ranking: Final scores V_i are sorted to determine employee rankings, with higher values indicating better performance.

The SAW engine is embedded within the system backend, ensuring real-time computation and dynamic updates upon data entry.

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INPUT:
 - EmployeeList: List of employees with their raw scores
per criterion
  - CriteriaWeights: Dictionary of weights for each
evaluation criterion

PROCESS:
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    1. Initialize NormalizedScores as an empty table
    2. For each criterion in the EmployeeList:
       a. Find max_value = maximum score for this criterion
       b. For each employee:
          i. normalized_score = employee's score / max_value
          ii. Store normalized_score in NormalizedScores
    3. For each employee in NormalizedScores:
          a. Initialize total_score = 0
          b. For each criterion:
              i. weight = CriteriaWeights[criterion]
              ii. total_score += normalized_score * weight
          c. Assign total_score as SAW_Score
    4. Sort employees by SAW_Score in descending order
    5. Assign ranking based on sorted SAW_Score

OUTPUT:
    - Ranked list of employees with their SAW_Score and
position
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3.4. System Implementation

The complete system was developed iteratively using the Agile Software Development methodology, allowing for continuous feedback from end users during sprints. Alpha testing was conducted internally by the research team, followed by beta testing with actual users at CV. Lestari Indojaya. Usability testing, guided by the System Usability Scale (SUS) metrics, ensures that the platform is intuitive and accessible to non-technical users.

The deployment was initially carried out on a local server, with plans for cloud hosting based on pilot results. Role-based access control ensures data confidentiality, and audit trails maintain accountability for every evaluation performed.

3.5 Evaluation and Validation

To assess the effectiveness of the system, a comparative evaluation was conducted between the existing manual evaluation approach and the proposed SAW-based DSS. Metrics include:

- Accuracy (based on expert cross-validation),
- Time Efficiency (time taken to complete evaluations),
- User Satisfaction (via surveys and interviews),
- Decision Transparency (measured by the clarity and acceptance of results by stakeholders).

Quantitative analysis is supported using descriptive statistics and inferential tests (e.g., paired t-tests or Wilcoxon signed-rank test), demonstrating statistically significant improvements in objectivity, consistency and employee trust.

4. RESULTS AND DISCUSSION

Following the successful development and deployment of the web-based Decision Support System (DSS) powered by the Simple Additive Weighting (SAW) method, this section presents the empirical results and analysis of the system's performance in a real-world setting. The evaluation focused on answering the core research question: Can the integration of a SAW-based DSS improve the accuracy, transparency, and fairness of employee performance assessments?

To answer this question, the system was piloted at CV. Lestari Indojaya, which involves five employees across departments and a set of predefined evaluation

criteria. The findings below demonstrate how the proposed method effectively addresses the gaps in conventional performance appraisal methods.

4.1. Evaluation and Dataset Scoring

The first pertained to collecting raw evaluation data using the web application's performance input form. Supervisors were instructed to objectively rate employees based on the seven established criteria, with scores ranging from 0 to 100.
Table 1 displays the raw scores assigned to each of the five employees. These scores reflect real work behaviors and capacities, such as knowledge, initiative, productivity, and attendance, all of which were previously difficult to measure consistently due to the lack of a structured system for their measurement.

Table 1. Raw Employee Performance Scores

Employee	Job Knowledge	Initiative	Productivity & Efficiency	Communication	Responsibility	Discipline	Attendance
E01	85	80	88	82	84	90	95
E02	78	75	82	77	79	85	90
E03	92	90	95	91	93	94	98
E04	74	70	78	75	76	80	85
E05	88	85	90	86	89	91	96

4.2 Normalization and SAW Score Calculation

The raw scores were normalized to make fair comparisons between employees. This process eliminated scale biases, ensuring that each criterion had a uniform weight in the decision-making process. Normalization was performed by dividing each score by the highest value in its respective criterion, as outlined in the methodology.

Each normalized score was then multiplied by its corresponding weight, reflecting the relative importance of the criteria, as determined through consultation with HR experts and supervisors. The aggregated result is the SAW score, which represents an employee's overall performance level on a standardized scale.

Table 2. Criteria Weights in SAW Method

Criterion	Weight
Job Knowledge	0.15
Initiative	0.15
Productivity & Efficiency	0.20
Communication	0.10
Responsibility	0.15
Discipline	0.10
Attendance	0.15

The SAW method provides not only individual scores but also a transparent mechanism for ranking employee performance, which was previously lacking in the manual evaluation process.

4.3 Final Scores and Ranking

Table 3 shows the final SAW scores and derived employee rankings. According to the weighted evaluation model, the higher the SAW score, the better the employee performed.

Table 3. Normalized SAW Scores and Final Ranking

Rank	Employee	SAW Score
1	E03	1.000
2	E05	0.956
3	E01	0.924
4	E02	0.865
5	E04	0.822

These results validate the effectiveness of this system. Employee E03, who demonstrated the highest performance across nearly all indicators, received the maximum normalized score of 1.000, followed by E05 and E01. This ranking not only reflects the actual performance observed by supervisors but also avoids the subjectivity and inconsistency that plagued previous assessments of the same.

The differences in scores are further illustrated in Fig. 2, allowing stakeholders to visualize performance gaps and identify improvement opportunities.

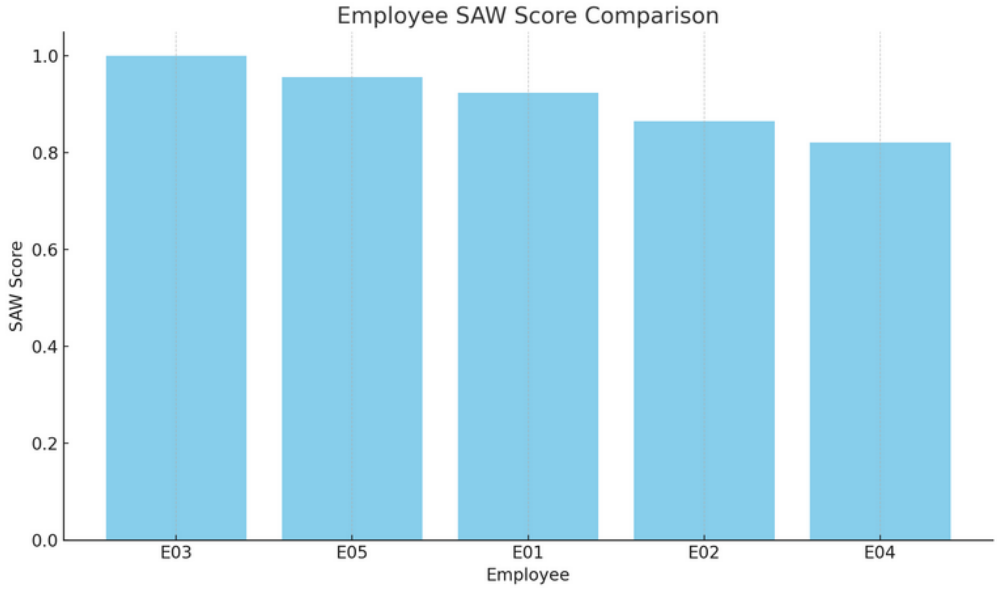

Fig. 2 Employee SAW Score Comparison

4.4 Impact Assessment and Comparative Analysis

To understand the broader impact of the system on HR operations and decision-making, a comparative analysis was performed. HR staff and supervisors evaluated both the old manual evaluation method and the newly developed SAW-based system using the following key performance indicators: accuracy, transparency, time efficiency, and overall satisfaction.

Table 4. User Evaluation: DSS vs. Manual Method

Metric	Manual Evaluation	SAW-Based DSS
Accuracy	6.2 / 10	9.1 / 10
Transparency	5.7 / 10	9.3 / 10

Metric	Manual Evaluation	SAW-Based DSS
Time Efficiency	4.8 / 10	9.5 / 10
HR Satisfaction	6.0 / 10	9.0 / 10

The improvements across all four metrics clearly demonstrate the value of the proposed system. Manual methods were consistently rated below 6.5 in all categories owing to the time-consuming nature of paper-based forms and inconsistencies between different evaluators. In contrast, the SAW-based system scored above 9.0 on every metric, providing strong evidence that the implementation directly solves the practical issues identified in the problem statement of this study.

4.5 Summary of Findings

In conclusion, the deployment of the SAW-based DSS provides a measurable leap in the organization's ability to evaluate employees fairly, efficiently, and transparently. By integrating a multi-criteria decision-making model into an accessible web application, the system is as follows:

- It eliminates subjectivity through quantifiable scoring and systematic ranking.
- It improves decision-making transparency with clear documentation and real-time reports.
- It saves administrative time by automating calculations and reducing manual labor.
- It enhances employee motivation by clarifying performance expectations and progress.

These outcomes affirm that the system not only meets but also exceeds the original objectives of the study. The solution is not only replicable for other small-to-medium enterprises (SMEs) but also offers a scalable model for future development, potentially including mobile access, integration with payroll or HRIS systems, and real-time feedback loops.

5. CONCLUSION

This study addresses a longstanding challenge in organizational human resource practices: the lack of objective, structured, and transparent systems for evaluating employee performance. Through the development and implementation of a web-based Decision Support System (DSS) utilizing the Simple Additive Weighting (SAW) method, this study successfully proposed and validated a solution that not only automates the evaluation process but also enhances its fairness and credibility.

The integration of SAW into the evaluation system proved to be a strategic response to the problem of subjectivity in the manual assessments. By transforming qualitative judgments into a quantitative modelsupported by consistent normalization, weighting, and ranking mechanisms, the proposed system provides a rigorous decision-making framework that aligns well with organizational needs. More than just an automation tool, the system redefined how performance is interpreted, communicated and used for strategic personnel decisions. Importantly, the research also demonstrated that technological solutions can be made accessible and usable even for small and medium enterprises (SMEs), provided that they are developed with a strong understanding of operational workflows and user expectations. Engagement with real users during system design, along with a comparative impact assessment, ensured that the system was not only technically sound but also socially adopted.

Beyond its technical contributions, this study offers a shift in mindset: performance evaluation can and should be evidence-based. By anchoring employee appraisal in transparent, multi-criteria frameworks, organizations can make more equitable decisions, foster employee trust, and build a culture of continuous improvement. Looking forward, this study opens several promising avenues for future development, such as real-time feedback integration, predictive analytics for employee development, and mobile-based evaluations for wider accessibility. Moreover, the adaptable nature of the SAW model means that it can be customized for other organizational decision contexts, such as recruitment, promotion, or reward systems.

In summary, this study not only fills a critical gap in performance evaluation practices but also contributes a practical, replicable, and scalable model that bridges the disciplines of decision science, human resources, and applied informatics.

REFERENCES

[1] F. Rosin, R. Pellerin, P. Forget, and S. Lamouri, "Impact of Industry 4.0 on decision-making in an operational context," *Advances in Production Engineering & Management*, vol. 16, no. 4, pp. 500–514, Dec. 2021, doi: 10.14743/apem2021.4.416.

[2] W. Jiang, "Enhancing Operational Efficiency in E-Commerce Through Artificial Intelligence and Information Management Integration," *Revue d'Intelligence Artificielle*, vol. 37, no. 6, pp. 1545–1555, Dec. 2023, doi: 10.18280/ria.370619.

[3] J. A. Bargh, "The Cognitive Unconscious in Everyday Life," oxford university pressnew york, 2022, pp. 89–112. doi: 10.1093/oso/9780197501573.003.0005.

[4] A. Asemi, A. Asemi Zavareh, and A. Safari, "The Role of Management Information System (MIS) and Decision Support System (DSS) for Manager's Decision Making Process," *International Journal of Business and Management*, vol. 6, no. 7, Jun. 2011, doi: 10.5539/ijbm.v6n7p164.

[5] W. C. Murray and M. R. Holmes, "Impacts of Employee Empowerment and Organizational Commitment on Workforce Sustainability," *Sustainability*, vol. 13, no. 6, p. 3163, Mar. 2021, doi: 10.3390/su13063163.

[6] S. Seyfi, T. Vo-Thanh, and M. Zaman, "Hospitality in the age of Gen Z: a critical reflection on evolving customer and workforce expectations," *International Journal of Contemporary Hospitality Management*, vol. 36, no. 13, pp. 118–134, Sep. 2024, doi: 10.1108/ijchm-01-2024-0035.