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Research Article

Decision Support System for the Verification Process of Civil Servant Promotion Proposals in the Bojonegoro Regency Government Using *the Analytic Hierarchy Process* (AHP) Method

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Abstract: The advancement of information technology has significantly transformed governance practices, particularly in enhancing efficiency, transparency, and accountability in public service delivery. One of the critical aspects of civil service management is the promotion of Civil Servants (PNS), which serves as a form of recognition for performance and dedication to the state. Following regulatory changes, especially the enactment of BKN Regulation Number 4 of 2023, the promotion schedule has increased to six times a year, demanding a faster and more accurate verification process. Although the State Civil Apparatus Information System (SIASN) is currently used to support administrative procedures, the verification process for promotion proposals remains manual and limited to specific administrators. Therefore, this study aims to design a Decision Support System (DSS) using the Analytical Hierarchy Process (AHP) method to assist in the objective and systematic verification of promotion proposals. AHP was chosen for its ability to incorporate both qualitative and quantitative aspects while minimizing subjective bias in decision-making. The proposed DSS considers criteria such as length of service, performance evaluation, educational background, and disciplinary history. This system successfully the verification process and supports more transparent and accurate decision-making within the Government of Bojonegoro Regency .

Keywords: Decision Support System; Civil Servant Promotion; AHP; Verification; Bojonegoro..

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1. Introduction

Global developments accompanied by technological advances have driven significant changes in people's lifestyles towards the era of modernization. These changes also have an impact on various aspects, including the implementation of government functions, the provision of public services, and development efforts at the regional level [1]. To improve efficiency, transparency and accountability in providing government services, a computerized system that can provide information and decisions is very much needed to support government policies so that the information provided can be objective and acceptable to the public.[2]

Promotion for civil servants is a form of appreciation for performance achievements and dedication given to the country, which is given after certain requirements are met. In addition to being a form of appreciation, this policy is also intended to provide stimulus to civil servants to continuously improve the quality of their work and loyalty in carrying out their duties. Regular promotion can be given one level higher if the civil servant has been in

his/her last rank for at least four years, and has obtained a performance score with the lowest category of "good" in the last two years. In addition, the level of formal education and ownership of training certificates are also important components in fulfilling the requirements for promotion [3].

Previously, the implementation of promotions for civil servants was carried out twice a year, namely in April and October. However, since the enactment of BKN Regulation No. 4 of 2023 concerning the Periodization of Civil Servant Promotions, there has been a change in the technical aspects that set the frequency of promotions to six periods in one year. Currently, the determination of promotions is carried out every February 1, April 1, June 1, August 1, October 1, and December 1. This provision does not include posthumous promotions or promotions based on length of service [4].

In the implementation of the administration of civil servant promotion, an integrated technology infrastructure has been used through a system developed by the State Civil Service Agency, known as the State Civil Service Information System (SIASN), however, this system only runs in the administrative realm operated by the SIASN Admin at the BKPP Kab, Bojonegoro. Therefore, the verification process for civil servant promotion proposals within the Bojonegoro Regency Government requires an evaluation that is carried out systematically and structured. The form of approach that can be used to support the decision-making stage in this case is the Analytic Hierarchy Process (AHP) technique. AHP is a comprehensive decision-making method because it is able to accommodate both qualitative and quantitative aspects simultaneously [5] . AHP has been proven effective in various decision-making contexts, including human resource management, because of its ability to minimize subjective bias and increase assessment consistency [6]. The application of AHP in the civil servant promotion verification process is expected to accelerate the decision-making process through the structuring of objective criteria, namely the length of service, performance assessment, level of education held and employee disciplinary history.

Referring to the problems that have been identified, an appropriate alternative solution is needed to answer the challenge, namely a Decision Support System that is able to facilitate the verification process of Promotion Proposals. So the author is interested in conducting a study entitled "Decision Support System for Verification of Promotion Proposals for Civil Servants in the Bojonegoro Regency Government Using *the Analytical Hierarchy Process* (AHP) Method."

2. Literature Review

As a theoretical basis, this study refers to a number of previous studies that are considered relevant to the topic raised. Several previous studies have emphasized the importance of digitalization and the application of technology-based systems in the personnel management process. One of the studies used as a reference was written by Rubiati and colleagues in 2020, entitled "Web-Based Promotion Proposal Decision Support System at the Sungai Sembilan Sub-district Office." The study developed a web-based system that aims to support the promotion proposal process in the Sungai Sembilan Sub-district Office. The system designed in the study is focused on facilitating data management and accelerating the promotion proposal process for employees [7].

Research by Budiantoro and Hendrik (2024) entitled "Implementation of SVM and KNN in the Teacher Promotion Decision Support System" examines the use of algorithms in Support Vector Machine or known as SVM and K-Nearest Neighbors (KNN) in a decision support system for the teacher promotion process. In this study, SVM is used to classify candidates who meet the requirements, while KNN plays a role in the final decision-making stage. The test results show that the combination of the two methods increases the accuracy of the eligibility prediction [8].

Furthermore, a study conducted by Aditia, Hamka, and Mustafidah (2025) entitled "Decision Support System for Promotion Eligibility of Educational Personnel Using the AHP-TOPSIS Method" developed a system that aims to assess the eligibility of promotion of educational personnel by combining the AHP method and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). The focus of this study is on the use of AHP to determine the weight of relevant criteria and TOPSIS to rank alternatives based on these weights. The results of the study show that this combination of methods is effective in increasing the objectivity of the decision-making process [9].

From the literature review, this study has differences with the approach used. This study uses the AHP method with weight calculation and consistency evaluation (Consistency Ratio <0.1) on the main criteria that have been set, namely the Length of Service of the Last Rank (C1), Performance Assessment (C2), Education/Training (C3), and Discipline (C4). The ranking of the proposed promotion is based on the highest score from the results of the AHP criteria weight calculation. The system developed is web-based using the PHP programming language and the database uses MySQL.

3. Method

Decision Support System (DSS) is a computer-based system designed to help decision makers solve semi-structured and unstructured problems [10]. In the application of DSS for verification of promotion proposals, the AHP method is used with the aim of accelerating the decision-making process by compiling objective criteria. This study uses input in the form of criteria and sub-criteria based on data attached to civil servants in Bojonegoro Regency, which are requirements in the promotion application process, such as length of service, performance assessment, education level, and other factors. The data is then used to verify and assess the feasibility of civil servant promotion proposals. In this context, the AHP method plays a role in determining the weight of each main criterion that affects the promotion requirement standards and produces output in the form of a recommendation ranking value for each employee's promotion proposal.

This research is located at the Bojonegoro Regency Education and Training Personnel Agency located at Jalan Teuku Umar Number 42, Kadipaten Village, Bojonegoro District, Bojonegoro Regency, East Java Province. The research implementation period took place from March to May 2025.

In conducting the research, there are several stages that are systematically arranged to ensure the research process runs smoothly and on target. These stages include identifying problems to determine solutions and outlining the discussions needed in designing a Decision Support System for the verification process of civil servant promotion proposals in the Bojonegoro Regency Government using the AHP method. This system requires criteria data that are a requirement for the Civil Servant Promotion process, such as length of service for the last rank, performance assessment data, data on qualifications for education or training levels, and employee disciplinary history. This system requires sub-criteria data such as: number of years of service, performance assessment predicates for the last 2 (two) years, suitability of education level and how the employee's disciplinary history is. This system requires Civil Servant data within the Bojonegoro Regency Government. This system is able to display Civil Servant data that meets the requirements for the Promotion process. This system is able to process data using the AHP method.

The data collection methods used in this study consist of several approaches. First, interviews were conducted by collecting information directly from promotion verifiers in the Bojonegoro Regency Government environment in order to obtain relevant and in-depth data. Second, literature studies were conducted by studying journals and scientific works related to the research topic, such as theories on Decision Support Systems, AHP methods, and system development methodologies.

In addition, system needs analysis is also carried out to identify and determine what needs must be optimized so that the system can run effectively and support optimal performance. Alternative data used in this study are sample data of civil servants in one of the Work Units of the Bojonegoro Regency Government, as many as 8 out of a total of 6915 employees. The employee data attributes used are Name, NIP, Organizational Unit, Rank/Group, Education and Position. The criteria used to verify the promotion proposal in the Bojonegoro Regency Government are: Last Term of Service, Group/Rank, Performance Assessment Predicate, Education/Training, and Disciplinary History [3].

Data processing is done using AHP calculations to calculate the priority weights of the criteria and subcriteria. The calculation of the pairwise comparison matrix is based on a comparison scale adapted from the AHP Comparison Value Scale Table. Each matrix element is compared with each other until all boxes are filled, the results are then normalized to obtain priority weights. Furthermore, consistency calculations are carried out through the Consistency Ratio (CR). If $CR \leq 0.1$ then the calculation results are considered consistent and acceptable.

The hardware used in this study is: Asus Vivobook M1403QA Laptop with AMD Ryzen7 5800HS Radeon Graphics 3.20GHz Processor, 16 GB RAM, and 512 GB SSD. While the software used is: Windows 11 Operating System, Visual Code Studio, Xampp, Microsoft Word and Microsoft Excel.

System testing is carried out using the Blackbox Testing method, which aims to ensure that all functions in the system have run as expected. This method is dynamic, where the success of the test is determined based on the suitability of the final results of the software with the requirements specifications, usage scenarios, and system designs that have been set, so that they can meet user expectations. Blackbox Testing focuses its validation on several important aspects, such as identifying missing or incorrect functions, errors in the interface, inconsistencies in data structures, and disruptions to system performance and behavior [11].

4. Results and Discussion

This study shows that the use of Decision Support System (DSS) with AHP method in the verification process of civil servant promotion proposals in Bojonegoro Regency Government has succeeded in increasing the efficiency and effectiveness of verification. The AHP method is applied to give weight to each criterion that is used as a reference in meeting promotion requirements. This system then produces output in the form of a ranking that is the basis for recommendations for promotion proposals for employees in a more objective and structured manner.

4.1 . System Implementation

Implementation of the Decision Support System (DSS) in the verification process of civil servant promotion proposals in the Bojonegoro Regency Government by utilizing the Analytic Hierarchy Process (AHP) method has been proven to help operators in conducting assessment verification more objectively and efficiently. The form of implementation of this system is as follows:

1. Login Page

   Figure 4.1 shows the *login page* , which is the initial page of the system and allows *users* to be asked to enter *the email* and *password* that have been registered in *the database* and according to the access rights they have.

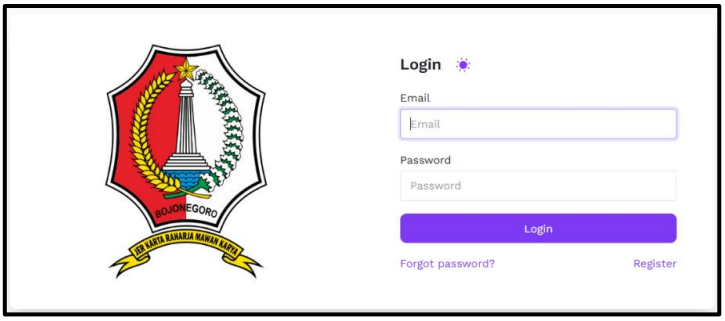
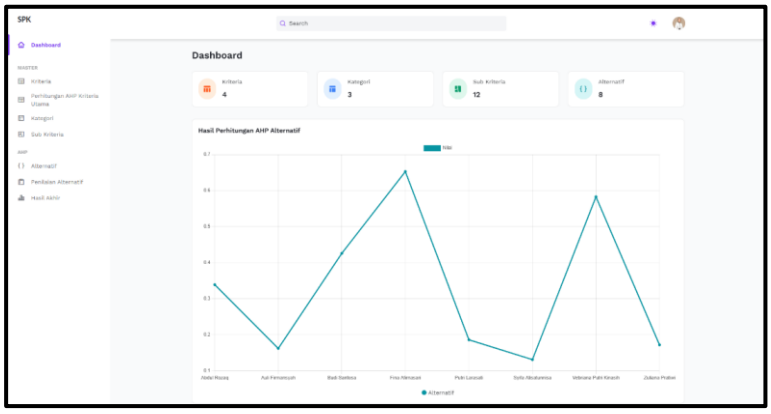


Figure 1. Login Page

2. Dashboard Page

Next, in Figure 4.2, it displays the *dashboard page* which is the main display of this system, this page presents important information concisely to the user.

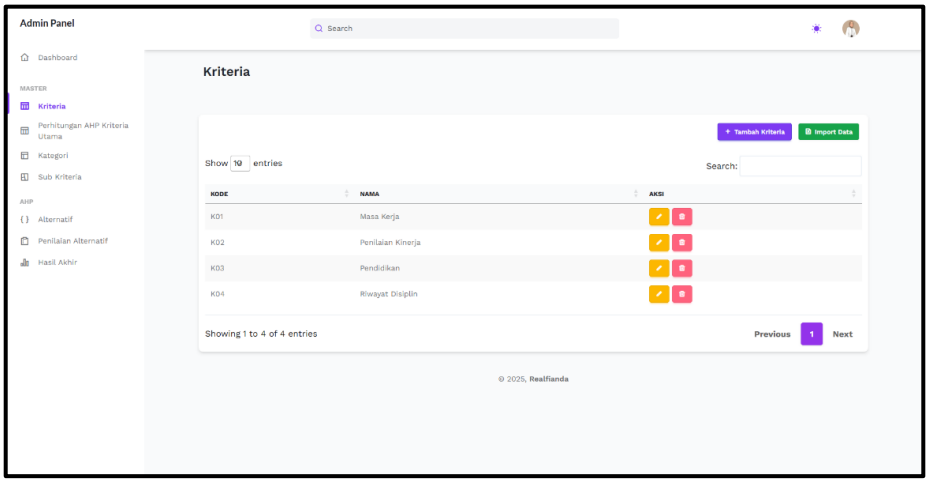
Figure 2. Dashboard page



3. Criteria Page

Then, in Figure 4.3, here is the page for managing criteria data and allows the admin to add, change and delete criteria data.

Figure 3. Criteria Page



4. AHP Calculation Page Criteria

Figure 4.4 is the page for calculating the normalization of the criteria matrix, where on this page the priority weight of each criterion is displayed.

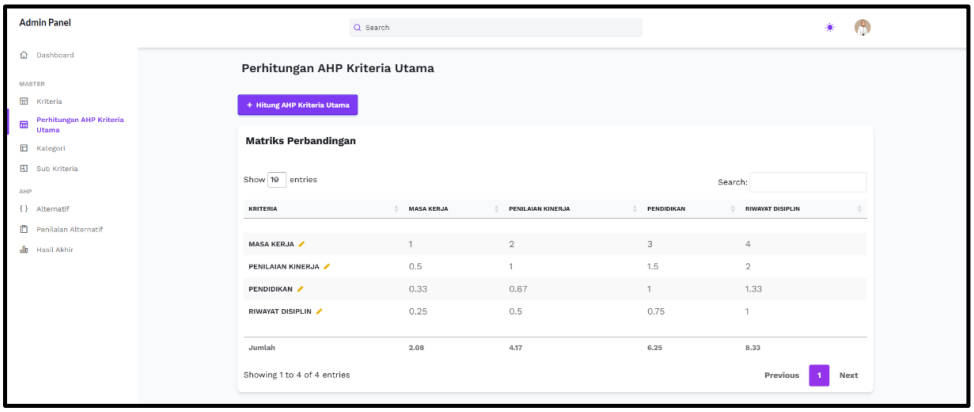
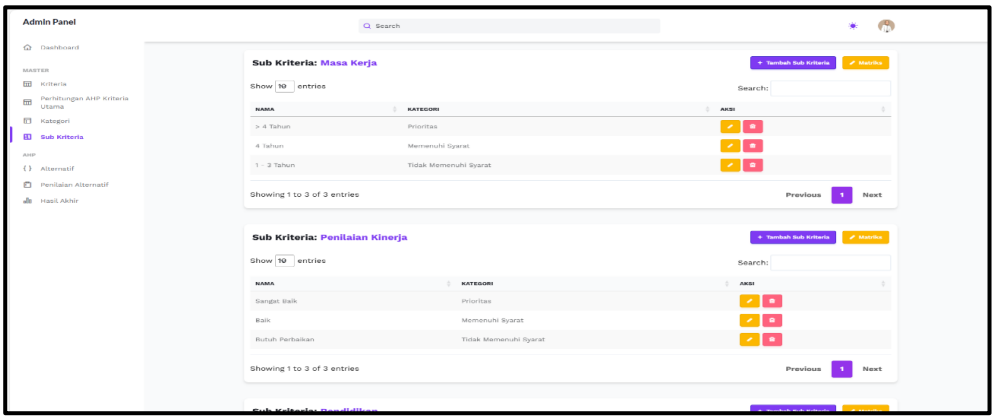


Figure 4. AHP Criteria Calculation Page

5. Sub Criteria Page

Then, in Figure 4.5, here is the page for managing sub-criteria data and allows the admin to add, change and delete criteria data.

Figure 5. Sub Criteria Page



6. Sub Criteria Calculation Page

Next, by clicking the "Matrix" button in Figure 4.5, the user will be directed to the matrix calculation page shown in Figure 4.6 where on this page you can perform the normalization calculation of the sub-criteria matrix, then on this page the priority weight of each sub-criteria will be displayed.

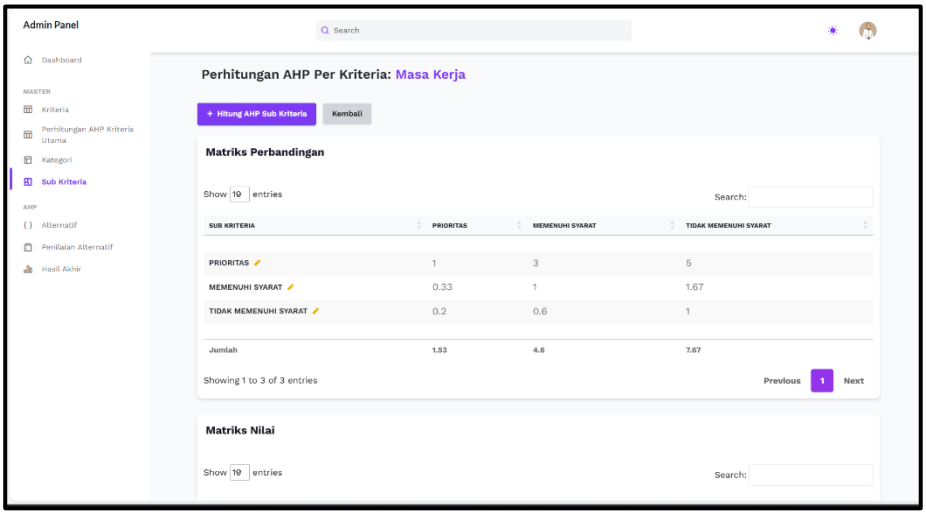


Figure 6. AHP Sub Criteria Calculation Page

7. Alternative Pages

Then in Figure 4.7 is the alternative menu page, which contains alternative data input, the data will be processed using AHP using the predetermined criteria calculation weights.

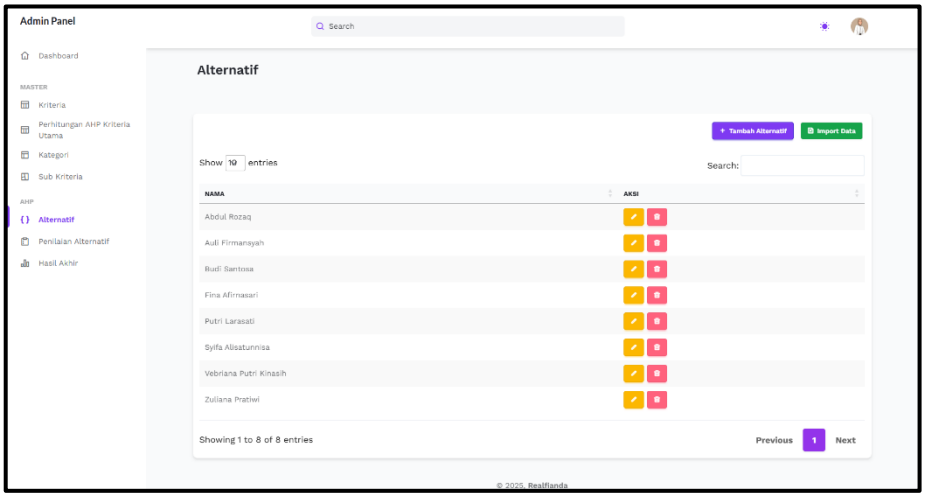


Figure 7. Alternative Page

8. Alternative Assessment Page

Next, the Alternative Assessment Page shown in Figure 4.8, where on this page the user can provide an assessment / weighting of the criteria for each alternative. Then the alternative data that has been given an assessment will be summarized and displayed as in Figure 4.9

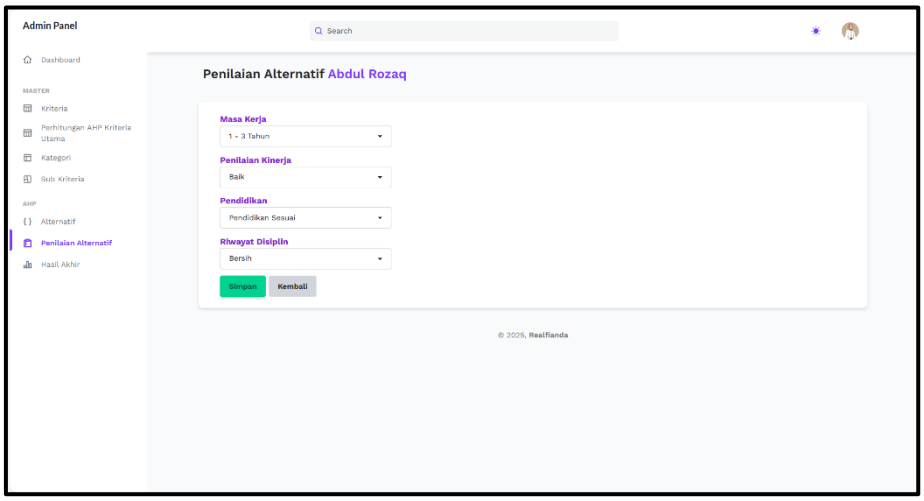


Figure 8. Alternative Assessment Page

Figure 9. Alternative Assessment Page

9. Ranking Page / Calculation Results

And the last is the Ranking Page shown in Figure 4.10, where this page displays the results of alternative calculations with assessments of each criterion, which will then be ranked based on the results so that alternative recommendations can be submitted for promotion.

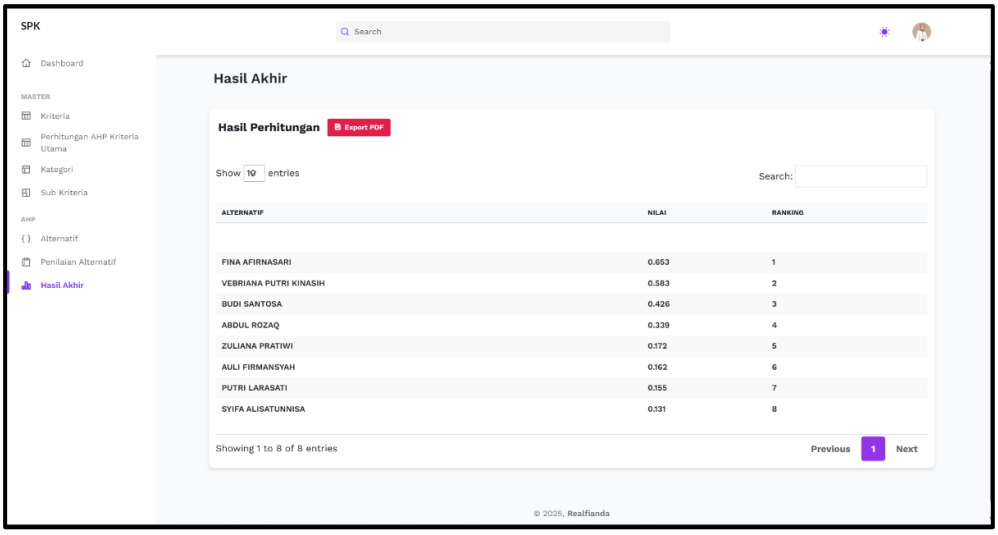


Figure 10. Calculation Results Page

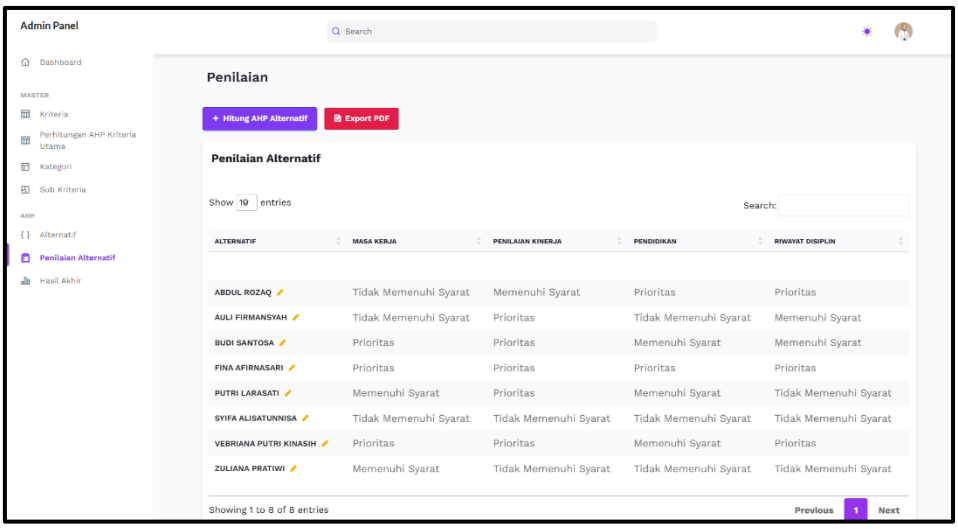
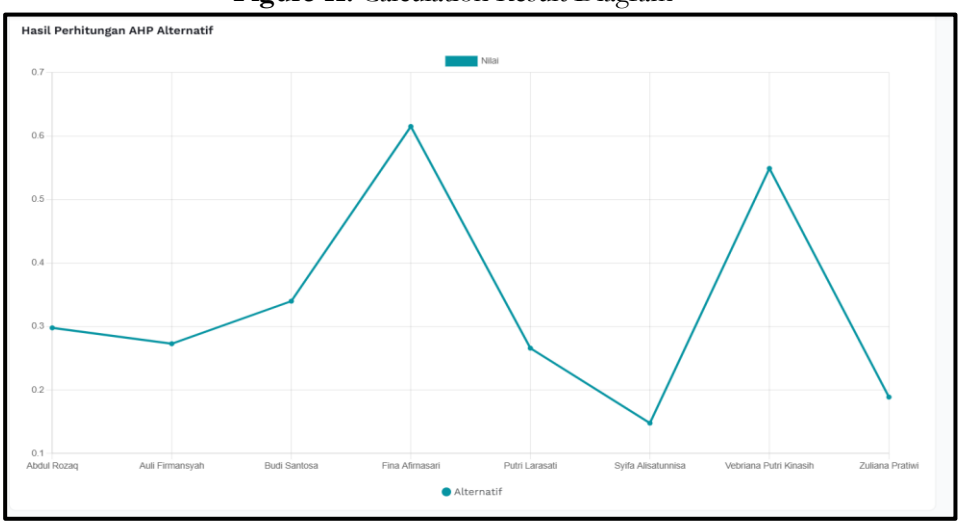


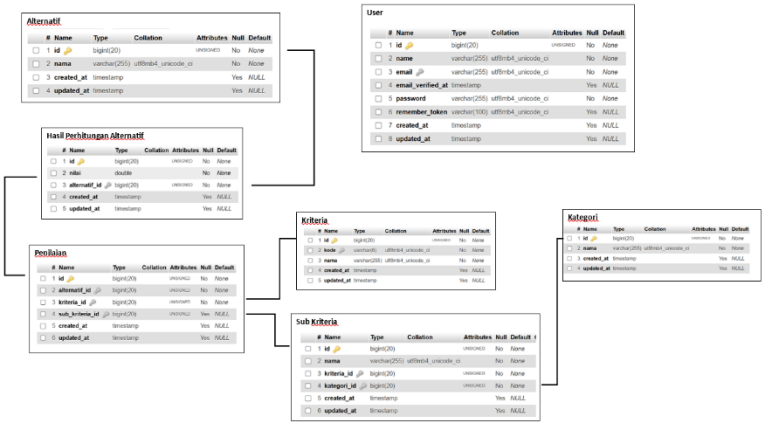
Figure 11. Calculation Result Diagram



Database Implementation

The database implementation in creating this system uses MySQL as *the Database Management System* , there are seven main tables for storing and can be related as needed, Figure 4.12 is the database tables in creating this SPK.

Figure 12. Database Implementation



System Testing (*Blackbox*)

System testing is carried out by researchers after the completion of all system functions, this test is intended to ensure whether the system can run according to the expected results. Table 4.1 shows the results of *Blackbox testing* on the Decision Support System for the Promotion Verification Process Using the AHP Method.

Table 1. *Blackbox* Testing

No	Scenario	Expected results	Conclusion
1.	Enter the correct *email* and *password then press the login button.*	If *the email* and *password* entered are correct, the system will display a *dashboard menu*	Succeed
2.	Entering the wrong *email* and *password and then pressing the login button.*	If *the email* and *password* entered are incorrect, the system will remain on the login menu and a warning will appear that *the username/password* is incorrect.	Succeed
3.	Press the "Start" button on *the dashboard.*	The page will move to the Criteria view.	Succeed
4.	Press the Add Criteria button, then Save	The page will display a pop-up containing a form to add criteria, the user is asked to fill in the criteria code and criteria name.	Succeed
5.	Press the edit button on the criteria menu	The page will display a pop-up containing a form to edit *the* criteria that have been *inputted* .	Succeed
6.	Press the delete button on the criteria menu	The page will display a pop-up containing a question to convince the user to delete the criteria or not.	Succeed
7.	Select another menu on the navigation panel	The page will display according to the selected menu.	Succeed
8.	Inputting matrix calculations in Criteria	The page will display a comparison matrix of each criteria.	Succeed

No	Scenario	Expected results	Conclusion
9.	Press the Calculate Main Criteria button on the AHP Main Criteria Calculation Menu	The page will display the AHP calculation results for each matrix that has been input *by* the user.	Succeed
10.	Press the Add Alternative button on the Alternatives menu	The page will display a pop-up containing a form to add Alternative data, the user is asked to fill in the Alternative data.	Succeed
11.	Press the edit button on the Alternative menu	The page will display a pop-up containing a form for editing *alternative* data.	Succeed
12.	Press the delete button on the Alternative menu	The page will display a pop-up containing a question to convince the user to delete the Alternative or not.	Succeed
13.	Fill in the Sub-Criteria for each criterion contained in the Alternative data	The page will display the Alternative Assessment display, users are asked to fill in the sub-criteria for each existing Criteria.	Succeed
14.	Press the Calculate Alternative AHP button on the Alternative Assessment menu	The page will display the AHP calculation from the Alternative data that has been paired between the Criteria and Sub-Criteria.	Succeed
15.	Press the Final Result menu	The page will display the Ranking Results display from the Alternative data.	Succeed
16.	Press *the Logout button*	The user will exit the system page, and then the Login menu will be displayed.	Succeed

Discussion

To evaluate the success level of implementing the Analytic Hierarchy Process (AHP) method in this system, researchers conducted a validation test by comparing the results of manual calculations and the results produced by the system.

1. Manual Calculation

   In manual calculations, the initial step taken is to compile a pairwise comparison matrix for each criterion. The results of the calculation can be seen in Table 2, namely the Criteria Comparison Matrix.

Table 2. Criteria Matrix

Years of service	Performance assessment	Education/Training	Disciplinary History
1	2	3	4
0.50	1	1.50	2.00
0.33	0.67	1	1.33
0.25	0.50	0.75	1
Total	2.08	4.17	6.25

After that, normalization is carried out on the criteria matrix to obtain the priority value of each criterion as in Table 3. Normalized Criteria Matrix. The results of the criteria priorities are as follows:

Table 3. Normalized Criteria Matrix

	Years of service	Performance assessment	Education/ Training	Disciplinary History	Amount	Priority
Years of service	0.481	0.48	0.48	0.48	1,921	0.48
Performance assessment	0.24	0.24	0.24	0.24	0.96	0.24
Education	0.159	0.161	0.16	0.16	0.639	0.16
Disciplinary History	0.12	0.12	0.12	0.12	0.48	0.12
Total	1.00	1.00	1.00	1.00	4.00	

1. Working Period: 0.48
2. Performance Rating: 0.24
3. Education/Training: 0.16
4. Disciplinary History: 0.12

Then the matrix consistency calculation is continued, and the result obtained is CR ≤ 0.1, so the calculation results are consistent.

The next calculation is the sub-criteria comparison matrix which also performs normalization and consistency calculations. The results of the sub-criteria priority calculations are obtained as in Table 4

Table 4. Normalized Sub-Criteria Matrix

	Prioritized	Qualify	Not eligible	Amount	Priority
Prioritized	0.654	0.652	0.652	1,958	0.653
Qualify	0.216	0.217	0.218	0.651	0.217
Not eligible	0.131	0.13	0.130	0.392	0.131
Total	1.00	1.00	1.00	3,000	

After the calculation of the sub-criteria priorities, it is continued to the alternative data processing stage. The employee data processed amounted to 8 employees, each of which was inputted based on data on length of service, performance, education, and disciplinary history. The alternative value of each employee was processed using the AHP calculation formula.

2. Comparison of Calculation Results

With the Decision Support System for the Verification Process of Civil Servant Promotion Proposals in the Bojonegoro Regency Government Using the Analytic Hierarchy Process (AHP) Method, the selection and ranking process based on scores becomes fast, accurate, transparent and does not require manual calculations. To validate the accuracy and reliability of the system, *error level measurements* are carried out using the Mean Absolute Percentage Error (MAPE) method . The results of this MAPE analysis are expected to show how consistent the SPK is in replicating

calculations carried out manually. As for *error calculations* using the MAPE method using equation (1)

Then in Table 5 presents the details of the comparison of the final values and error values that occur in each alternative. This table clearly shows the difference between the manual calculation results and the SPK results, which are the basis for calculating the system's accuracy.

Table 5. Comparison of Calculation Results

$$\text{MAPE} = \sum_{t=1}^{n} \left| \frac{y_i - \hat{y}_i}{\hat{y}_i} \right| \times 100\% \quad \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Name	Manual Calculation	Final Results of SPK	$\left\|\frac{y_i - \hat{y}_i}{\hat{y}_i}\right\|$
FINA AFIRNASARI	**0.653**	**0.653**	0
VEBRIANA PRINCESS KINASIH	**0.58324**	**0.583**	0
BUDI SANTOSA	**0.42628**	**0.426**	0
ABDUL ROZAQ	**0.33908**	**0.339**	0
DR.	**0.17228**	**0.172**	0
AULI FIRMANSYAH	**0.16196**	**0.162**	0
PRINCESS LARASATI	**0.15508**	**0.155**	0
SYIFA ALISATUNNISA	**0.131**	**0.131**	0

5. Conclusion

Decision Support System for the Verification Process of Civil Servant Promotion Proposals in the Bojonegoro Regency Government Using the Analytic Hierarchy Process (AHP) Method can help the verification process of promotion proposals objectively by considering predetermined criteria, namely length of service, performance assessment, education level, and disciplinary history. The AHP method successfully provides weight to each criterion and sub-criteria with consistent calculation results, resulting in promotion proposal recommendations that can be considered by personnel verifiers.

This system provides significant benefits in facilitating the decision-making process for civil servant promotion proposals, resulting in a more efficient, transparent, and accurate verification process. In the future, it is hoped that this system can continue to be developed by adding more comprehensive data processing features, as well as expanding the scope of processed employee data, so that it can provide increasingly optimal recommendation results and can be implemented widely within the scope of government.

Reference

[1.] Zulfa, A., & Vitadiar, T. Z. (2023, March). Decision support system for website-based assessment of exemploying teachers at SMK Al-Hikmah Sumobito using SMART method (Vol. 7). https://doi.org/10.33752/inovate.v7i2.4115

[2.] Aditia, R., Supriyono, Hamka, M., & Mustafidah, H. (2025). Decision support system for promotion eligibility of educational personnel using the AHP-TOPSIS method.

[3.] Budiantoro, H., & Hendrik, B. (2024). Implementation of SVM and KNN in teacher promotion decision support system. KomtekInfo Journal, 11(4). https://jkomtekinfo.org/ojs

[4.] Government of Indonesia. (2002). Government Regulation of the Republic of Indonesia Number 12 of 2002 concerning amendments to Government Regulation Number 99 of 2000 concerning promotion of civil servants.

[5.] Kusuma, E. Y., Tanhella, Z., Vitadiar, Z., Ginanjar, S. P., & Kristianto, H. (2025, April). Decision support system for selecting exemptor students of Al-Muhajirin Islamic Boarding School using web-based AHP method. https://doi.org/10.33752/inovate.v9i2.8901
[6.] Mahdiania, D., & Hasibuan, M. S. (2024). Implementation of decision support system in selecting supplier using Analytical Hierarchy Process (AHP) method. Journal of Information Systems Technology and Applications, 7(1), 411–418. https://doi.org/10.32493/jtsi.v7i1.39286
[7.] Parlika, R., Nisaa', T. A., Ningrum, S. M., & Haque, B. A. (2020). Literature study of the lack and excess of testing the black box. Teknomatika, 10(2), 1–5.
[8.] Rubiati, N., et al. (2020). Informatics web-based decision support system for proposal proposals at Sungai Sembilan District Office. Journal of Informatics, Management and Computers, 12(2).
[9.] State Civil Service Agency. (2023). BKN Regulation 4 of 2023 on Civil Servant Promotion Periodization.
[10.] Sudarto. (2022). Utilisation of Analytical Hierarchy Process (AHP) as a decision support system model for selecting high-performing employees.
[11.] Syihab, M. A. A., & Vitadiar, T. Z. (2025, April). Web-based Jepara furniture sales information system using the double moving average method. https://doi.org/10.33752/inovate.v9i2.8900