IMPLEMENTATION OF A COMBINATION OF WP AND MOORA METHODS IN RECRUITMENT OF CASUAL DAILY LABORERS TO BECOME PERMANENT EMPLOYEES

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ABSTRACT

The Industrial Revolution 4.0 has emphasized the strategic role of information technology in supporting organizational decision-making, particularly in workforce recruitment. Within this context, PTPN IV, a leading company in the plantation sector, continues to encounter challenges in promoting Casual Daily Laborers (BHL) to permanent employees through an objective and transparent selection process. To address this issue, this study introduces a decision support system (DSS) that integrates the Weighted Product (WP) method with Multi-Objective Optimization by Ratio Analysis (MOORA). The WP method is applied to calculate preference values based on weighted criteria, while MOORA facilitates multi-criteria optimization, thereby strengthening the accuracy of the ranking process. Empirical findings indicate that the combined approach significantly enhances decision-making effectiveness, producing more consistent and fair outcomes compared to conventional methods. The practical implication of this research lies in providing PTPN IV with a reliable tool to improve efficiency, ensure fairness, and strengthen accountability in employee promotion decisions, which ultimately contributes to organizational performance and competitiveness.

Keywords: Decision Support System (DSS), Weighted Product (WP), MOORA, Employee Promotion, Plantation Industry

1. INTRODUCTION

In the era of the Industrial Revolution 4.0, technology is developing very rapidly, especially in the field of information technology, which is now the main key in supporting smooth business operations (Susanto et al., 2021). However, this development also requires companies to continue to adapt, such as improving employee digital skills, and data security is very important in the use of information technology. With proper use, this technology drives business progress and innovation. Currently, almost all aspects have been integrated with computerized systems, including decision making (Harahap & Triase, 2022).

With the help of technologies such as big data and artificial intelligence, data analysis becomes faster and more accurate, thus supporting more effective and informed decisions (Akbar et al., 2024). Decision-making is crucial when faced with various choices. Nowadays, this process does not only depend on human thinking, because human limitations in analyzing problems can be assisted by computerized systems (Dhouib et al., 2024; Proboningrum & Sidauruk, 2021).

PTPN IV is part of a BUMN engaged in the plantation processing industry, especially palm oil. Headquartered in Jakarta, this company not only focuses on business development, but also cares about the welfare of the community around its operational areas (Purba et al., 2023; Sherly et al., 2023). Casual Daily Laborers (BHL) play an important role in the operations of PTPN IV, especially in field work, namely oil palm fruit harvesters. These oil palm harvesters are an important pillar in the palm oil industry, so to maintain business continuity and increase loyalty, the company appoints some BHL to be appointed as permanent employees after going through a performance evaluation based on the quality and quantity of work (Taufiq et al., 2020). This process requires a systematic, transparent, and fair approach, given its significant impact on operational sustainability and workforce satisfaction (Tkatek et al., 2021).

The main problem in the selection of Casual Daily Laborers (BHL) at PTPN IV is the unstructured system, and the assessment still depends on the foreman's assessment, which is often not subjective. As a result, performance evaluation and candidate selection can be uneven and do not fully reflect the quality and potential of the individual. There are also many BHL who resign before being appointed because the assessment process is quite long. Where this almost always happens every year, especially in 2019, there was quite a loss of BHL. With that, PTPN IV needs a more transparent, objective, and efficient selection method so that the selected employees really have the best abilities to support the company (Radhi, 2020).

With these problems, PTPN IV requires a decision support system (DSS) with the best approach to assist the selection process and determine which BHLs are worthy of being appointed as permanent employees (Irawan et al., 2023). With the DSS, decision-making can be done more accurately, efficiently, and more objectively. To implement DSS in this case, using a combination of methods in DSS (Decision Support Systems), namely the Weighted Product (WP) method and also the MOORA (Multi-Objective Optimization by Ratio Analysis) method (Sinon & Rozi, 2021).

WP is known for its effectiveness in calculating alternative preferences systematically and efficiently, especially in situations with many criteria. The steps in this method include weight normalization, preference vector calculation, and a ranking process to determine the best choice based on the existing criteria (Yudistira & Sari, 2020). The MOORA method was chosen because this method has the ability to perform complex mathematical calculations and has a high level of selectivity (Firmansyah et al., 2024; Prabiantissa et al., 2024). By assessing both beneficial and unfavorable criteria, MOORA helps to produce more optimal decisions. This method provides a clear and data-based basis for recruitment, where each candidate is assessed based on the weight of the criteria that have been set.

The assessment results are then calculated mathematically to ensure more objective decisions (Hasibuan et al., 2023). These two methods were chosen because they can help evaluate candidates objectively and multi-criteria. WP is effective in calculating candidate scores based on criteria weights, while MOORA optimizes ranking by considering benefit and cost criteria. The combination of the two minimizes subjective bias, resulting in more accurate and fair recruitment decisions.

This study refers to several previous studies that also used the WP and MOORA methods. One study that compared the two methods showed that each had advantages in determining the best customers, with a level of accuracy that depended on the characteristics of the data and the criteria used (Mugiarso & Rasim, 2023). Other studies explain that the MOORA method has a high level of selectivity in choosing the best alternative based on certain criteria (Mesran et al., 2021). Meanwhile, there is also research that concludes that the WP method is effective in providing recommendations based on predetermined criteria (Dewi et al., 2023). Based on these findings, the author is interested in using a combination of WP and MOORA methods because both can produce more optimal decisions.

This study aims to develop a decision support system with the WP and MOORA methods to assess and determine Casual Daily Laborers who are worthy of being appointed as permanent employees objectively, accurately, and efficiently. This system helps PTPN IV to conduct workforce selection in a more structured and data-based manner, so that decisions are fairer and in accordance with company needs. Different from previous studies, this study focuses on the application of a combination of WP and MOORA in the selection of daily contract workers. In addition to considering productivity and discipline, recruitment decisions also look at aspects of sustainability and loyalty. With WP comparing weighted criteria and MOORA being selective in determining the best alternative, this system presents a more accurate and objective workforce selection.

2. THEORY

A Decision Support System (DSS) is a system designed to assist the decision-making process by providing information, modeling, and processing data interactively (Febriana & Budiarto, 2021; Yuliana et al., 2022). The concept of Decision Support Systems (DSS) was first introduced by Gorry and Scott Morton in the literature related to information systems and computing in 1971 (Daulay, 2020; Fahlepi, 2020). Decision support systems (DSS) play an important role as a computerized tool, guiding and improving the decision-making process, which is important for the progress of the Company (Asgarova et al., 2024).

Casual daily laborers are workers who are hired based on needs without any long-term work ties or permanent work contracts. They only work when asked by the employer, so the number of working days in a month is uncertain and depends on market demand or company needs (Taufiq et al., 2020). The existence of casual laborers in the world of work is part of the flexibility of the labor market, especially for companies that require a large number of workers but do not want to be tied to long-term obligations (Tkatek et al., 2021).

Weighted Product (WP) is one of the approaches used in decision-making based on Multi-Attribute Decision Making (MADM). This method utilizes multiplication techniques to integrate the values of each attribute (criterion), with each attribute value raised to the power using the associated attribute weight. The Weighted Product method is one of the approaches in decision-making that is often used to solve multi-criteria problems. approach works on the principle of multiplication, where the rating values of each attribute are combined to produce a final score that reflects the ranking of alternatives based on predetermined criteria (Apriliana, 2021).

Multi-Objective Optimization based on Ratio Analysis (MOORA) method is a method introduced by Brauers and Zavadskas in (Mahendra et al., 2021). This method is used to solve optimization problems involving more than one objective by analyzing the ratios between the various alternatives available. The advantage of the Moora method lies in its flexibility and ease of understanding, especially in separating subjective elements in the evaluation into weighted criteria based on several decision attributes (Yani & Hasugian, 2023). This method also has high selective ability because it can help determine the objectives of conflicting criteria, both beneficial and detrimental criteria (costs) (Setyono & Sarno, 2020).

3. METHOD

In this study, the author uses a quantitative method with a descriptive approach to explain the research results. The quantitative method was chosen because the data used are in the form of numbers and are analyzed using statistics (M. Sari et al., 2022). Descriptive research aims to describe the situation or condition of the research object based on current facts, then the results are analyzed and interpreted (Samsudin et al., 2025). The following are the research methods that will be carried out in several stages:

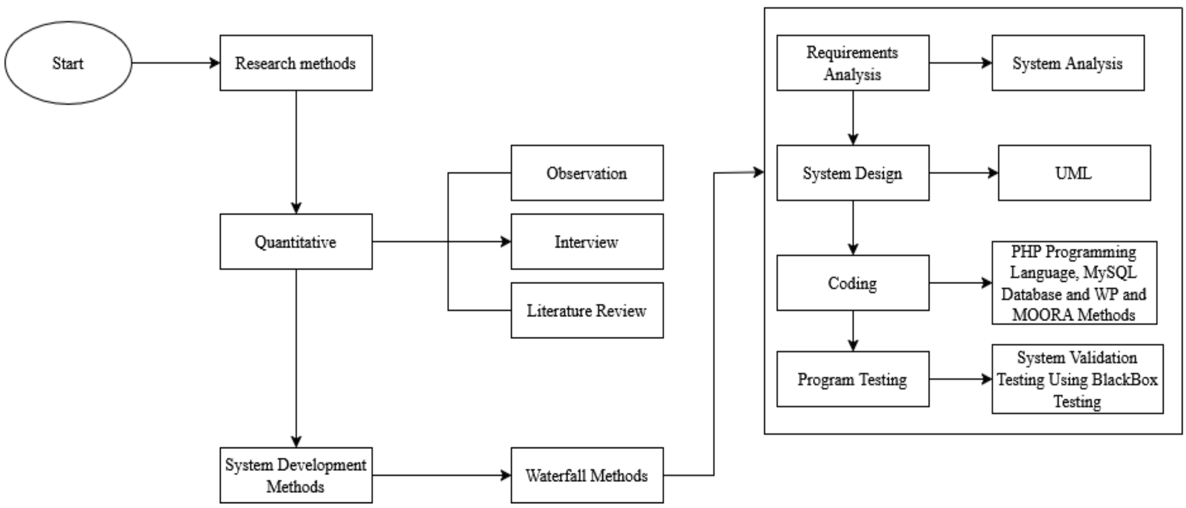

Figure. 1. The Research Methods

3.1 Research Method

In this study, the first stage begins by applying the research method, namely the quantitative method with a descriptive approach. This method allows the author to obtain in-depth data on the phenomenon being studied. This quantitative method, of course, requires data that will be used in the research. In this method, there are 3 ways of collecting data: 1) Observation, 2) Interview, and 3) Literature Review.

3.2 System Development Methods

At this stage, the author uses the waterfall method as a system development method. This method was chosen because it has clear and sequential stages so that it can ensure that each

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part of the system is well developed (Samsudin et al., 2022). This method has several stages: 1) Requirement Analysis: At this stage, a system analysis of the existing system is carried out, which aims to design a more efficient system that can overcome existing problems. 2) System Design: Next is system design. where the design process uses the Unified Modeling Language (UML), which aims to design diagrams that explain the flow and interactions in the system. 3) Coding: at this coding stage, the author uses PHP as a programming language and also uses MySQL as its database. In this stage, the WP and MOORA methods are also used, where in the calculation of the WP and MOORA methods, there are several steps. The WP method has 3 steps taken in determining decision-making:

a. Normalization or improvement of weights

$$Wj = \frac{Wj}{\sum \mathrm{Wj}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

b. Determine the value of Vector S

$$Si = \prod_{j=1}^{n} X_{ij}^{wj} \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

c. Determining the Value of Vector V

$$Vi = \frac{\prod_{j=1}^{n} X_{ij}^{wj}}{\prod_{j=1}^{n} (X_j^{w})^{wj}} \ldots\ldots\ldots\ldots\ldots\ldots.. \quad (3)$$

Meanwhile, the MOORA method has 4 steps that must be followed, as follows:

a. Making Matrix Formation
   Create a decision matrix based on the available data, with the following format:
   1) Rows: alternatives to be evaluated.
   2) Columns: criteria or attributes used for evaluation. Each element of the matrix indicates the value of the criteria for a particular alternative.

$$X_{ij} \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ x_{m1} & x_{m2} & \cdots & x_{mn} \end{bmatrix} \quad (1)$$

b. Normalization Of the Decision Matrix
   In the normalization process, the best denominator is the square root of the sum of the squares of each alternative for each attribute. This ratio can be expressed as follows:

$$X_{ij} = \frac{x_{ij}}{\sqrt{\sum_{k}^{m} = 1 x_{ij}^{2}}} \quad (2)$$

c. Calculating Optimization Value
   Calculate the optimization value by differentiating the criteria into:
   1) Benefit (profitable): the greater the value, the better.
   2) Cost (unprofitable): the smaller the value, the better.

$$y_i = \sum\nolimits_{j}^{g} = 1\, x_{ij} - \sum\nolimits_{k}^{n} +\, g + 1\, x_{ij}$$

$$y_i = \sum\nolimits_{j=1}^{g} w_j x_{ij} - \sum\nolimits_{j=g+1}^{n} w_j x_{ij} \;\; (j = 1, 2, \cdots, n)$$

d. Determine Alternative Ranking
   1) Sort the yi values from the largest to the smallest.
   2) The alternative with the highest yi value is the most optimal or meets the best criteria (R. P. Sari & Alliandaw, 2022).

The next stage is program testing. To ensure the system runs as expected and is error-free, the author applies the black-box testing method. This testing focuses on the functionality of the system without considering its internal structure.

4. RESULTS AND DISCUSSION

4.1 Requirement Analysis

Based on the analysis conducted at PTPN IV Pasir Mandoge Unit, several criteria were identified as essential components in developing a decision support system (DSS). These criteria represent the key indicators of employee evaluation and were assigned specific weights based on their relative importance, shown in Table 1.

Table 1. Criteria Data

No	Criteria	Code	Value
1	Discipline	C1	15%
2	Compilance	C2	15%
3	Productivity	C3	35%
4	Physical Health	C4	25%
5	Palm Fruit Quality	C5	10%
	Total		100%

The five criteria above were determined as the main indicators in evaluating the performance of Casual Daily Laborers (BHL) for promotion to permanent employee status. Productivity (C3) was given the highest weight of 35%, reflecting its dominant contribution to plantation performance. This is consistent with previous studies that emphasize productivity as a critical factor in performance-based employee promotion, particularly in labor-intensive industries such as agriculture and plantations (Gazi et al., 2024). In addition to the criteria, ten employees were evaluated as alternatives, as shown in Table 2. Each alternative was assessed against the five criteria using a rating scale from 1 to 5.

Table 2. Alternative Data

Code	Alternative Name	Value To Criteria				
		C1	C2	C3	C4	C5
A1	Kurniawan Sandi	5	5	4	4	4
A2	Teja Saragih	5	4	5	5	3
A3	Dharmawan	4	3	5	4	5
A4	Joel Situmorang	5	5	5	5	4
A5	Supandi	4	5	5	4	5
A6	Ahmad Pratama	4	4	5	5	5
A7	Suprapto	3	3	5	5	4
A8	Fitriono	5	5	5	5	5

Code	Alternative Name	Value To Criteria				
		C1	C2	C3	C4	C5
A9	Ahmat Fitra	4	4	4	4	5
A10	Sahat Panjaitan	5	5	5	5	4

This dataset forms the input for the DSS, which applies the Weighted Product (WP) and Multi-Objective Optimization by Ratio Analysis (MOORA) methods to generate objective rankings of candidates. Similar approaches integrating WP and MOORA have been widely adopted in decision-making contexts such as recruitment, supplier selection, and scholarship awarding due to their robustness in handling multi-criteria problems (Alastal et al., 2025).

4.2 Design System

The system design stage illustrates how the decision support system is structured and how users interact with it. The Use Case Diagram in Figure 2 demonstrates the relationship between system functions and the two types of users: Admin and Leader (User).

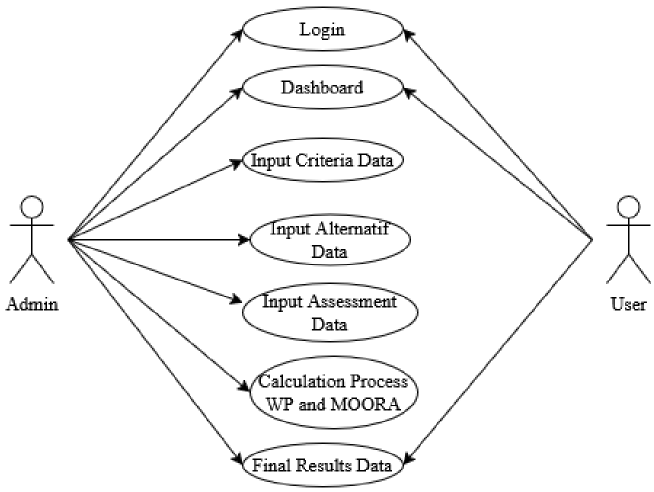

Figure. 2. Use Case Diagram

The Admin has full access rights and can perform a wide range of functions, including logging in, viewing, inputting, editing, and deleting data. This encompasses managing criteria data, alternative data, and assessment data. Additionally, the Admin can view the calculation process of both the WP and MOORA methods and generate the final results. On the other hand, the Leader (User) has limited access, which allows them only to log in and view the final decision results produced by the system. This system design ensures operational flexibility through the Admin’s role while also maintaining fairness and transparency by allowing Leaders to access the final decision outcomes without interfering in the calculation process.

4.3 Result

The system was implemented as a web-based application using PHP for programming and MySQL as the database for data management and storage. The DSS integrates both WP and MOORA methods for decision analysis, as shown in the following subsections.

a. WP Calculation

The Weighted Product method begins with weight normalization:

$Wj = \frac{Wj}{\sum \mathrm{Wj}}$....................

$$W_1 = \frac{15}{15\ +15+35+25+10} = \frac{15}{100} = 0{,}15$$
$$W_2 = \frac{15}{15\ +15+35+25+10} = \frac{15}{100} = 0{,}15$$
$$W_3 = \frac{35}{15\ +15+35+25+10} = \frac{35}{100} = 0{,}35$$
$$W_4 = \frac{25}{15\ +15+35+25+10} = \frac{25}{100} = 0{,}25$$
$$W_5 = \frac{10}{15\ +15+35+25+10} = \frac{10}{100} = 0{,}1$$

After the criteria weights have been corrected, the Vector (S) value is calculated by raising the value of each criterion to the power and multiplying it by the previously corrected weight.

$Si = \prod_{j=1}^{n} X_{ij}^{wj}$..................

$$S1 = (5^{0,15})(5^{0,15})(4^{0,35})(4^{0,25})(4^{0,1}) = 4{,}2769$$

This calculation is continued up to S10 and will get the following results:

Table 3. Vector S Result

Alternative	Vector S Value
A1	4,2769
A2	4,5946
A3	4,2357
A4	4,8897
A5	4,5731
A6	4,6762
A7	4,1949
A8	5,0000
A9	4,0903
A10	4,8897
Total	45,4211

After getting the results of the Vector S, the next step is to determine the vector value (V), namely, dividing the preference of each alternative by the total number of vectors S:

$Vi = \frac{\prod_{j=1}^{n} x_{ij}^{wj}}{\prod_{j=1}^{n} (x_j^{w})^{wj}}$..................

$$V_1 = \frac{4{,}2769}{45{,}4211} = 0{,}0942$$

And continue up to V10 according to the number of existing alternatives. From the results of the Vector V calculation of alternative data A1 to A10, a ranking is made, namely:

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Table 4. WP Ranking Results

Alternative	Vektor V Value	Ranking
A1	0,0942	7
A2	0,1012	5
A3	0,0933	8
A4	0,1077	3
A5	0,1007	6
A6	0,1030	4
A7	0,0924	9
A8	0,1101	1
A9	0,0901	10
A10	0,1077	2

From the calculation of the vector value V, the ranking of alternative data from rank 1 to rank 10 is obtained as follows: A8, A10, A4, A6, A2, A5, A1, A3, A7, A9. These findings demonstrate the ability of WP to produce accurate preference rankings based on multi-criteria analysis, aligning with earlier studies highlighting WP's efficiency in recruitment and selection systems (Vatankhah et al., 2024).

b. MOORA Calculation

Based on the data that has been obtained and given the previous weight value, then in the calculation using the MOORA method several stages are carried out. The first stage is to create a Decision matrix. The decision matrix functions as a performance measurement of alternative I on attribute J.

$$X = \begin{bmatrix} 5 & 5 & 4 & 4 & 4 \\ 5 & 4 & 5 & 5 & 3 \\ 4 & 3 & 5 & 4 & 5 \\ 5 & 5 & 5 & 5 & 4 \\ 4 & 5 & 5 & 4 & 5 \\ 4 & 4 & 5 & 5 & 5 \\ 3 & 3 & 5 & 5 & 4 \\ 5 & 5 & 5 & 5 & 5 \\ 4 & 4 & 4 & 4 & 5 \\ 5 & 5 & 5 & 5 & 4 \end{bmatrix}$$

After obtaining the decision matrix results, the next step is to normalize the matrix.

$$x1,1 = \frac{x1,1}{\sqrt{x^2 1,1 + x^2 2,1 + x^2 3,1 + x^2 4,2 + x^2 5,1 + x^2 6,1 + x^2 7,1 + x^2 8,1 + x^2 9,1 + x^2 10,1}}$$

$$x1,1 = \frac{5}{\sqrt{5^2 + 5^2 + 4^2 + 5^2 + 4^2 + 4^2 + 3^2 + 5^2 + 4^2 + 5^2}}$$

$$x1,1 = \frac{5}{\sqrt{198}} = \frac{5}{14{,}07}$$

$$x1,1 = 0{,}3553$$

The calculation is continued until X10.5. And produces the normalization of the Y matrix, as follows:

$$Y = \begin{bmatrix} 0,3553 & 0,3618 & 0,2626 & 0,2734 & 0,2843 \\ 0,3553 & 0,2894 & 0,3283 & 0,3418 & 0,2132 \\ 0,2843 & 0,2171 & 0,3283 & 0,2734 & 0,3553 \\ 0,3553 & 0,3618 & 0,3283 & 0,3418 & 0,2843 \\ 0,2843 & 0,3618 & 0,3283 & 0,2734 & 0,3553 \\ 0,2843 & 0,2894 & 0,3283 & 0,3418 & 0,3553 \\ 0,2132 & 0,2171 & 0,3283 & 0,3418 & 0,2843 \\ 0,3553 & 0,3618 & 0,3283 & 0,3418 & 0,3553 \\ 0,2843 & 0,2894 & 0,2626 & 0,2734 & 0,3553 \\ 0,3553 & 0,3628 & 0,3283 & 0,3418 & 0,2843 \end{bmatrix}$$

Then the optimization value calculation is carried out on Yi (Max – Min), but because all criteria data are of a benefit nature, the calculation only adds up all normalization values multiplied by the weight, as follows:

$$Y_i = (0,15 \times x_{i,1}) + (0,15 \times x_{i,2}) + (0,35 \times x_{i,3}) + (0,25 \times x_{i,4}) + (0,1 \times x_{i,5})$$

$$Y_1 = (0,15 \times 0,3553) + (0,15 \times 0,3618) + (0,35 \times 0,2626) + (0,25 \times 0,2734) + (0,1 \times 0,2843)$$

$$Y_1 = 0,0533 + 0,0543 + 0,0919 + 0,0684 + 0,0284 = 0,2963$$

Then the calculation is continued to Y10. Thus, the optimization results of Yi are obtained as follows:

Table 5. Yi Value

Alternative	Yi Value
A1	0,2963
A2	0.3184
A3	0.2940
A4	0.3364
A5	0.3157
A6	0.3219
A7	0.2933
A8	0.3435
A9	0.2818
A10	0.3364

Thus, the ranking results are obtained from the MOORA calculation results, namely:

Table 6. MOORA`s Ranking

Alternative	**Yi Value**	**Ranking**
A1	0,2963	7
A2	0.3184	5
A3	0.2940	8

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Alternative	Yi Value	Ranking
A4	0.3364	3
A5	0.3157	6
A6	0.3219	4
A7	0.2933	9
A8	0.3435	1
A9	0.2818	10
A10	0.3364	2

The results (Table 6) show that Fitriono (A8) again ranked first, confirming the consistency of both WP and MOORA in identifying the best candidate. The convergence of results strengthens the reliability of the DSS, consistent with findings from previous research that integrated MOORA for recruitment optimization (Firera & Iskandar, 2022).

c. Web Result

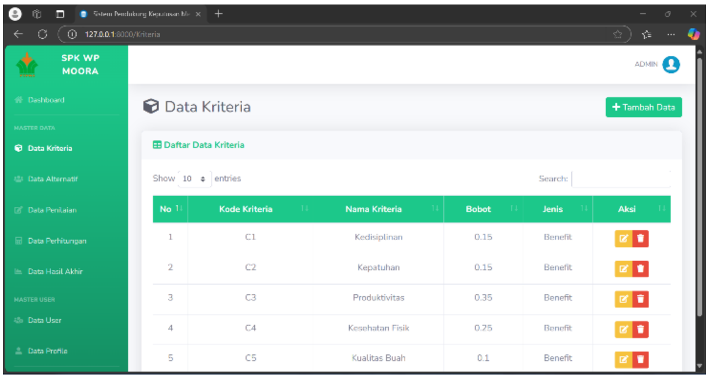

Figure 3. Criteria Data Page

On this page, there are existing criteria data and their weights. This page can only be accessed by the admin, where the admin can input, edit, and also delete data.

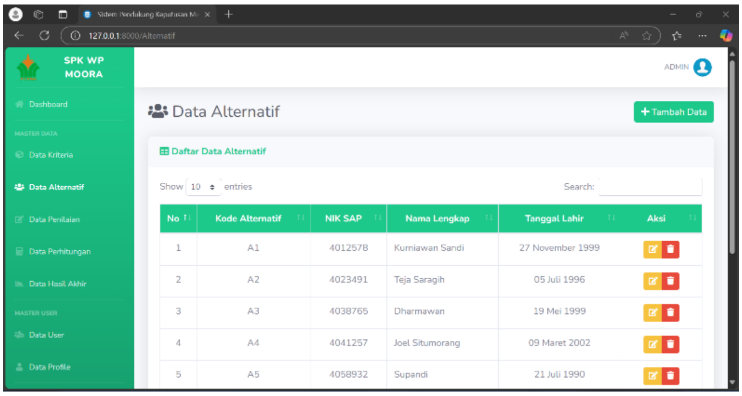

Figure 4. Alternative Data Page

This page will contain data related to alternatives, namely, data from BHL, which will be recruited as permanent employees. This page can also only be accessed by the admin, where the admin can input, edit, and also delete data.

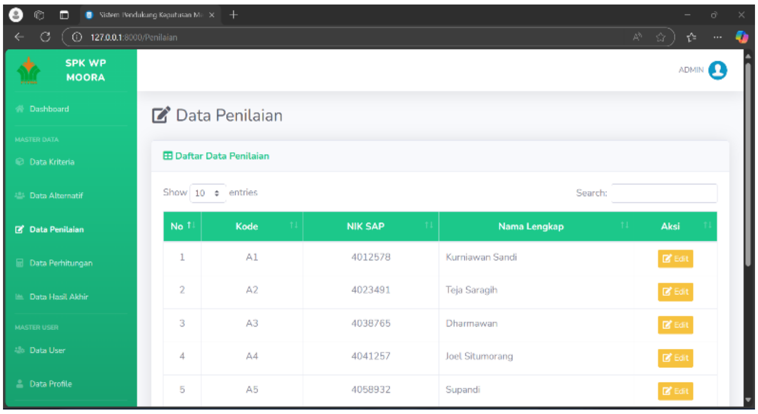

Figure 5. Assessment Data Page

On this page, it will display the assessment data for each alternative, where the admin will input the value for the alternative. On this page, the admin can also edit data if there is an input error.

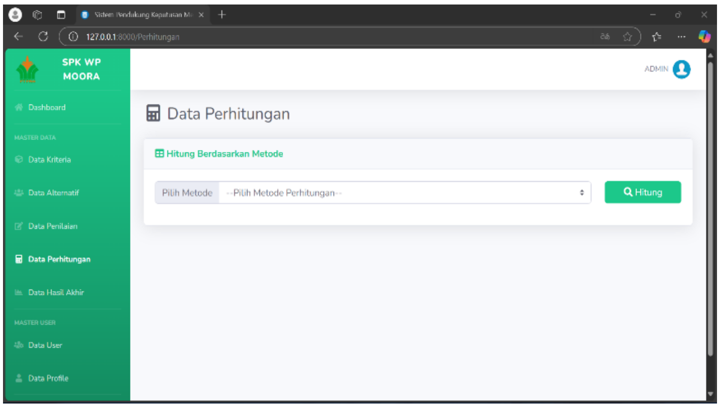

Figure 6. Calculation Page

This page will load the WP and MOORA calculation process, where the admin will choose which method will be processed first, and then the calculation will be processed.

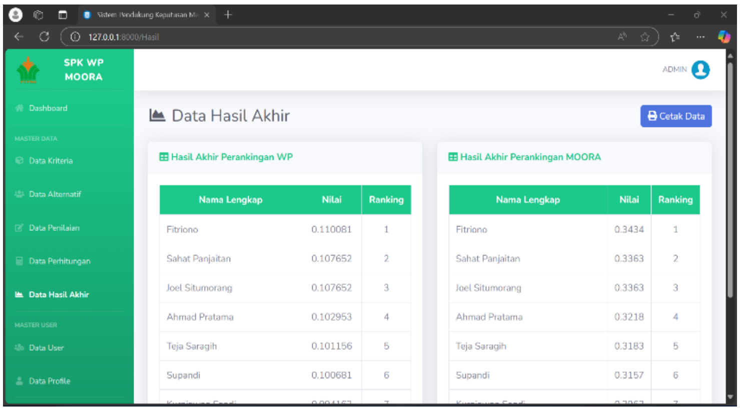

Figure 7. Final Result Page

This page can be accessed by admins and leaders (users), where this page will load the calculation results data for both methods and display the ranking. This modular design ensures usability and transparency. Similar DSS implementations have reported increased efficiency in HR decision-making, especially in industries requiring objective selection processes (Salehzadeh & Ziaeian, 2024).

5. CONCLUSIONS AND SUGGESTIONS

Based on the findings of this study, the integration of the Weighted Product (WP) and Multi-Objective Optimization by Ratio Analysis (MOORA) methods within the decision support system has proven to be an effective approach for assisting the selection of Casual Daily Laborers (BHL) to be promoted as permanent employees at PTPN IV. The combination of these two methods offers a more objective and systematic framework compared to traditional selection processes, which often relied heavily on subjective judgment.

The ranking results demonstrate that candidate performance can be evaluated more transparently through well-defined criteria, namely discipline, compliance, productivity, physical health, and fruit quality. By applying both WP and MOORA, the system provides more accurate identification of the best candidates for promotion, thereby enhancing the reliability of the decision-making process. Similar findings have been reported in prior studies, which confirm that hybrid multi-criteria decision-making methods improve the precision and fairness of recruitment and selection processes.

Beyond improving recruitment efficiency, the implementation of this DSS supports corporate governance by fostering fairness, transparency, and accountability in employee promotion policies. This aligns with broader research in human resource analytics, which emphasizes the value of data-driven decision-making in strengthening organizational performance and employee trust. In conclusion, the WP MOORA-based DSS developed in this study not only addresses the challenges of subjectivity in promotion decisions but also provides a scalable model that can be adapted for use in other labor-intensive industries. By integrating measurable performance indicators with systematic optimization techniques, this research contributes to advancing the role of decision support systems in organizational management and offers practical value for companies aiming to build fairer and more transparent human resource practices.

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