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EMPLOYEE PERFORMANCE ASSESSMENT BASED ON MONTHLY PERFORMANCE USING AHP-SAW AT UPPKH PAMEKASAN REGENCY

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Abstract

Employee performance assessment plays an important role in improving organizational productivity and supporting decision-making processes. However, the evaluation process at UPPKH Pamekasan Regency is still conducted manually, which often leads to subjectivity, inconsistency, and inefficiency. Previous studies have not fully addressed the integration of objective weighting and accurate ranking in a validated system, highlighting a research gap. Therefore, this study develops a Decision Support System (DSS) for employee performance assessment using the combination of the Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW) methods. The AHP method is used to determine the weights of nine predetermined evaluation criteria through pairwise comparison, while the SAW method is applied to calculate the alternative values of 20 PKH facilitators based on their performance scores. The results show that the system is able to produce objective and structured rankings, where the highest preference value is obtained by alternative K4 with a score of 0.922, followed by K5 with a score of 0.919, and K3 with a score of 0.902. The developed system has been tested using black box testing, which confirms that all system functionalities operate correctly. Therefore, the proposed system effectively reduces subjectivity and improves evaluation accuracy, as demonstrated by the high Spearman correlation value of 0.97143 (97%). This study contributes by integrating AHP and SAW methods with validation mechanisms for employee performance assessment, providing a more reliable and objective decision-support tool for UPPKH Pamekasan Regency.

Keywords: Decision Support System; AHP; SAW; Employee Performance; Ranking

Abstrak

Penilaian kinerja karyawan memainkan peran penting dalam meningkatkan produktivitas organisasi dan mendukung proses pengambilan keputusan. Namun, proses evaluasi di UPPKH Kabupaten Pamekasan masih dilakukan secara manual, yang seringkali menimbulkan subjektivitas, inkonsistensi, dan ketidakefisienan. Penelitian-penelitian sebelumnya belum sepenuhnya mengatasi integrasi pembobotan objektif dan perangkingan yang akurat dalam sistem yang tervalidasi, sehingga menunjukkan adanya kesenjangan penelitian. Oleh karena itu, penelitian ini mengembangkan Sistem Pendukung Keputusan (SPK) untuk penilaian kinerja karyawan menggunakan kombinasi metode Analytical Hierarchy Process (AHP) dan Simple Additive Weighting (SAW). Metode AHP digunakan untuk menentukan bobot sembilan kriteria evaluasi yang telah ditentukan sebelumnya melalui perbandingan berpasangan, sedangkan metode SAW diterapkan untuk menghitung nilai alternatif 20 fasilitator PKH berdasarkan skor kinerja mereka. Hasil penelitian menunjukkan bahwa sistem mampu menghasilkan perangkingan yang objektif dan terstruktur, di mana nilai preferensi tertinggi diperoleh oleh alternatif K4 dengan skor 0,922 disusul dengan K5 dengan skor 0.919 kemudian K3 dengan skor 0.902. Sistem yang dikembangkan telah diuji menggunakan pengujian black box, yang mengkonfirmasi bahwa seluruh fungsionalitas sistem berjalan dengan benar. Dengan demikian, sistem yang diusulkan secara efektif mengurangi subjektivitas dan meningkatkan akurasi evaluasi, sebagaimana ditunjukkan oleh nilai korelasi Spearman yang tinggi sebesar 0,97143 (97%). Penelitian ini berkontribusi dengan mengintegrasikan metode AHP dan SAW beserta mekanisme validasi untuk penilaian kinerja karyawan, sehingga menghasilkan alat pendukung keputusan yang lebih andal dan objektif bagi UPPKH Kabupaten Pamekasan.

Kata kunci: Sistem Pendukung Keputusan; AHP; SAW; Kinerja Karyawan; Perangkingan

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INTRODUCTION

Employee performance assessment is one of the most important factors in improving organizational productivity and motivating employees. Employee performance evaluation is critical in organizational management because it serves as a strategic method for ensuring alignment between individual contributions and organizational objectives (Shah et al., 2022). Furthermore, another research states that human resource management, particularly employee performance evaluation is highly important for organizational growth (Sampath et al., 2024; Zebua, 2025). In today's organizations, performance appraisal is more than just an administrative task; it is also a key procedure that aids managerial decision-making regarding promotion, salary, and employee development. Several recent studies demonstrate that effective performance evaluation systems greatly enhance productivity and strengthening organizational competitiveness by aligning individual performance with strategic organizational goals (Banayee et al., 2022; Firdaus et al., 2024). Competence, professional attitude, work motivation, and effective employee performance assessment can greatly influence service quality within organization (Agustina et al., 2025).

In Indonesia, there is a unit under Department of Social Services called Unit Pelaksana Program Keluarga Harapan (UPPKH). UPPKH is responsible for managing social assistance programs, particularly Program Keluarga Harapan (PKH). This program's success highly dependent on the performance of the employees in carrying out their duties, Such as data collection, verification, and participant monitoring. Therefore, accuracy and consistency are essential to achieve the unit's objectives. Performance evaluations are also necessary to assist coordinators in assessing program success.

However, UPPKH Pamekasan Regency still uses manual or traditional methods for employee performance assessment. Although commonly used, manual methods tend to rely on subjective judgments, which can lead to bias and inconsistency (Hertyana et al., 2022). Subjective evaluations can affect employee performance, which in turn can affect the quality of service (Putri et al., 2024). In addition, the absence of clear criteria weighting makes it difficult to determine the importance of each performance indicator (Pohan et al., 2020; Suprapto et al., 2024). Furthermore, manual evaluations are time-consuming and prone to errors. They also make multi-criteria calculations difficult, resulting in inefficiency (Indriani et al., 2025). These issues indicate the need for a more reliable and systemic approach in assessing employee performance in UPPKH Pamekasan Regency.

To address this problem, this study proposes the implementation of a Decision Support System (DSS). A DSS plays an important role in improving the quality of decision making by using structured, systematic, and data analysis, which can reduce subjectivity and increase accuracy (Ardi et al., 2025; Mulyana & Syahputra, 2025). Recent studies show that combining methods can improve efficiency and accuracy in the evaluation process, as well as produce consistent ranking results (Purnomo Putro et al., 2025), and handle complex criteria and uncertainty (Utomo & Tosungku, 2023). AHP-SAW combines structured weighting with a clear ranking mechanism, making it suitable for employee assessment systems (Arbansyah et al., 2024; S & Siska, 2024).

There are several previous studies that have investigated DSS using AHP, SAW, and their combination. Previous studies that rely exclusively on AHP for performance assessment reveal a notable methodological limitation, while AHP is well-suited for criteria weighting, it lacks an efficient mechanism for alternative ranking, potentially reducing the overall effectiveness of the evaluation process (Lidyawati et al., 2024; Prasetyo & Marodiyah, 2024). Another study discussed about developing DSS utilizing SAW method for the performance assessment, the absence of system testing and system validation to determine whether the system's output is credible and the method's applicability in real-world decision-making (Nazryani et al., 2024). Meanwhile, studies combining AHP and SAW have shown promising results in producing objective decisions, but still face challenges related to criteria determination and input data accuracy (Suprapto et al., 2024). A comparative study evaluating AHP-SAW, AHP-WP, and AHP-TOPSIS demonstrated that AHP-SAW outperformed the other two methods (Yanti Suartini et al., 2023). Furthermore, (Nirwan et al., 2024) similarly concluded that AHP-SAW outperforms AHP-TOPSIS, collectively reinforcing the suitability of AHP-SAW as the methodological choice for this study.

Based on these previous studies AHP-SAW has shown promising results in various case studies. However, there is still lack of integrated implementation that ensures proper criteria weighting, comprehensive system validation, and

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performance assessment based on reports. Therefore, this study aims to develop a DSS for employee performance assessment using the AHP-SAW method at UPPKH Pamekasan Regency. This research seeks to determine the criteria and weights and generate a ranking of employees based on monthly performance. The results of this study are expected to assist coordinators at UPPKH Pamekasan Regency in making better decisions and improve employee efficiency.

RESEARCH METHODS

This research was conducted to develop a Decision Support System (DSS) using combination of Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW) method. This system was built using Laravel framework (PHP programming language-based framework). The final result is a website application. To achieve this result, author uses research workflow. Figure 1 below illustrates how the author conducts this research.

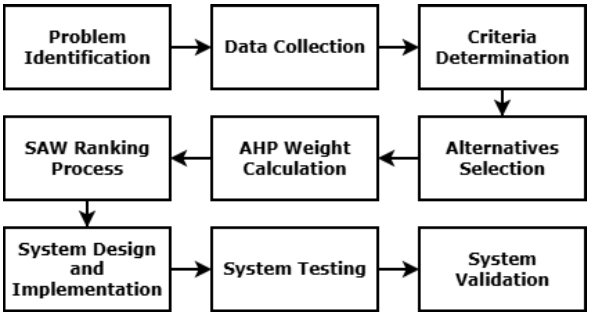

Figure 1. Research Workflow

Problem Identification

There are two types of employees at UPPKH Pamekasan Regency. First, employees who assist PKH participant, referred to as PKH facilitators (Pendamping PKH). PKH facilitators are responsible for field tasks, such as gathering PKH participants for socialization activities, updating participants data to determine their continued eligibility for PKH social assistance, verifying if the social assistance funds have been properly distributed to PKH participants, and preparing both activity reports and monthly reports. The second type are employees who validate the work of PKH facilitators, known as regency coordinators. Regency coordinators are responsible for validating the results of social assistance fund verification conducted by PKH facilitators and evaluating the reports submitted by them.

The primary issue at UPPKH Pamekasan Regency is the imbalance between the number of regency coordinators and PKH facilitators. There are two regency coordinators overseeing 148 or more PKH facilitators and no system or application for helping regency coordinators evaluate reports from PKH facilitators. They just use program like Excel and Word. In addition, some PKH facilitators produce reports that are inaccurate and not submitted on time, which further delays the coordinator's work.

Based on an interview with one of the coordinators, the author proposes a solution in the form of application designed to support both regency coordinator and PKH facilitators in performing their task. The application will implement AHP-SAW method to evaluate employee performance, which is expected to enhance motivation among employees at UPPKH Pamekasan Regency. There are other features as well but author focuses on explaining employee performance assessment in this study because of page limitations.

Data Collection

Data collection was conducted using three methods which is observation, interviews, and documentation.

Observation was carried out to gain an in-depth understanding of PKH facilitators' daily tasks, which include conducting socialization activities, collecting posyandu attendance data of PKH participants, recording school enrollment data of PKH participants' family members, and other related field activities.

Interviews were conducted with two regency coordinators and three PKH facilitators who had previously served as administrative operators assisting coordinators. The interviews aimed to understand how coordinators evaluate facilitators' monthly reports and work performance.

Documentation involved collecting UPPKH operational data from 2022 to 2024. This data provided the necessary insights for designing the application's database structure, user interface, and other system components.

Criteria Determination

The evaluation criteria were determined by reviewing PKH facilitators' monthly reports obtained during the documentation process. From these reports, key factors contributing to the quality of a proper and complete monthly report were identified. Combined with insights gathered from the interviews, nine criteria were established for evaluating PKH facilitators' monthly reports

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within the proposed application. Each criterion was further assigned a weight reflecting its relative importance in the overall evaluation, which was determined through the AHP pairwise comparison process. The final set of criteria and their corresponding weights are presented in Table 1.

Table 1. Determined Criteria

	Aspect Assessment
C1	Percentage of social assistance distribution
C2	Percentage of PKH participant updates
C3	P2K2 activities
C4	Realization of activities
C5	Activity plans
C6	Recapitulation of constraints in activity implementation
C7	Recapitulation of health and education facility data
C8	Samples of group meeting notes
C9	Activity documentation

Alternatives Selection

As shown in Table 1, all nine criteria are classified as benefit criteria, as none of them represent cost criteria. For the alternatives, 20 PKH facilitators were selected as samples based on two considerations which is the number of PKH participants they assist and the completeness of their monthly reports in the periods prior to the implementation of the proposed system. Facilitators were drawn from different districts across Pamekasan Regency to ensure representative coverage. These selected facilitators are presented in Table 2 and will be used in the subsequent alternatives ranking calculation.

Table 2. Selected Alternatives

Name	Code	C1	C2	C3	C4	C5	C6	C7	C8	C9
M. Wahdi	K1	100	100	20	20	30	3	12	1	6
Hefni	K2	90	95	15	15	30	2	11	1	3
Hendri	K3	90	80	20	25	30	0	11	1	6
Shafwan	K4	100	100	25	25	31	3	11	1	6
Anwar	K5	100	95	22	29	30	3	14	1	6
Faisal	K6	95	100	21	20	29	3	15	1	4
Khoiroh	K7	80	100	20	20	30	2	15	1	6
Mukhlis	K8	75	90	20	15	30	2	9	1	2
Basri	K9	80	90	20	20	30	1	8	1	2
Farhan	K10	60	95	15	20	31	1	8	1	2
Rukmiyati	K11	90	93	16	15	30	0	8	1	6
Eva	K12	93	95	10	19	30	4	8	1	6
Wahdi	K13	92	100	20	20	30	5	10	1	6
Hafid	K14	100	85	20	30	30	1	10	1	6
Marhadi	K15	100	87	20	20	29	1	10	1	6
Fatimah	K16	100	89	15	25	27	2	10	1	6
Faried	K17	94	100	20	25	27	2	10	1	4
Bahri	K18	84	100	18	31	30	3	9	1	4
Muhally	K19	95	90	19	30	31	3	9	1	2
Faisol	K20	100	88	23	29	30	5	9	1	3

AHP Method

The Analytical Hierarchy Process (AHP) is a method used to determine criteria weights by decomposing a complex decision problem into a hierarchical structure of criteria and sub-criteria (Cremades & Ponsich, 2025). AHP determines weights through pairwise comparisons and validates consistency using the Consistency Index (CI) and Consistency Ratio (CR) (Lidyawati et al., 2024; Setiawan et al., 2025). AHP can also be combined with other methods to enhance decision-making accuracy (Shen & Liao, 2022). The calculation of the AHP method is conducted through the following steps:

1. Construct pairwise comparison matrix

Each criterion is compared with others using a scale of relative importance (1-9) to form a pairwise comparison matrix $A = [a_{ij}]$.

$$A = \begin{bmatrix} a_{11} & \cdots & a_{1j} \\ \vdots & \ddots & \vdots \\ a_{i1} & \cdots & a_{ij} \end{bmatrix} \quad (1)$$

2. Normalize the pairwise comparison matrix

The normalization process is performed by dividing each element of the matrix by the total value of its respective column. Equation (2) is used to normalize matrix.

$$r_{ij} = \frac{a_{ij}}{\sum_{i=1}^{n} a_{ij}} \quad (2)$$

3. Calculate Criteria Weight

Priority weight of each criterion w_i is obtained by calculating the average of each row.

$$w_i = \frac{\sum_{j=1}^{n} r_{ij}}{n} \quad (3)$$

4. Calculate Consistency Ratio (CR)

Maximum eigenvalue (λ_{max}) is first calculated using equation (4):

$$\lambda_{max} = \frac{\sum_{i=1}^{n} \frac{(Aw)_i}{w_i}}{n} \quad (4)$$

The Consistency Index (CI) is then calculated using Equation (5):

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (5)$$

Finally, the Consistency Ratio (CR) is calculated using Equation (6):

$$CR = \frac{CI}{RI} \quad (6)$$

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If the value of CR is less than 0.1, the pairwise comparisons are considered consistent. Otherwise, the comparisons need to be revised.

SAW Method

Simple Additive Weighting (SAW) evaluates and ranks alternatives based on the weighted sum of their normalized performance scores. SAW is applied after criteria weights have been determined through AHP, making the AHP–SAW combination an objective and systematic approach for selecting the best alternative based on multiple criteria. The calculation of SAW method is conducted through the following steps:

1. Construct decision matrix

The decision matrix X consists of alternatives and criteria values.

2. Normalize the decision matrix

The normalization process depends on the attribute type:

- For benefit criteria

$$r_{ij} = \frac{x_{ij}}{\max(x_{ij})} \quad (7)$$

- For cost criteria

$$r_{ij} = \frac{\min\,(x_{ij})}{x_{ij}} \quad (8)$$

3. Calculate preference value

The final preference value for each alternative V_i is calculated using Equation (9):

$$V_i = \sum_{j=1}^{n} w_j \cdot r_{ij} \quad (9)$$

After obtaining the preference values for all alternatives, the alternatives are ranked in descending order based on V_i. A higher value of V_i indicates a higher level of preference for the alternative

System Development

System development in this study utilizes prototyping method. This approach was selected because it allows iterative refinement of the application based on continuous feedback from end users.

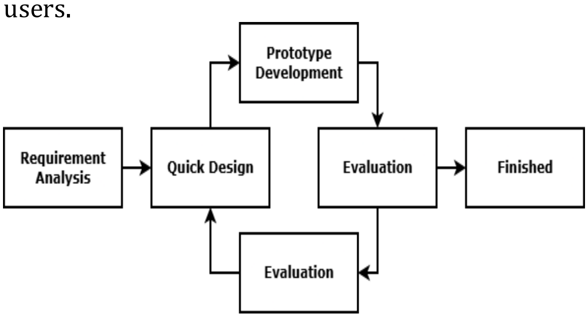

Figure 2. Prototyping Method Diagram

Figure 2 illustrates the prototyping method used to develop the system. First, requirement analysis is conducted through data collection, as described earlier. Second, a quick design is created in the form of a wireframe using Figma, translating the gathered requirements into a visual representation. Third, the initial prototype is evaluated by coordinators and three facilitators who have prior experience as administrative operators, in order to collect feedback. Fourth, revisions are made to the prototype based on the feedback received. This process is repeated iteratively until the prototype meets user requirements. Finally, the system is developed using the Laravel framework.

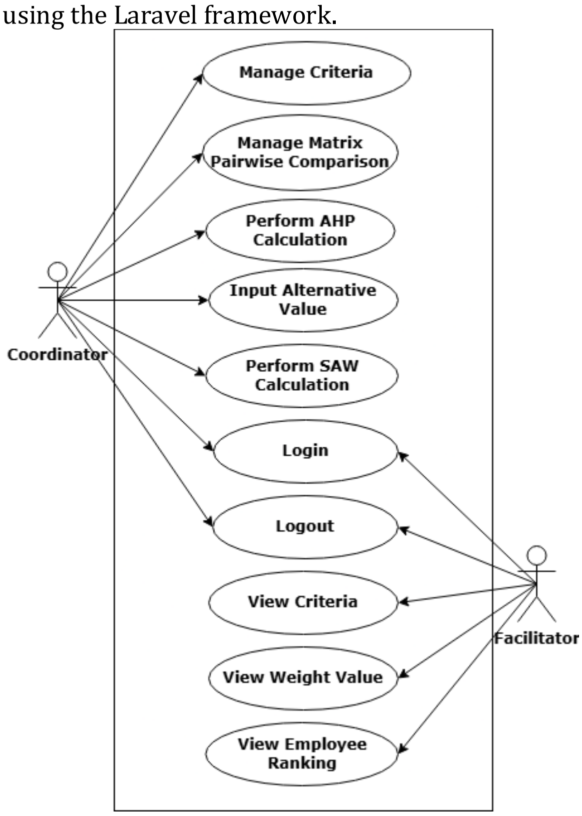

Figure 3. System Use Case Diagram

Figure 3 illustrates the relationship between two actors and the main functions of the application. The actors consist of the coordinator and the facilitator. The coordinator is responsible for managing criteria, managing pairwise comparison matrix values, performing AHP calculations, inputting alternative values, performing SAW calculations, as well as logging in and logging out. Meanwhile, the facilitator has limited access and can only perform actions such as logging in, logging out, viewing criteria, viewing weight values, and viewing employee data.

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Validation Method (Spearman Correlation)

To validate the ranking results produced by the AHP-SAW method, this study employs the Spearman Rank Correlation Coefficient to measure the correlation between the system-generated rankings and the manual rankings performed by the coordinators. The Spearman correlation is a non-parametric statistical measure used to assess the strength and direction of the relationship between two ranked variables (Permatasari et al., 2022). The Spearman Rank Correlation Coefficient (ρ) is calculated using the following formula:

$$\rho = 1 - \frac{6\sum d^2}{n(n^2-1)} \quad (10)$$

RESULTS AND DISCUSSION

This section presents the computational results of the AHP-SAW method applied to the nine criteria defined in Table 1 and the 20 alternatives listed in Table 2, followed by an analytical interpretation of the ranking outcomes. The developed application and its implementation of the AHP-SAW method are then presented, demonstrating how the computation is embedded within the system. The section concludes with two layers of evaluation: validation of the AHP-SAW ranking results using the Spearman Rank Correlation Coefficient, and functional testing of the application using the black-box method. Throughout this section, computation results, system implementation, and evaluation findings are discussed.

AHP Weight Calculation

The AHP computation begins with the construction of a pairwise comparison matrix for the nine selected criteria, following Saaty's scale of relative importance (1–9). Each value in the matrix represents the relative importance of one criterion over another, where a value greater than 1 indicates that the row criterion is more important than the column criterion, and its reciprocal is placed in the corresponding transposed cell.

Table 3 presents the resulting pairwise comparison matrix. Examining the matrix, C1 and C2 receive consistently high importance values relative to most other criteria, suggesting that they are considered the most influential in evaluating PKH facilitator performance. Conversely, C8 and C9 receive lower importance values, indicating they contribute less to the overall evaluation compared to the higher-ranked criteria.

Table 3. Pairwise Comparison Matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9
C1	1	1	3	3	3	3	3	3	3
C2	1	1	2	3	3	3	3	3	3
C3	0.33	0.5	1	3	3	3	3	3	3
C4	0.33	0.33	0.33	1	3	3	5	3	3
C5	0.33	0.33	0.33	0.33	1	2	3	3	3
C6	0.33	0.33	0.33	0.33	0.5	1	3	3	3
C7	0.33	0.33	0.33	0.2	0.33	0.33	1	3	2
C8	0.33	0.33	0.33	0.33	0.33	0.33	0.33	1	3
C9	0.33	0.33	0.33	0.33	0.33	0.33	0.5	0.33	1
Total	4.33	4.49	7.99	11.5	14.5	15.9	21.8	22.3	24

Following the construction of the pairwise comparison matrix, the next step is normalization. Each value in the matrix is divided by the total sum of its respective column, as defined in Equation (2). This normalization process eliminates the scale differences between columns and allows for a fair comparison across all criteria. The resulting normalized pairwise comparison matrix is presented in Table 4.

Table 4. Pairwise Comparison Matrix Normalized

	C1	C2	C3	C4	C5	C6	C7	C8	C9
C1	0.23	0.22	0.38	0.26	0.20	0.19	0.14	0.13	0.12
C2	0.23	0.22	0.25	0.26	0.20	0.19	0.14	0.13	0.12
C3	0.08	0.11	0.04	0.26	0.20	0.19	0.14	0.13	0.12
C4	0.08	0.07	0.04	0.09	0.20	0.19	0.23	0.13	0.12
C5	0.08	0.07	0.04	0.03	0.07	0.12	0.14	0.13	0.12
C6	0.08	0.07	0.04	0.03	0.03	0.06	0.14	0.13	0.12
C7	0.08	0.07	0.04	0.02	0.02	0.02	0.05	0.13	0.08
C8	0.08	0.07	0.04	0.03	0.02	0.02	0.02	0.04	0.12
C9	0.08	0.07	0.04	0.03	0.02	0.02	0.02	0.02	0.04
Total	1	1	1	1	1	1	1	1	1

Table 4 was obtained by dividing each value in Table 3 by its corresponding column total, following Equation (2). It is worth noting that C1 and C2 consistently show higher normalized values across most columns, reinforcing their dominant role in the evaluation, while C8 and C9 show lower values, indicating their comparatively minor contribution to the overall weight distribution.

From the normalized matrix, the priority weight of each criterion w_i is calculated by averaging each row. Summing all values in a row and dividing by the number of criteria (n = 9). The resulting criteria weights are presented in Table 5.

Table 5. Criteria Weights

	Sum of Each Row	Weight

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C1	1.879	0.209
C2	1.774	0.197
C3	1.281	0.142
C4	1.163	0.129
C5	0.832	0.092
C6	0.715	0.079
C7	0.517	0.057
C8	0.451	0.050
C9	0.346	0.038
Total	9	1

As shown in Table 5, C1 carries the highest weight (0.209), followed closely by C2 (0.197), together accounting for over 40% of the total weight. This indicates that these two criteria are the most decisive factors in distinguishing facilitator performance. In contrast, C8 and C9 carry the lowest weights (0.050 and 0.038 respectively), suggesting that while they contribute to the evaluation, their influence on the final ranking is limited.

CI and CR Calculation

Although the weights in Table 5 are mathematically valid for use in the SAW calculation, it is necessary to verify the consistency of the pairwise judgments before proceeding. This is done by computing the Consistency Ratio (CR), which requires first by calculating maximum eigenvalue.

Table 6. Product-Wise Matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9
C1	0.048	0.044	0.053	0.034	0.019	0.015	0.008	0.007	0.005
C2	0.048	0.044	0.036	0.034	0.019	0.015	0.008	0.007	0.005
C3	0.016	0.022	0.006	0.034	0.019	0.015	0.008	0.007	0.005
C4	0.016	0.015	0.006	0.011	0.019	0.015	0.013	0.007	0.005
C5	0.016	0.015	0.006	0.004	0.006	0.010	0.008	0.007	0.005
C6	0.016	0.015	0.006	0.004	0.003	0.005	0.008	0.007	0.005
C7	0.016	0.015	0.006	0.002	0.002	0.002	0.003	0.007	0.003
C8	0.016	0.015	0.006	0.004	0.002	0.002	0.001	0.002	0.005
C9	0.016	0.015	0.006	0.004	0.002	0.002	0.002	0.001	0.002

Table 6 presents the product-wise matrix, obtained by multiplying each element of the original pairwise comparison matrix (Table 3) by the corresponding criterion weight from Table 5. The row totals represent the weighted sum vector for each criterion, which are then carried forward to Table 7 for the eigenvalue calculation.

Table 7. Maximum Eigenvalue

	Total (Table 6)	Weight (Table 5)	Weight/Total
C1	0.233	0.209	1.113
C2	0.226	0.197	1.115
C3	0.132	0.142	0.930
C4	0.107	0.129	0.830
C5	0.077	0.092	0.837
C6	0.069	0.079	0.870
C7	0.056	0.057	0.982
C8	0.053	0.050	1.060
C9	0.050	0.038	1.320
Max Eigenvalue (λ_{max})			**9.057**

Table 7 presents the ratio of each row total to its corresponding criterion weight. The maximum eigenvalue (λ_{max}) is obtained by averaging all nine ratios, yielding a value of 9.057. The proximity of λ_{max} to n (9) is an encouraging sign, as a perfectly consistent matrix would produce λ_{max} = n exactly. The small deviation of 0.057 suggests only a minor degree of inconsistency in the pairwise judgments, which is expected and acceptable in practice. The Consistency Index (CI) is then calculated using Equation (5):

$$CI = \frac{\lambda_{max} - n}{n - 1} = \frac{9{,}057 - 9}{9 - 1} = \frac{0{,}057}{8} \approx \mathbf{0{,}007}$$

The calculation of CI value resulting 0.007 is very close to zero, which further confirms the high consistency of the pairwise comparisons. The next step is to compute the Consistency Ratio (CR) by dividing CI by the Random Index (RI). For a matrix of n = 9 criteria, the RI value is 1.45

$$CR = \frac{CI}{RI} = \frac{0{,}007}{1{,}45} \approx \mathbf{0{,}005}$$

Since CR = 0.005 < 0.1, the pairwise judgments are confirmed to be acceptably consistent. This very low CR value reflects a high degree of logical coherence in the expert judgments used to construct the pairwise comparison matrix, strengthening the reliability of the criteria weights derived in Table 5. These weights are therefore valid and will be applied with confidence in the subsequent SAW ranking calculation.

SAW Ranking Process

The SAW method is applied to rank the 20 selected PKH facilitator alternatives based on their performance across the nine criteria. As established

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in Section 3.5, all nine criteria are classified as benefit criteria, meaning that higher values are more desirable. Consequently, the normalization formula applied to all criteria follows Equation (7):

$$r_{ij} = \frac{x_{ij}}{\max(x_{ij})}$$

Each raw performance score for every alternative is divided by the maximum value observed in its respective criterion column, producing normalized values in the range [0, 1]. The resulting normalized decision matrix is presented in Table 8.

Table 8. Normalized Selected Alternatives

Code	C1	C2	C3	C4	C5	C6	C7	C8	C9
K1	1.0	1.0	0.8	0.65	0.97	0.6	0.8	1.0	1.0
K2	0.9	0.95	0.6	0.48	0.97	0.4	0.73	1.0	0.5
K3	0.9	0.8	0.8	0.81	0.97	0.0	0.73	1.0	1.0
K4	1.0	1.0	1.0	0.81	1.0	0.6	0.73	1.0	1.0
K5	1.0	0.95	0.88	0.94	0.97	0.6	0.93	1.0	1.0
K6	0.95	1.0	0.84	0.65	0.94	0.6	1.0	1.0	0.67
K7	0.8	1.0	0.8	0.65	0.97	0.4	1.0	1.0	1.0
K8	0.75	0.9	0.8	0.48	0.97	0.4	0.6	1.0	0.33
K9	0.8	0.9	0.8	0.65	0.97	0.2	0.53	1.0	0.33
K10	0.6	0.95	0.6	0.65	1.0	0.2	0.53	1.0	0.33
K11	0.9	0.93	0.64	0.48	0.97	0.0	0.53	1.0	1.0
K12	0.93	0.95	0.4	0.61	0.97	0.8	0.53	1.0	1.0
K13	0.92	1.0	0.8	0.65	0.97	1.0	0.67	1.0	1.0
K14	1.0	0.85	0.8	0.97	0.97	0.2	0.67	1.0	1.0
K15	1.0	0.87	0.8	0.65	0.94	0.2	0.67	1.0	1.0
K16	1.0	0.89	0.6	0.81	0.87	0.4	0.67	1.0	1.0
K17	0.94	1.0	0.8	0.81	0.87	0.4	0.67	1.0	0.67
K18	0.84	1.0	0.72	1.0	0.97	0.6	0.6	1.0	0.67
K19	0.95	0.9	0.76	0.97	1.0	0.6	0.6	1.0	0.33
K20	1.0	0.88	0.92	0.94	0.97	1.0	0.6	1.0	0.5

It is worth noting that C8 yields a normalized value of 1.0 for all 20 alternatives, indicating that all facilitators performed equally on this criterion and therefore it does not contribute to differentiating the alternatives in the ranking. C6, on the other hand, shows the widest variation across alternatives, making it one of the most discriminating criteria despite its relatively moderate weight (0.079).

The preference value V_i for each alternative is then computed using Equation (9), by multiplying each normalized value by its corresponding criterion weight from Table 5 and summing the results. For example, the preference value for K1and K2 is calculated as follows:

$$V_1 = 0{,}209 \times 1 + 0{,}197 \times 1 + 0{,}142 \times 0{,}8 + 0{,}129 \times 0{,}65 + 0{,}092 \times 0{,}97 + 0{,}079 \times 0{,}6 + 0{,}057 \times 0{,}8 + 0{,}050 \times 1 + 0{,}038 \times 1 = 0{,}902$$

$$V_2 = 0{,}209 \times 0{,}9 + 0{,}197 \times 0.95 + 0{,}142 \times 0{,}6 + 0{,}129 \times 0{,}48 + 0{,}092 \times 0{,}97 + 0{,}079 \times 0{,}4 + 0{,}057 \times 0{,}73 + 0{,}050 \times 1 + 0{,}038 \times 0{,}5 = 0{,}754$$

This process is repeated for all 20 alternatives. The complete preference values and final rankings are presented in Table 9.

Table 9. Ranking Calculation Results

Code	Preference Value	Ranking
K4	0.922	1
K5	0.919	2
K13	0.902	3
K14	0.894	4
K1	0.889	5
K20	0.887	6
K6	0.872	7
K7	0.865	8
K18	0.85	9
K17	0.836	10
K16	0.828	11
K15	0.82	12
K19	0.812	13
K3	0.803	14
K12	0.798	15
K2	0.754	16
K11	0.742	17
K8	0.721	18
K9	0.703	19
K10	0.676	20

As shown in Table 9, K4 achieves the highest preference value of 0.922, ranking first among all 20 alternatives. Examining K4's normalized scores in Table 8 reveals the reasons behind this outcome. K4 achieves perfect scores in the two higher criteria weights, C1 and C2 and also achieves the maximum score in C3 and C5. Since C1 and C2 together account for over 40% of the total weight, K4's consistently strong performance in these criteria has a decisive impact on its final ranking. K5 ranks second with a preference value of 0.919, a very narrow margin behind K4, primarily due to its slightly lower score in C3 and C2.

In contrast, K10 ranks last with a preference value of 0.676, largely attributable to its lowest score in C1 combined with low scores in C3 and C6. This pattern confirms that performance in the higher criteria weight, particularly C1 and C2, is the primary determinant of the final ranking, while

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lower criteria weight such as C8 and C9 have a comparatively limited influence.

These results are consistent with findings from similar AHP-SAW studies in employee performance evaluation contexts, where criteria weights derived from expert judgment tend to amplify differences in performance on the most important dimensions while moderating the impact of secondary criteria (Lathoif et al., 2025)

System Implementation

The following presents the key interface pages of the developed application.

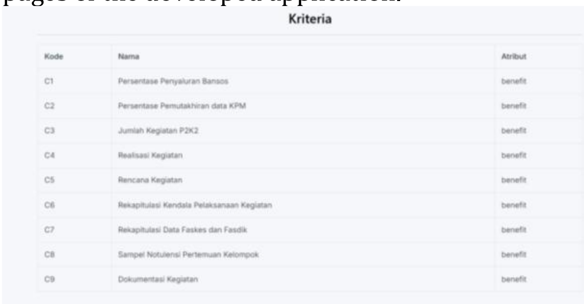

Figure 4. Criteria Page

Figure 4 displays the Criteria Page. Coordinators can add, edit, or remove criteria, while facilitators are restricted to view-only access, ensuring that criteria management remains under coordinator authority.

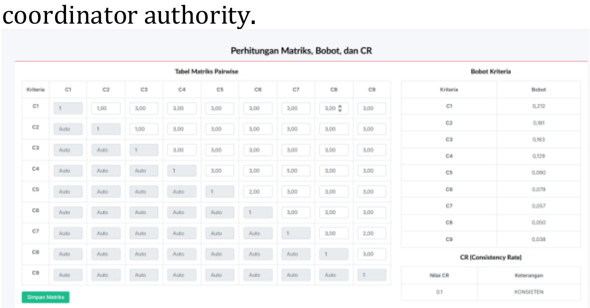

Figure 5. Matrix Calculation, Weight, and CR Page

Figure 5 shows the Matrix Calculation, Weight, and CR Page. The coordinator inputs pairwise comparison values, and the system automatically computes the criteria weights through the AHP calculation.

Figure 6. Ranking Calculation Page

Figure 6 shows the Ranking Calculation Page. Coordinators input alternative performance scores, and the system automatically computes the SAW preference values and produces the final ranking. Facilitators can only view the ranking results.

Application Functionality Testing

Black-box testing was conducted to evaluate the functional correctness of the application without accessing the source code, making it an efficient method for identifying errors prior to deployment (Huda et al., 2022). All identified issues were resolved before delivering the application to UPPKH Pamekasan Regency. The testing results are presented in Table 10.

Table 10. Black Box Testing

No	Feature	Test Case	Expected Result	Valid
1	Login	Valid NIK and password	Redirected to dashboard	Valid
2	Login (Failed)	Wrong NIK or password	redirected to login	Valid
3	Unauthorized Access	Facilitator accesses coordinator page	Access blocked, redirected	Valid
4	CRUD Criteria	CRUD criteria data	Successfully CRUD criteria	Valid
5	Input Matrix Pairwise	Valid values entered	Values saved to matrix	Valid
6	Input Matrix Pairwise (Invalid)	Values outside 1-9 scale entered	Input rejected	Valid
7	Calculate AHP	Consistent matrix (CR < 0.1)	Weight calculated	Valid
8	Calculate AHP (Inconsistent)	Inconsistent matrix (CR > 0.1)	Revision prompted	Valid
9	Input Alternative Values	Coordinator inputs performance scores	Values saved successfully	Valid
10	Input Alternative Values (Invalid)	Missing values submitted	Validation error, submission prevented	Valid
11	Calculate SAW	New alternative value inputted	System can automatically calculate SAW	Valid
12	View Ranking Page	User opens ranking page	Ranking results displayed correctly	Valid

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All 12 tested scenarios produced valid results, confirming that the application functions correctly. A pass rate of 100% was achieved, indicating that the system is functionally stable and ready for deployment.

AHP-SAW Accuracy Evaluation

The accuracy of the AHP-SAW method is evaluated by comparing the system-generated rankings with the manual rankings provided by coordinators, who assessed facilitator performance based on their direct field experience. Table 11 presents the ranking comparison.

Table 11. Ranking from UPPKH and System

Code	UPPKH	System	d	d^2
K4	1	1	0	0
K5	3	2	1	1
K13	2	3	-1	1
K14	6	4	2	4
K1	4	5	-1	1
K20	5	6	-1	1
K6	7	7	0	0
K7	8	8	0	0
K18	9	9	0	0
K17	11	10	1	1
K16	10	11	-1	1
K15	12	12	0	0
K19	13	13	0	0
K3	18	14	4	16
K12	16	15	1	1
K2	15	16	-1	1
K11	14	17	-3	9
K8	17	18	-1	1
K9	19	19	0	0
K10	20	20	0	0
Total				38

The Spearman Rank Correlation Coefficient is calculated using Equation (10) as follows:

$$\rho = 1 - \frac{6\sum d^2}{n(n^2-1)} = 1 - \frac{6(38)}{20(20^2-1)} = \mathbf{0,97143}$$

The result of ρ = 0.971 (97.1%) indicates a very strong positive agreement between the system-generated rankings and the UPPKH manual rankings.

Examining the ranking differences in Table 11 more closely, the majority of alternatives show zero or minimal rank differences, indicating that the system accurately reflects coordinator assessments for most facilitators. The largest discrepancy occurs at K3. The deviation at K3 may be attributed to qualitative performance aspects that the coordinators consider in their manual assessment but are not fully captured by the nine quantitative criteria in the current system. These discrepancies, while worth noting, are minor relative to the overall strong correlation and do not significantly affect the validity of the system's ranking output.

This result is consistent with findings from comparable AHP-SAW decision support system studies, where Spearman correlation values above 0.90 are commonly reported as evidence of method validity (Permatasari et al., 2022).

CONCLUSIONS AND SUGGESTIONS

Conclusion

This study successfully developed and deployed a web-based DSS for PKH facilitator performance evaluation at UPPKH Pamekasan Regency, addressing the challenge coordinators overseeing facilitators without evaluation tool. The system integrates the AHP method for objective criteria weighting and the SAW method for alternative ranking.

The AHP calculation produced CR = 0.005, confirming the reliability of the nine criteria weights. Among the criteria, C1 and C2 carried the highest weights (0.209 and 0.197 respectively), together accounting for over 40% of the total weight, indicating their dominant influence on facilitator performance evaluation. The SAW ranking identified K4 as the top-performing facilitator with a preference value of 0.922, owing to its consistently high scores across the higher weighted criteria.

Accuracy evaluation using the Spearman Rank Correlation Coefficient produced ρ = 0.971, indicating very strong agreement between the system-generated rankings and the manual rankings provided by UPPKH coordinators. Black-box testing confirmed 100% functional validity across 12 test scenarios, confirming that the application is functions correctly.

Despite the strong results, this study acknowledges several limitations. First, the evaluation criteria were defined based on monthly report assessments only, and may not fully capture qualitative aspects of facilitator performance that coordinators consider in manual evaluation, as reflected by the ranking discrepancies observed for K3 and K11. Second, the sample of 20 alternatives, while representative across districts not represent all active facilitators and may not generalize to all performance patterns within the organization.

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Suggestion

For future development, the evaluation criteria can be expanded to include sub-criteria or qualitative performance indicators, such as field responsiveness and participant satisfaction, to provide a more comprehensive assessment framework and reduce ranking discrepancies between the system and coordinator judgment. Additionally, future studies should compare the AHP-SAW method with other approaches such as TOPSIS, VIKOR, or PROMETHEE to evaluate differences in ranking outcomes and identify the most suitable method for PKH facilitator performance evaluation.

The application can further be extended into a mobile-based platform to improve accessibility for coordinators and facilitators conducting field activities, where desktop access may be limited. A more rigorous user experience evaluation using standardized instruments such as the System Usability Scale (SUS) or USE Questionnaire is also recommended to systematically measure usability and guide further interface improvements.

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