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Implementation of simple additive weighting in determining employee performance based on android at BSI Bank KCP Perbaungan

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ABSTRACT

This study aims to develop and implement a Decision Support System (DSS) based on the Simple Additive Weighting (SAW) method for employee performance evaluation at BSI Bank KCP Perbaungan. The main problems faced by the bank are subjectivity and inefficiency in performance evaluation using manual methods. With this Android-based DSS, employee performance evaluations can be carried out more objectively and transparently, based on criteria such as productivity, work quality, attendance, and teamwork ability. This study involves data collection through observation and interviews with bank management to determine the weights of the criteria used in performance evaluation. The SAW method is then applied to process employee performance data and generate a final score used to identify the best employees. The results show that the SAW method is effective in improving the accuracy and speed of performance evaluations. The implementation of the Android-based DSS simplifies management in handling employee data and generating real-time performance reports. This study concludes that the use of the SAW method in an Android-based DSS can reduce subjectivity in evaluations and improve decision-making efficiency at BSI Bank KCP Perbaungan.

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Introduction

Employee performance management is an important aspect of a company's success (Pratama et al., 2022). Objective and efficient employee performance evaluation becomes crucial in a competitive business environment (Darmansah et al., 2022). According to (Rustiawan et al., 2023) employee performance management is vital because it can improve productivity, motivate employees, and support the achievement of organizational goals. However, many companies still face challenges in the employee performance evaluation process. Most companies still use manual methods such as involving the use of forms or physical worksheets filled out by direct supervisors and HR managers, which are still commonly used in the employee performance evaluation process. These are often prone to inaccuracy, subjectivity, and imperfections (Larasati et al., 2021). This can result in employee dissatisfaction and even a decline in productivity, thus failing to align individual goals with organizational objectives (Sunardi et al., 2022).

Bank BSI KCP Perbaungan is part of Bank Syariah Indonesia (BSI), one of the state-owned Islamic banks in Indonesia. According to (Agustianna et al., 2020) the large number of divisions and performance evaluation criteria make the form-filling method ineffective because it is prone to subjective assessments and lacks transparency in the performance evaluation process, as observed at Bank BSI KCP Perbaungan. In fact, according to (Aufa Moerrin & Priono, 2022) transparency in work makes everyone accountable for their actions and results, helping managers clearly see who contributes effectively and who needs further assistance or guidance. Additionally, transparency is closely related to Key Performance Indicators (KPIs) used by organizations to assess the extent to which strategic and operational goals have been achieved (Rahmatunnisa et al., 2024). Therefore, a system is needed to ensure that the employee performance evaluation process is measurable based on KPIs and not subjective, so that the evaluation is more weighted and objective (Anita, 2023). A solution to address the issues surrounding effective performance evaluations is the use of a Decision Support System (Kustiawan et al., 2022).

A Decision Support System (DSS) is a computer system designed to assist decision-making in semi-structured or unstructured contexts (Firzatullah, 2021). According to (Nadia Fadilah Frinstin Lintang et al., 2021) the characteristics of a DSS should be capable of supporting complex decision-making, be interactive, flexible, and adaptive. This system provides tools, data, and analytical models that help users evaluate information and make better decisions, in the context of this research, decisions to determine the best employee performance based on certain criteria (Sibyan, 2020). The existence of a DSS can provide decision support solutions and facilitate computerized systems for employee evaluations (Septilia et al., 2020). According to (Pranata et al., 2021) the algorithms used in DSS development include the Analytic Hierarchy Process (AHP), Simple Additive Weighting (SAW), Decision Tree, Fuzzy Logic, and TOPSIS. In the context of this study, the method used in system implementation is the Simple Additive Weighting (SAW) method.

The Simple Additive Weighting (SAW) method is one of the multi-criteria decision-making methods that works by assigning relative weights to each criterion used to evaluate alternatives, and then calculating the total score for each alternative by summing the weighted results with the normalized criterion values (Sumarlin et al., 2019). According to (Ramadhan & Nizam, 2021), SAW is a weight-based decision evaluation method in which each alternative is assessed against all criteria, and then the score is calculated based on the weight of each criterion. The SAW method works by assigning relative weights to each criterion used to evaluate alternatives and then calculating the total score for each alternative by summing the weighted results with the normalized criterion values (Yunita et al., 2023). Some advantages of the SAW method, according to (Anas et al., 2020) include simplicity, flexibility, efficiency, and ease of understanding. This is also in line with the reason researchers use the SAW method because it is easy to understand and implement. It allows decision-makers to quickly generate results without requiring deep mathematical knowledge or complex programming skills (Setiawansyah & Saputra, 2023). This system can help administrators provide information and insights about which paper plan to choose based on the most cost-effective estimate.

Method

This study uses a quantitative method. Quantitative methods are approaches that focus on the collection and analysis of data in the form of numbers or statistics (Jaya, 2020). The data collection method involved direct observation and research at Bank BSI KCP Perbaungan, located at Jl. Serdang No. 35, Kel. Simpang TigaPekan, Kec. Perbaungan, Kab. Serdang Bedagai, Provinsi Sumatera Utara, on March 4, 2024. The researcher also conducted an interview with Mr. Deny, the HR Manager of Bank BSI KCP Perbaungan, on March 7, 2024, to obtain data related to employee evaluation criteria. The types of software used in this research are as follows:

1. Java Development Kit 21 Version (JDK): Used for Android application development because Android Studio uses the Java programming language, which provides the Java compiler, development tools, and libraries needed for Java software development (Tarigan et al., 2020).
2. Android Studio 2023.1.1 Version: Used for Android application development. Android Studio is the official Integrated Development Environment (IDE) for Android application development,

providing tools and features for building, testing, and deploying Android applications (Fadli Shani et al., 2020)

The hardware used in this research includes:

1. Laptop Asus ROG Flow X13 Ryzen 9 RX780M RAM 16 GB
2. Smartphone Samsung Galaxy A14 for testing the decision-making system.

Results & Discussion

Employee performance evaluation at Bank BSI KCP Perbaungan is conducted by considering four criteria selected by the researcher based on previous literature, namely productivity, work quality, attendance/discipline, and teamwork ability (Febriani & Ramli, 2023). Each of these criteria has a different weight, according to its level of importance in assessing an employee's performance. The details of the criteria weights used are as follows:

Table 1. Employee Performance Evaluation Criteria Weights

Code	Criteria	Weights
C1	Productivity	35%
C2	Work Quality	30%
C3	Attendance / Discipline	20%
C4	Teamwork Ability	15%
Total	-	100%

After determining the weight for each criterion, the next step is to assign a score to each sub-criterion for each employee. This assessment is based on the results of the performance evaluations conducted over a certain period. The scores given for each sub-criterion range from 1 (very poor) to 5 (very good), with the following details:

Table 2. Sub-Criteria Scores for Employees

Employees	Productivity (C1)	Work Quality (C2)	Attendance (C3)	Teamwork Ability (C4)
Muhammad Arif	4	4	5	3
Siti Nurhaliza	5	3	4	4
Ahmad Fauzan	3	5	4	5
Rahmawati	4	4	3	3
Dewi Sartika	5	5	5	4

For each criterion, the employee's sub-criteria scores are normalized by dividing each employee's sub-criteria score by the highest sub-criteria score for that criterion. This normalization process is conducted to reduce bias in evaluating criteria with different score ranges. Below is the table of normalization results :

Employees	Productivity (C1)	Work Quality (C2)	Attendance (C3)	Teamwork Ability (C4)
Muhammad Arif	0.80	0.80	1.00	0.60
Siti Nurhaliza	1.00	0.60	0.80	0.80
Ahmad Fauzan	0.60	1.00	0.80	1.00
Rahmawati	0.80	0.80	0.60	0.60
Dewi Sartika	1.00	1.00	1.00	0.80

The final score for each employee is calculated by summing the products of the normalized sub-criteria scores and the assigned criterion weights. The formula for calculating the final score is as follows:

$$\text{Final Score} = (C1 \times \text{Weight } C1) + (C2 \times \text{Weight } C2) + (C3 \times \text{Weight } C3) + (C4 \times \text{Weight } C4) \quad (1)$$

The following table shows the final scores for each employee:

Table 3. Final Employee Scores Based on the SAW Method

Employees	Final Score
Muhammad Arif	0.80(0.35) + 0.80(0.30) + 1.00(0.20) + 0.60(0.15) = 0.82
Siti Nurhaliza	1.00(0.35) + 0.60(0.30) + 0.80(0.20) + 0.80(0.15) = 0.83
Ahmad Fauzan	0.60(0.35) + 1.00(0.30) + 0.80(0.20) + 1.00(0.15) = 0.83
Rahmawati	0.80(0.35) + 0.80(0.30) + 0.60(0.20) + 0.60(0.15) = 0.75
Dewi Sartika	1.00(0.35) + 1.00(0.30) + 1.00(0.20) + 0.80(0.15) = 0.93

Based on the calculations performed, the implementation of the Simple Additive Weighting (SAW) method has proven to provide an objective assessment of employee performance at Bank BSI KCP Perbaungan. This method helps identify employees with the best performance and provides a solid foundation for management to make decisions regarding rewards or performance improvement actions. Further analysis shows that productivity and work quality are the most influential criteria in determining employee performance, as indicated by the higher weights assigned to these two criteria. Attendance/discipline and teamwork ability also play important roles, though not as significant as productivity and work quality.

Based on the calculations above, it can be seen that Dewi Sartika has the highest final score of 0.93, indicating that she has the best performance among all the evaluated employees. This shows that Dewi Sartika excels in productivity, work quality, attendance/discipline, and teamwork ability. Other employees also demonstrated good performance with scores close to the highest value, but there are variations in certain aspects, such as work quality and teamwork ability, which influenced their final scores.

Next, the implementation was carried out on a mobile-based application according to the calculations previously described. The researcher designed an Entity Relationship Diagram (ERD) that illustrates the relationships between entities in this employee performance evaluation system. This ERD is used to model the data that will be managed in the Android application being developed ('Afiifah et al., 2022). The ERD diagram can be seen in the image below.

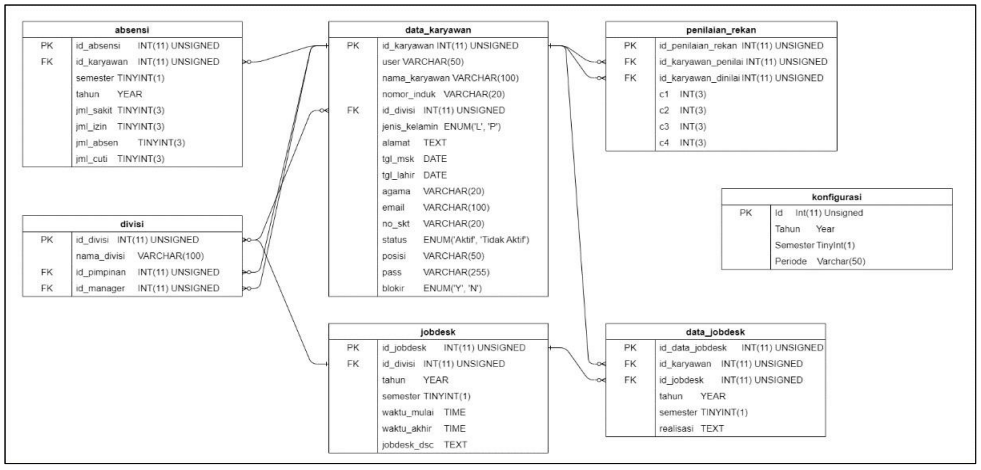

Figure 1. Entity Relationship Diagram (ERD)

This ERD shows the main tables such as the employee table, criteria table, employee scores table, and final results table. Each table has clear relationships, where the employee table is related to

the criteria and employee scores tables through relationship entities. Below is the display of the application that has been implemented on an Android smartphone.

- Android Application Display
    1. Login Page
    2. Employee Data Admin and Assessor Access Rights

Figure 2. Login Page

3. Employee Edit Page Admin Access

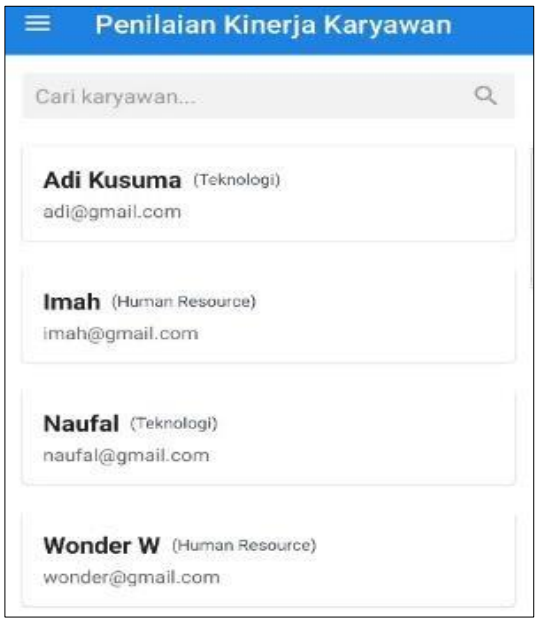

Figure 3. Employee Data Page Admin and Assessor Access

4. Menu

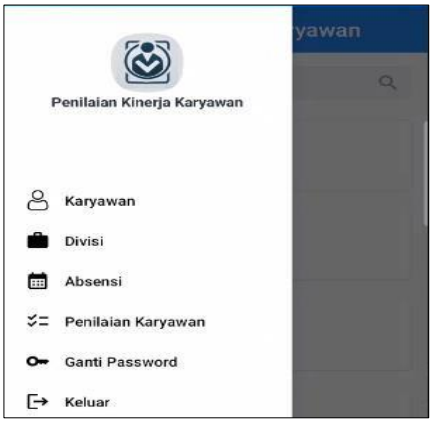

Figure 4. Menu

5. Division Page

Figure 5. Data Division Page

6. Attendance Employess Page

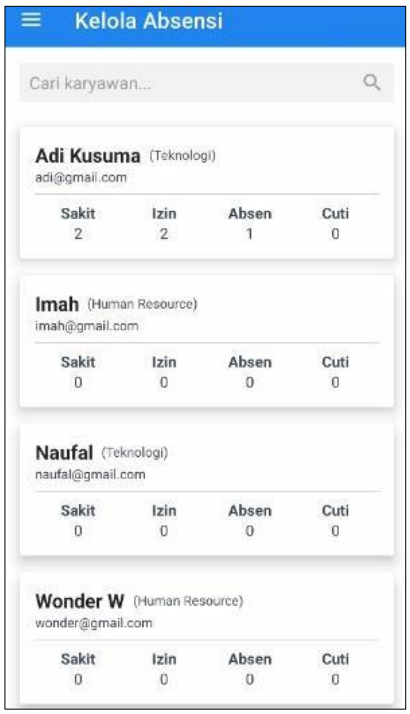

Figure 6. Attendance Employess Page

7. Detail Attendance Page

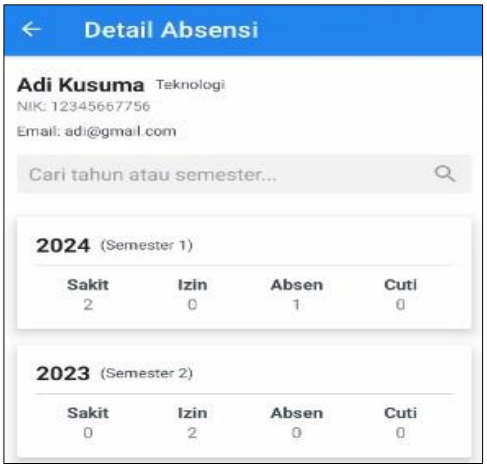

Figure 7. Detail Attendance Employees

8. Menu Logout

Figure 8. Menu Logout

9. Employee Evaluation Page Employee Access

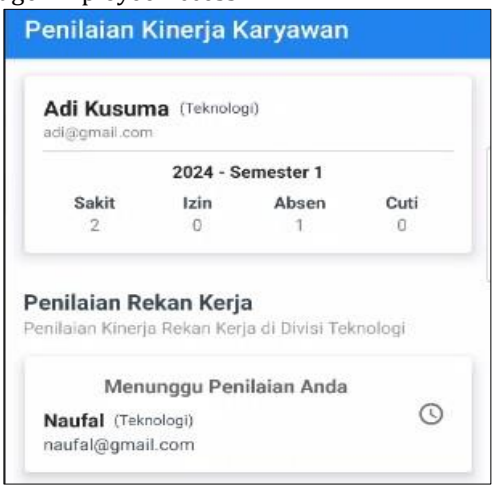

Figure 9. Employees Evaluation

10. Attendance Detail Page Employee Access

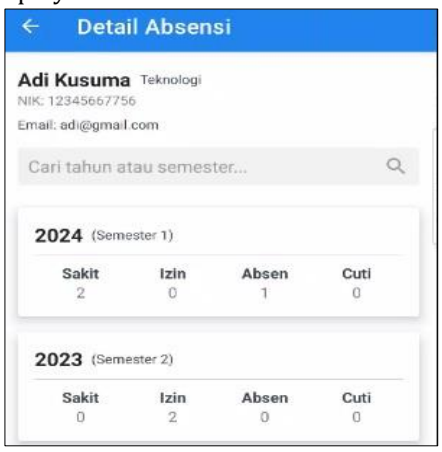

Figure 10. Attendance Detail Page Employee Access

11. Profile Page Employee Access

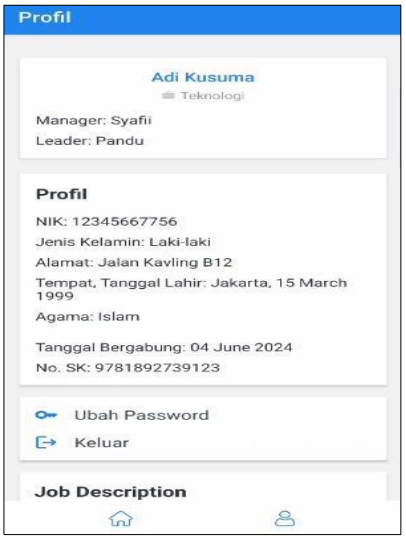

Figure 11. Profile Page Employee Access

Discussion

The implementation of the Simple Additive Weighting (SAW) method in employee performance evaluation at Bank BSI KCP Perbaungan has facilitated an objective assessment by integrating four key criteria: productivity, work quality, attendance/discipline, and teamwork ability. Each criterion is weighted differently based on its importance, with productivity and work quality holding higher weights. Through normalization and calculation of scores for each criterion, Dewi Sartika emerged as the highest-performing employee with a final score of 0.93, indicating consistent excellence across all evaluated criteria. While other employees also demonstrated strong performance, minor variations in scores for specific criteria, such as work quality and teamwork ability, influenced their final rankings. The SAW-based assessment system was further developed into a mobile application designed for both administrators and employees. The application includes various functionalities, such as an employee management interface, attendance tracking, and performance evaluation details. The app's Entity Relationship Diagram (ERD) depicts core tables, including employee data, criteria, scores, and final evaluation results, ensuring a structured approach to data management. This mobile-based system simplifies access to performance metrics and enables employees to view their evaluations, fostering transparency. Overall, the SAW method and mobile application provide a comprehensive and efficient

solution for performance evaluation, supporting informed decision-making on rewards and areas for improvement.

Conclusion

Based on the results of the study, several conclusions can be drawn. First, the Simple Additive Weighting (SAW) method has proven to be effective in providing an objective and structured evaluation of employee performance based on four main criteria: productivity, work quality, attendance/discipline, and teamwork ability. Second, the performance evaluation revealed that the employee with the highest score, Dewi Sartika, excelled in all the evaluated aspects, making her the best-performing employee at Bank BSI KCP Perbaungan. Lastly, the implementation of an Android-based evaluation system enabled a more efficient and real-time performance evaluation process, offering ease in monitoring and decision-making for management. Suggestions for future similar research include the following. First, to achieve a more comprehensive performance evaluation, it is recommended to add additional criteria such as initiative, innovation, and adaptability to change. Second, the Android-based performance evaluation application can be enhanced by incorporating features like performance trend analysis and employee development recommendations based on evaluation results. Third, further training for evaluators is necessary to ensure the validity of the data entered into the system, accurately reflecting the employees' actual performance. Lastly, it is suggested that performance evaluations be conducted periodically, for example, quarterly, to ensure that employees remain motivated and their performance is consistently monitored.

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