



# Application of Analytic Hierarchy Process and Simple Additive Weighting in Designing The Best Employee Selection Decision Support System at PT Pos Indonesia

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## Abstract

The purpose of this study is to compare the best employee evaluation outcomes using the analytical hierarchy process (AHP) technique and simple additive weighting (SAW) method as a support system for best employee suggestions. The author employed four different approaches for gathering data for this study: literature studies, interviews, observation, and similar literature studies. The RAD paradigm is being used in the development of this decision support system (DSS). The unified modeling language, or UML, tool is used in this system development methodology. It's time to put the system into action after it has been designed and analyzed. The black box testing methodology will be used for the experiments. Based on the research results, it was found that this system was able to assist decision makers in providing employee assessments quickly and precisely according to the predetermined time, whereas previously managers were always late and exceeded the time limit when assessing employees. The output of this system is that it can provide direct reports to the employees being assessed to find out the results of the scores obtained and make decisions about selecting the best employees. A decision support system for employee performance assessment uses the PHP and MySQL programming languages as the database. AHP and SAW methods, rapid application development (RAD) system development methods, and system testing with black box testing.

**Keywords:** Selection, Best Employee, Simple Addictive Weighting, Analytic Hierarchy Process, Rapid Application Development.

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## 1. Introduction

Employees are a very vital resource in a company or agency because they play many roles in every activity of the organization. The company uses employee performance appraisals as an evaluation process to find talented and devoted employees [1]. The overall performance of work is not only seen or assessed by physical results but also includes various things, such as work ability, discipline, work relationships, initiative, leadership, and special matters according to the field and level of work held. HR managers can make specific decisions about training and development, coaching, career plans or promotions, compensation increases, promotions, and other administrative matters based on the feedback they receive from performance appraisal findings [2]. Employee performance and accountability to the company are tied to performance appraisals. since businesses want excellent performance [3]. Employees can utilize this exam as feedback on their abilities, strengths, limitations, and potential. This information can then be used to set objectives, strategies, and directions for their career growth [4]. Pos Indonesia is a state-owned firm (BUMN) in Indonesia that works in the postal service industry. As of right now, Pos Indonesia's legal form is a limited liability corporation, or simply the company [5]. In terms of improving employee performance, the company carries out an assessment of its employees, and within one month, the leadership carries out an assessment of its subordinate employees [6]. Employees with the highest assessment results are the best employees. However, the employee assessment process often experiences delays and takes longer, namely approximately 1 week for each division manager [7]. This sometimes makes it difficult for managers because assessments are still manual, and human error in calculations can cause errors in selecting the best employees [8]. AHPs and SPKs can be constructed using a variety of models, such as simple additive weighting and the analytical hierarchy process. The SAW approach is employed due to its many benefits, such as its ease of comprehension, increased adaptability, capacity to tackle intricate issues, and ability to implement learning grounded in human expertise and problem-solving experience [9]. Furthermore, the analytical hierarchy process method is employed since it transforms large, unstructured problems into a flexible, understandable model [10]. AHP produces an

overall evaluation of how desirable each alternative is, offers a measurement scale and procedure for obtaining priorities, and takes logical consistency in the assessments used to decide priorities into account [11]. A decision support system uses decision-making models to assist in choosing the right kind of decision from among the many options now available [12]. The goal is to accomplish specific desired goals or activities by finding solutions to challenges, which can be structured, semi-structured, or unstructured [13]. DSS is an interactive tool for performing analysis using models, not to replace human decision-making [14]. The intricacy of commercial transactions or processes, the volume of data and information, the requirement for logic or truth in decision-making, and other variables necessitate the presence of SPK [15]. The total outcome of a person doing duties over a given time period, including work standards, targets, or criteria that have been previously decided and mutually agreed upon, is called performance assessment [16]. Workers are an organization's lifeblood and can be valuable assets or non-tangible capital, contributing to the very existence of the enterprise [17] [18].

The idea behind the simple weighted addition, or simple additive weighting (SAW) method, is to determine the weighted total of the performance ratings for every alternative across all qualities [19]. In order to use SAW, the decision matrix X must be normalized to a scale that allows comparison with any possible rating [20]. The benefit of SAW is that it can perform more accurate evaluations based on predefined preference weights and criteria values [21]. It may also use a ranking method to identify the best option among several options after establishing the weights for each feature [21]. The analytical hierarchy process (AHP) was developed in 1970 by Thomas L. Saaty as a decision-support technique [22]. Complex multi-factor or multi-criteria problems are ranked according to AHP. A hierarchy is a depiction of a problem's multi-level structure, which goes from objectives to alternatives [23]. It helps to simplify complex problems by dividing them into smaller groupings. Pairwise comparisons are used by AHP to ascertain the relative weight and importance of each component in the overall problem [24] [25]. One approach to system analysis and design that puts an emphasis on objects is called object-oriented analysis and design, or OOAD. In OOAD, object identification describes how an item stands out in a given context and how other objects can identify and interact with it [26]. OOAD includes four broad principles for system analysis and design, with objects and classes serving as its primary keys [27]. A collection of modeling conventions called Unified Modeling Language (UML) is used to describe software systems in relation to objects. UML is a powerful tool in the development of object-oriented systems because it provides a visual modeling language that allows system developers to share and communicate their designs easily [28]. Decision support systems, performance assessment, analysis methods such as SAW and AHP, OOAD approaches, and UML are very important tools and techniques in the world of business and system development that aim to improve efficiency, accuracy, and quality of decisions and system management as a whole.

## **2. Research Methods**

In this research, the data collection methods used by the author are four: observation, interviews, literature studies, and similar literature studies. The data obtained from observations was then matched with archival data and analyzed. The development of this decision support system (DSS) uses the RAD model, which includes scope definition, analysis, design, construction, and testing. The flow of this research only extends to construction and testing, while further development and implementation are handed over to other interested agencies or researchers. This system development method uses the UML (unified modeling language) tool. After analyzing and designing the system, it is time for the system to be implemented. At this stage, there are several activities in question, namely: At this stage of programming, the design results are put into the form of a programming language that is used so that it can be run in the form of an application. The software used in this programming process is Sublime Text as editor software, Adobe Photoshop CS3 for image processing, and AppServ v2.2, which includes Xampp version 1.7 for the web server, PHP version 5.3.5 for the programming language, and MySQL for databases. System testing: at this stage, a trial is carried out on the new system so that it can be used without finding any problems. The tests that will be carried out use the black box testing method. In black box testing, there is no need to know what actually happens in the system or software. Because what is tested is input/output. Black box testing is an approach to testing whether each function in the program can run correctly. In conducting research, the stages of research activities follow the research methodology. There are four main stages: the initial analysis stage, situation analysis, system development, and reporting stage, namely reporting the research results.

## **3. Results and Discussion**

Based on the results of direct observations and interactions with the users involved, it can be seen that the current employee performance appraisal system follows a series of predetermined steps. The stage begins with the HR team, whose task it is to check and fill in data related to the employees who will be assessed. This data is then submitted to the head of the relevant department for further assessment. Managers evaluate employee performance based on predetermined criteria, with a limited assessment time span of one month of work. However, obstacles are visible in this system. The assessment process still occurs manually, where each head of department must fill out an assessment form, which is then submitted to the head of office. This manual process causes delays in the

flow of information and increases the time duration for the announcement of assessment results. In addition, HR staff also have to collect data from these various forms and transfer it into Excel documents, resulting in process complexity that slows down the entire appraisal system. The impact is quite pronounced, as employees have to wait longer to find out the results of their assessment. This indicates that the current assessment system is not fully optimal and effective. Time limitations and manual processes that are still dominant in filling in and processing data are the main obstacles to speeding up information on employee assessment results. Therefore, it is necessary to review and improve the performance appraisal system to enable a more efficient and transparent process for all parties involved.

The proposed system for employee performance appraisal has been designed with structured procedures to involve relevant users in it. The process begins with a login step for actors such as admin, manager, and head of office, using their respective credentials in the form of a username and password. The administrator's role is to manage user data that has access to the employee assessment system. Managers are responsible for managing employee data, determining the weight of assessment criteria, providing assessments, managing assessment results, analyzing comparisons, and printing assessment results. Meanwhile, the head of the office has the authority to approve employee reports that have been assessed and print the assessment results. In the comparison between the current system and the proposed system, there is a significant improvement. The proposed web-based system is able to overcome the obstacles that exist in the assessment process, which still relies on the use of manual forms by each head of department. Furthermore, by automatically storing all employee assessment data in the system, the risk of human error that may arise if documents or data are lost can be minimized. This has the potential to address time-related issues in the employee appraisal process, bring efficiency to data management, and increase the accuracy and reliability of available information.

An activity diagram is a visual representation of the workflow or activities in a system or business process. In the system design mentioned, the activity diagram describes a series of activities carried out by various system actors, namely the administrator, manager, and head of office. An actor who has registered with the system initiates the workflow with a login activity. After logging in, the actor will be directed to the main page, which displays a login form. The system will verify the actor's username and password with the data stored in the database. If the data is correct, the system will confirm a successful login and display the main system page. Then, various actors in the system carry out a variety of tasks. Admins have access to the user data menu, where they can add, change, and delete user data. Managers have activities to manage employee data, including changing information and criteria parameters, providing performance assessments, and managing employee assessment data. The head of the office has the task of giving approval to employee assessments. Next, there is a comparative analysis activity of employee assessment results using the simple additive weighting (SAW) and analytical hierarchy process (AHP) methods. This analysis helps determine the best employees based on a comparison of assessment results. Finally, after all activities have been carried out, all users (admin, manager, and head of office) have the option to log out of the system. After logging out, they will return to the login page to exit the system. All activities depicted in the activity diagram include various steps and functions carried out by actors in the system, from user data management to employee performance evaluation, as well as the analysis process to determine the best employee assessment results.

Class diagrams and sequence diagrams are an important part of defining the structure and interaction of objects in an employee assessment system. First, the class diagram will reflect the system structure by defining the required classes. Before creating a class diagram, the author identifies potential classes based on nouns that might describe the class. For example, admin, manager, employee, criteria classes, and so on. Second, the sequence diagram will describe the interactions between objects in each use-case scenario. For example, when a user logs in, the system validates the data and provides notifications of success or failure. Based on the user level, the system displays the appropriate display. Admins can manage user data by adding, changing, or deleting data, with the option to save or cancel changes. The admin, manager, and head of office then carry out the password change activity. Various activities are carried out by managers, including changing employee data, parameter importance scale values, assessing employees, managing assessment data, and carrying out comparative analysis of assessment results using the simple additive weighting and analytical hierarchy process methods. The head of the office plays a role in providing approval for assessments that have been carried out previously. Finally, after finishing using the system, all users (admin, manager, and head of office) can exit the system. This covers a wide range of activities in an employee appraisal system, from user management to performance evaluation and comparison of appraisal results. Class and sequence diagrams provide a comprehensive view of the structure and interaction of objects in the employee appraisal system.

Designing the best employee selection system begins with designing a database based on the logic of the company data model integrated with UML, namely through mapping class diagrams to a relational database. After that, the next stage is to explain the database structure built for the best employee selection system. Continue with designing the menu structure in this system. The following are details of the system design for selecting the best employees: The first stage is the login interface, which is the first step for administrators, managers, and office heads to enter

the best employee assessment system. Continue with the home admin interface design, which becomes the main display after the admin successfully logs in. Then, there is a user management interface design that allows admins to manage system users by either adding, deleting, or editing user data. Apart from that, there are special interface designs for managers, such as the manager home interface, which displays the main display after logging in; the managing employee data interface for adding, deleting, and editing employee data; and the assessment interface, which allows managers to assess employees. There are also interface designs for analyzing assessment results, such as the AHP calculation analysis interface and the SAW calculation analysis interface, which allow managers to view assessment results using the AHP and SAW methods. Finally, there is a results comparison interface design that displays the comparison results between the two methods. Then, there is a unique interface design for the head of office, such as the head of office home interface, which shows the main display after the head of office has successfully logged in, and the assessment approval interface, which enables the head of office to approve or disapprove of the outcomes of the assessment that the previous manager has carried out. The entire interface design forms a system framework that facilitates users (admin, manager, and head of office) in carrying out activities related to employee assessment by adding, deleting, editing data, and analyzing assessment results using the AHP and SAW methods.

At this stage, researchers focus on coding or programming to build a previously planned system. This programming stage involves using the PHP programming language as the main tool to facilitate system development. Through this programming, researchers can implement the logic and features that were previously planned in the design phase. The results of this programming stage are documented in the system source code attachment. The appendix contains the source codes used in building the system, explaining the logic and structure used in implementing the system features that have been previously designed. Apart from that, a system interface attachment is also prepared to show the interface results or visual appearance of the system that has been built. This documentation provides a visual overview for readers or parties who are interested in seeing the appearance and way users interact with a system that has been developed using PHP as the programming language. After completing the system development, the next stage is to carry out testing using the black box testing method. This is done by testing the application with various test cases that have been arranged in a test table. Testing is carried out by entering data into the system and checking the output, ensuring that the output is as expected. At the admin level, testing includes steps such as entering the home page, displaying the user data input form, editing user data if necessary, deleting user data, and finally exiting the system. Meanwhile, at the manager level, testing includes steps such as entering the home page, displaying the user data input form, displaying parameters for employee assessment, displaying the AHP method calculation results, displaying the SAW method calculation results, displaying the calculation results of both methods, and finally exiting the system. For testing at the head of office level, the steps include entering the home page, displaying employee data that has been assessed for approval or rejection, and finally exiting the system. Each level of testing will test the key functions of each role or access level in the system to ensure that the system operates as expected and provides output in accordance with the functionality that has been designed.

#### **4. Conclusion**

The AHP and SAW methods are used to figure out how much weight each criterion and sub-criteria parameter should have. The parameters are based on data from the company, and the priority scale for the parameters is based on interviews with managers who make all the decisions. This system is able to assist decision-makers in providing employee assessments quickly and precisely according to the specified time, where previously managers were always late and exceeded the time limit when assessing employees. The output of this system is that it can provide direct reports to the employees being assessed to find out the results of the scores obtained and make decisions about selecting the best employees. A decision support system for employee performance assessment uses the PHP and MySQL programming languages as the database. AHP (analytical hierarchy process) and SAW (simple additive weighting) methods, rapid application development (RAD) system development methods, and system testing with black box testing. In the system that was built, there are still limitations and shortcomings that require improvements to increase the benefits of this system, which can be developed through further research. Therefore, there are several things that need to be considered for further research, namely as follows: It is hoped that managers can provide appropriate or timely assessments and approvals. This decision support system can later be further developed by adding employee salary increases and complaints regarding the assessments given. This decision support system can later be further developed by adding criteria or sub-criteria parameters so that it can strengthen the results of decision-making in providing employee performance assessments.

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