Multi-Criteria Analysis for Selecting Superior Rice Seeds Using SAW-AHP

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Abstract

Rice is the staple food of the Indonesian population, and the quality of rice production largely depends on the selection of superior rice seeds. However, farmers often rely solely on manual observation and personal experience in seed selection, which can lead to crop failures due to suboptimal choices. This research aims to develop and implement a web-based Decision Support System (DSS) to assist farmers in selecting superior rice seeds using the Simple Additive Weighting (SAW) and Analytic Hierarchy Process (AHP) methods. The system evaluates nine criteria across seven seed alternatives, applying a 1–5 scale in SAW and a 1–9 pairwise comparison scale in AHP. The results indicate that HMS 700 ranks first in SAW with a score of 0.85, followed by IF16 at 0.75. In contrast, AHP identifies Inpari 42 as the top alternative with a priority value of 0.176, followed by IF17 at 0.161. The implementation of this system improves decision-making accuracy and contributes to increased agricultural productivity.

***Keywords -** S*uperior Rice Seeds, SAW, AHP, Decision Support System, Multi-Criteria Analysis

1. INTRODUCTION

Rice plants are often found in beautiful villages, displaying colors that range from green to yellowish. For farmers in these villages, planting rice is the most important occupation, as rice is the staple food for the Indonesian people. Rice cultivation usually follows a specific schedule, depending on the season and month. However, in uncertain weather conditions, farmers must be more cautious and wise in choosing the types of crops they will plant[1]. By considering these factors, the consistency in rice planting among farmers can be observed. However, it is not only consistency that matters, as the harvest results also play a significant role. Sufficient land availability provides many opportunities for farmers to cultivate rice, but the common problems they face often stem from the selection of rice seeds that do not meet expectations. Good-quality rice seeds cannot be identified merely by sight or touch; instead, a reliable system or method is needed to ensure the selection of superior seeds. Since farmers are the main actors in the agricultural sector, their attitudes and preferences toward seed varieties are crucial, as they serve both as rice producers and consumers of seed products.[2].

High-quality harvests will certainly have a positive impact on improving people's standard of living. Therefore, in order to achieve harvest results that meet the desired targets, it is necessary to improve the existing system by developing a specialized application and implementing a method that can assist farmers in selecting superior rice seeds before planting. A Decision Support System (DSS) is a model-based system designed to help farmers make better decisions.[3]. Good decision-making will certainly have a positive impact on farmers' activities. According to previous research, the Simple Additive Weighting (SAW) method is used to calculate the total performance value of each alternative across all attributes [4]. The SAW method requires normalizing the decision matrix (X) into a scale that allows comparison among all alternative evaluations. The weighting consists of six fuzzy numbers, namely: very low (SR), low (R), medium (S), moderately high (TI), high (T2), and very high (ST). However, the limitation of this system lies in the relatively small number of criteria, which reduces the accuracy of the decision-making results.

According to previous research [5], six criteria were used in the analysis. This method is capable of producing complex decisions, which are then simplified into a hierarchical structure. Furthermore, by comparing existing factors or criteria, the technique allows for the assessment of both consistency and inconsistency in the evaluations made. The study generated a ranking of rice seed recommendations for Madang Suku 1 District, with MR = 1.855, Inpari 42 = 1.470, Ciherang = 1.119, Inpari 32 = 1.000, and Ciliwung = 0.558. However, the system designed in this research also revealed certain weaknesses, particularly in the criterion related to land selection, as the issue of land conditions had not been adequately addressed.

Previous research emphasizes the need for an environmentally friendly, economically feasible, and adaptive farming system model to achieve sustainable agriculture [6]. This study employed a mixed-method approach, combining qualitative and quantitative techniques, including observation, semi-structured interviews, and structured interviews conducted with 64 respondents. The findings indicate that farmers have abandoned the traditional cyclical planting pattern based on the agricultural calendar, and most local rice varieties have been replaced with Superior Rice Varieties or High-Yielding Varieties (VHT). Consequently, farmers have become dependent on external inputs such as inorganic fertilizers, synthetic fertilizers, modern rice seeds, and fossil energy. Moreover, VHT has been found to be more susceptible to pests and diseases, such as brown planthoppers (*Nilaparvata lugens* Stål), and more vulnerable to water scarcity due to drought caused by climate change. This study highlights the urgency of implementing environmentally friendly, economically viable, and adaptive farming system models to support sustainable agriculture.

The research proposed a new similarity measurement approach using fuzzy sets [7]. Its advantages were evaluated through the preference ordering technique based on the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) to determine the optimal technical parameters for the sowing machine. The experiment enabled the identification of the best results, with the correlation between input attributes and decision variables determined through their correlation coefficients with technical factors. Furthermore, the influence of technical factors on output results was examined to identify those contributing to superior product quality. However, a limitation of this system lies in its evaluation of sowing machine quality, as the results were not presented in graphical form, making it difficult to observe product quality across different months.

The study applied the Simple Additive Weighting (SAW) method, which solves problems through several steps, including determining criteria and assigning weights [8]. The results indicated that the highest ranking was achieved by the Raja Lele rice variety with a total score of 1.00, followed by Cisadane (0.84), IR-64 (0.80), and Mekongga (0.78). Thus, the selection of the best rice seeds fell on Raja Lele. However, a limitation of this study lies in the lack of clarity in the research methodology, particularly regarding system analysis, design, and the explanation of the problem-solving process. The study showed that the most superior rice seed alternative to be planted in Pasapa Village, Budong-Budong District, was Ciliwung, with a score of 0.453 [9]. This was followed by Ciherang (0.434), Inpari 66 (0.429), Inpari 12 (0.426), and Mekongga (0.135). User Acceptance Testing (UAT) yielded a result of 76.5% based on nine questions answered by 36 respondents. Meanwhile, black-box testing demonstrated that the system functioned as intended. However, the design results did not clearly outline the criteria related to the topics discussed, making the discussion outcomes less transparent.

The application of the Promethee method successfully provided recommendations for superior rice seeds [10]. Black-box testing confirmed that the decision support system operated without errors and produced recommendations for high-quality rice seeds that met functional requirements. However, a limitation of the system is that the specific values of the results were not presented in the abstract, making the outcomes less transparent. Decision Support Systems (DSS), when integrated with appropriate computational methods, can assist farmers in making data-driven decisions, particularly in selecting agricultural inputs such as seeds and fertilizers, thereby contributing significantly to the improvement of agricultural productivity.[11]. Methods such as SAW in agricultural contexts have proven effective in helping policymakers and farmers select the best alternatives from various options based on multiple criteria, including disease resistance, yield potential, and land suitability[12]. The SAW method was found to be more effective in assisting farmers in selecting quality rice seedlings based on criteria such as age, leaf color, plant height, and leaf blade characteristics, as it demonstrated a relatively low error rate [13]. In contrast, the decision support system using the TOPSIS method was also able to support the selection of quality rice seedlings; however, it exhibited a higher error rate. Therefore, the weaknesses identified in the system require further refinement by implementing methods with lower error rates. Variety treatment was found to influence several parameters, including the number of tillers at 2, 4, 6, 8, and 10 weeks after planting (WAP), leaf area, root length, plant biomass, number of panicles per hill, and grain weight per hill [14]. The number of tillers at 2–6 WAP and grain weight per hill were also affected by seedling age treatment. The Inpari 3 rice variety demonstrated superior agronomic characteristics and yield performance compared to the Inpari 30 Sub Ciherang variety. Furthermore, seedlings aged 14 days after sowing (DAS) produced better tiller growth compared to those aged 21 DAS, while seedlings aged 21 DAS resulted in higher yields compared to 14 DAS. However, a limitation of the system is that if the floating system is unstable or poorly designed, the plants may still experience stress. Sucrose serves not only as a means of carbohydrate transport in plants but also functions as a signaling molecule in addition to being a nutrient [15]. However, its signaling mechanism remains poorly understood. In this study, neutral invertase 8 (OsNIN8) was mutated at G461R to OsNIN8m, which increased its charge and hydrophobicity, reduced sucrose hydrolysis by 13%, and enhanced sucrose binding compared to the wild type. A limitation of this system is the absence of evidence regarding its long-term agronomic and physiological impacts. Several strategies are applied in planting methods [16]. The mechanical transplanting method (MT) increases yields and provides environmental benefits by reducing nitrogen fertilizer use by 16% while increasing seed input by 9%. The mechanical direct seeding method (MD) reduces nitrogen fertilizer and seed input by 10–12%, whereas the manual transplanting method (MAT) increases N-K fertilizer and seed input by 15–33%. However, a limitation of this system is that not all farmers are able to access the required tools due to financial constraints.

The findings showed that, compared to main crops, insect pest management is less economically significant [17]. Protecting ratoon crops from root and stem damage during the main harvest period provided little to no benefit for ratoon crop production. Moreover, the overall benefits of insect pest control on ratoon crops remain uncertain. A limitation of the pest control strategy is that it only offers short-term impacts and does not provide sustained protection for ratoon growth. Conservation Agriculture (CA) practices support sustainable and climate-resilient agriculture by increasing land and water productivity, enhancing food security, and improving agricultural profitability [18]. Despite these benefits and growing government support, CA adoption in South Asia remains limited. To overcome barriers and enhance adoption in rice–wheat (R-W) systems, an effective support system is essential, including integrated weed management, financial incentives, and the dissemination of technical knowledge. In addition, special assistance is required to ensure the correct implementation of CA practices by farmers. However, a limitation of the system is the lack of sufficient targeted support to guide farmers in the proper application of CA.

The study produced calculation results showing identical values for Mr. Narso and Mr. Joko, leading to a rice seed selection recommendation system that can assist farmers in choosing the appropriate rice seeds using the Collaborative Filtering method [19]. However, a limitation of this system lies in the relatively small amount of data, which affects the validity and reliability of the results. The implementation of a web-based decision support system using AHP and SAW calculations showed that A3 reached 0.798 in the web system and 0.799 in manual calculations, resulting in only a 1% difference [20]. Based on these results, the system achieved an accuracy level of 99% and was capable of handling 10 alternatives. Among them, Tarabas rice seeds, with a score of 0.933, were identified as the best option. Furthermore, black-box testing of 21 features demonstrated that the system functioned correctly. However, a limitation of this system is the relatively small number of alternatives, which restricts farmers' options in selecting superior rice seeds. Based on previous studies and their identified limitations, this research aims to design and implement a Decision Support System (DSS) using the Simple Additive Weighting (SAW) and Analytic Hierarchy Process (AHP) methods with nine criteria and seven alternatives. The objective of this study is to assist farmers in Pasar V Kebun Kelapa Village, Beringin District, Deli Serdang Regency, in selecting superior rice seeds. The SAW method is applied using a scale of 1–5, while the AHP method employs a scale of 1–9.

2. RESEARCH METHODS

This research employs a quantitative approach through calculations involving criteria and alternative variables, utilizing the SAW and AHP methods. The study was conducted by collecting data directly from Pasar V Kebun Kelapa Village, Beringin District, Deli Serdang Regency. Data collection included direct field observations of farmers' land/rice fields and interviews with Mr. Muktar, one of the local rice farmers. Through these interviews, several insights were obtained regarding obstacles that often lead to crop failure, as well as the characteristics of superior rice seeds, both in terms of strengths and weaknesses. In addition to primary data, this study also used secondary data derived from books, journals, e-books, and other references to support the analysis. The research was carried out in several stages, including:

1. Research Design

This study employs a quantitative descriptive research design to analyze and determine the selection of superior rice seeds based on specific criteria. The design integrates the Decision Support System (DSS) approach using the Simple Additive Weighting (SAW) and Analytic Hierarchy Process (AHP) methods to compare results and provide more accurate decision-making recommendations. The use of a quantitative descriptive design is appropriate because it enables systematic numerical calculations, rankings, and comparisons of alternatives.

2. Sources of Data

The data sources used in this study consist of:
Primary Data: obtained from field observations and interviews with rice farmers in Pasar V Kebun Kelapa Village, Beringin District, Deli Serdang Regency. The interviews focused on the process of selecting superior rice seeds, the obstacles encountered in the selection process, and rice cultivation practices associated with the use of superior rice seeds.
Secondary Data: obtained from references such as books, journals, and previous studies that discuss Decision Support Systems, the SAW and AHP methods, as well as theories related to rice cultivation and the selection of superior rice seeds.

3. Research Procedure

The research procedure was carried out in the following stages:

1. Problem Identification
   Identify the problems faced by farmers, particularly crop failures caused by the use of inappropriate rice seeds.
2. Research Design Development
   After identifying the problems, a research design was developed using a quantitative approach with a Decision Support System (DSS) framework based on the AHP and SAW methods.
3. Criteria and Alternatives Determination
   Determine nine criteria and seven alternatives for superior rice seeds, obtained through interviews with farmers and supported by literature reviews.
4. Data Collection
   Collect data through direct field observations and interviews with farmers regarding the characteristics and selection of superior rice seeds.
5. Data Analysis

Analyze the data using the Simple Additive Weighting (SAW) and Analytic Hierarchy Process (AHP) methods to calculate, normalize, and rank alternatives based on the established criteria.

6. System Design and Implementation
   Design and implement a web-based Decision Support System (DSS) application using PHP and MySQL to perform calculations and present recommendation results to users.
7. System Testing
   Conduct black-box testing to verify system functionality and user testing involving farmers to evaluate the usability and benefits of the system.
8. Evaluation and Maintenance
   Evaluate the system interface and periodically update the data to ensure accuracy and sustainability in decision-making.

4. Stages of Implementation

The stages of implementation in this research are as follows:

1. Stage 1: Preparation – Determining the research topic, formulating the problem, setting the objectives, and preparing interview questions.
2. Stage 2: Literature Review – Analyzing relevant references such as journals, books, and e- books to serve as the theoretical foundation and to support the completion of the research report.
3. Stage 3: System Design – Designing the system using quantitative methods.
4. Stage 4: System Development – Developing a web-based Decision Support System (DSS) application using the SAW and AHP algorithms, implemented with PHP and MySQL.
5. Stage 5: System Testing – Validating the system output by comparing manual calculation results with those produced by the application.
6. Stage 6: Implementation – Deploying the application for use by farmers in Pasar V Kebun Kelapa Village, Beringin District, Deli Serdang Regency.
7. Stage 7: Maintenance – Periodically updating the database and improving features based on user feedback to ensure continuous system enhancement.

2.1. Decision Support System

Decision Support Systems (DSS) were first developed by Michael S. Scott Morton in the 1970s. DSS are interactive, computer-based information systems designed to assist decision-makers in solving unstructured problems by utilizing models and data. These computer-based systems have the capability to support decision-making, identify and correct data errors, and generate alternative solutions [21]. An interactive system is designed and developed to support the decision-making process by providing alternatives generated through model design, data processing, and information analysis. This system offers decision-makers the best recommendations or options by supplying necessary information derived from well-processed data, enabling problems to be addressed more quickly and accurately [22].

2.2. SPK Components

The Decision Support System consists of three subsystem components: data management, model management, and dialogue management, as illustrated in Figure 1. As shown in Figure 1, the three main components of a Decision Support System (DSS) are data management, model management, and dialogue management. These components interact with one another, with data serving as the primary input for both the model and the user. The model processes the data and returns the analysis results to the data management component for storage or display to the user. This interaction ensures that decisions are made based on information that has been accurately and properly processed.

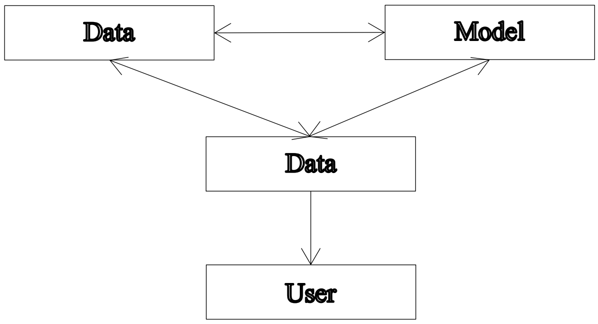

Figure 1. Relationship among the Three Elements

2.3. *Metode Simple Additive Weighting (SAW)*

In the SAW method, the decision-maker must assign a value to each attribute. The total score for each alternative is calculated by summing the products of the attribute values and their corresponding weights. Prior to this calculation, the SAW method requires a normalization process to ensure that the ranking of each attribute is dimensionless.

$$Rij = \begin{cases} \dfrac{Xy}{Max\ XY} & \text{if j is a profit attribute (\textit{benefit})} \quad (1) \\[2ex] \dfrac{Min\ Xy}{Xy} & \text{If j is a cost attribute (\textit{cost})} \quad (2) \end{cases}$$

Information :

rij = Normalization effectiveness assessment
xij = vertical and horizontal units of each matrix
Max xij = the largest size in each row and column
Min xij = smallest size in each row and column
Benefit = the criteria with the higher value, the better.
Cost = the smaller the value of the criteria, the better.

where rij is the normalized performance assessment of alternative Ai on attribute Cj; i=1,2,..,m and j=1,2,...,n. The preference value (the most important) for each alternative (Vi) is given as follows:

$$Vi = \sum_{j=1}^{n} Wjrij \quad (3)$$

Information:
Vi = Final preference score for each alternative
Wj = Weight of criterion j
rij = Normalized performance value of alternative i for criterion j

A higher Vi value indicates that the choice Ai is more popular. For the Simple Additive Weighting (SAW) solution, the solution procedure is:

1. Determine what criteria will be used as a reference in decision making, after creating a matrix based on the criteria (C1, C2, C3,…, Cn), then normalize the matrix R

R= r11 r12 r1n
.
.
rm1 rm2 rmn (4)

2. Determine the suitability rating of each alternative for each criterion and assign a preference weight (W)

3. The final result is obtained from the ranking process, namely the sum of the multiplication of the normalized matrix R with the preference weight vector, so that the largest value is obtained which is selected as the best alternative Ai for the solution.

2.4. Metode AHP (Analytic Hierarchy Process)

The Analytic Hierarchy Process (AHP), developed by Thomas L. Saaty, is a functional hierarchical model that primarily relies on human judgment as input. AHP is a method for solving multi-criteria problems within the Multi-Attribute Decision Making (MADM) framework. Complex or unstructured problems are decomposed into sub-problems and then organized into a hierarchical structure. The AHP method can address problems involving multiple criteria by comparing the preferences of each element within the hierarchy. Specifically, AHP is suitable for prioritization or alternative selection problems that exhibit the following characteristics [23]:
1. Includes qualitative criteria that are difficult to quantify precisely.
2. Each criterion may have sub-criteria, which can be organized into a hierarchical structure.
3. Assessments can be conducted by one or more decision-makers simultaneously.
4. There is a limitation on the number of available alternative choices.

In general, the Analytical Hierarchy Process (AHP) method consists of the following steps:

1. Sum the values of each column in the matrix.

2. Divide each value in a column by the column total to normalize the matrix.

$$\sum_{i=1}^{n} a_{ij} = 1 \qquad (5)$$

Where :
a : pairwise comparison matrix
i : row in matrix a
j : column in matrix a

3. Add up the values of each matrix and divide by the number of elements to get the average value.

$$w_i = \frac{1}{n}\sum_{j=1}^{n} a_{ij} \qquad (6)$$

Where:
a_{ij} : Normalized matrix element values
n : Number of criteria (matrix size)
wi : Weight or priority vector for criterion i

4. CI (Consistency Index) is obtained by the formula:

$$\text{CI} = \frac{\lambda\, max - n}{n - 1} \qquad (7)$$

Where :
λ max : is the principal eigenvalue derived from the pairwise comparison matrix
n : Number of criteria (matrix size).

3. RESULT AND DISCUSSION

The results and discussion at this stage will explain the comparison between the quantitative calculations of the SAW and AHP methods where the discussion begins with the calculation of the SAW method and continues with the AHP method. After the results are obtained between the two methods, a comparison of the values of the alternatives that are a priority will be carried out to determine superior rice seeds for food productivity.

3.1. SAW Method

The following is the SAW method calculation :

a. Determine criteria

The discussion of the research consists of 9 criteria which can be seen in the following table:

Table 1. Criteria table

No	Criteria	Criteria Name
1.	C1	Certified seeds (seed origin)
2.	C2	Healthy and undamaged seeds
3.	C3	Viability
4.	C4	Resistant to disease or pests
5.	C5	Shorter harvest time
6.	C6	Increased harvest quantity
7.	C7	Soil type
8.	C8	Altitude
9.	C9	Rainfall pattern

Table 1. presents the nine criteria for selecting superior rice seeds used in this study.

Table 2. Alternative

No	Alternative	Alternative Name
1.	A1	HMS 700
2.	A2	IF16
3.	A3	IF17
4.	A4	IF18
5.	A5	Inpari 42
6.	A6	Inpari 32
7.	A7	Bima Sakti

Table 2. presents the alternatives for selecting superior rice seeds as a solution to the problems discussed

b. Normalized performance matrix

$$R = \begin{matrix} 1 & 1 & 0.2 & 0.5 & 1 & 0.75 & 1 & 0.8 & 1 \\ 1 & 1 & 0.2 & 1 & 0.8 & 0.25 & 1 & 0.4 & 0.4 \\ 0.4 & 1 & 0.8 & 0.75 & 0.2 & 0.75 & 0.6 & 0.4 & 1 \\ 0.2 & 0.75 & 0.4 & 0.25 & 0.8 & 0.5 & 0.8 & 0.2 & 1 \\ 0.2 & 0.25 & 1 & 0.75 & 0.8 & 0.25 & 0.2 & 0.6 & 0.8 \\ 0.8 & 0.25 & 0.4 & 0.75 & 0.6 & 1 & 0.2 & 1 & 0.4 \\ 0.4 & 0.25 & 0.2 & 0.5 & 1 & 0.75 & 0.8 & 1 & 0.4 \end{matrix}$$

Figure 2. Normalized performance matrix

Figure 2 shows the results of normalizing the alternative values for each criterion

c. Performing the Ranking Process

The following is the calculation of Calculating the preference weight value for each alternative (Vi) :

V_1=((1*0.2)+(1*0.12)+(0.2*0.08)+(0.5*0.1)+(1*0.1)+(0.75*0.08)+(1*0.15)+(0.8*0.07)+(1*0.1))
= (0.2+0.12+0.016+0.05+0.1+0.06+0.15+0.056+0.1) = 0.852 = 0.85
V2=((1*0.2)+(1*0.12)+(0.2*0.08)+(1*0.1)+(0.8*0.1)+(0.25*0.08)+(1*0.15)+(0.4*0.07)+(0.4*0.1))
=(0.2+0.12+0.016+0.1+0.08+0.02+0.15+0.028+0.04) = 0.754 = 0.75
V_3=((0.4*0.2)+(1*0.12)+(0.8*0.08)+(0.75*0.1)+(0.2*0.1)+(0.75*0.08)+(0.6*0.15)+(0.4*0.07)+(1*0.1))
=(0.08+0.12+0.064+0.075+0.02+0.06+0.06+0.028+0.1) = 0.607 = 0.61
V_4=((0.2*0.2)+(0.75*0.12)+(0.4*0.08)+(0.25*0.1)+(0.8*0.1)+(0.5*0.08)+(0.8*0.15)+(0.2*0.07)+(1*0.1))=(0.04+0.09+0.032+0.025+0.08+0.04+0.12+0.014+0.1) = 0.541 = 0.54
V_5=((0.2*0.2)+(0.25*0.12)+(1*0.08)+(0.75*0.1)+(0.8*0.1)+(0.25*0.08)+(0.2*0.15)+(0.6*0.07)+(0.8*0.1)) =(0.04+0.03+0.08+0.075+.0.08+0.02+0.03+0.042+0.08) = 0.477 = 0.48
V_6=((0.8*0.2)+(0.25*0.12)+(0.4*0.08)+(0.75*0.1)+(0.6*0.1)+(1*0.08)+(0.2*0.15)+(1*0.07)+(0.4*0.1))
=(0.16+0.03+0.032+0.075+0.06+0.08+0.03+0.07+0.04) = 0.577 = 0.58
V_7=((0.4*0.2)+(0.25*0.12)+(0.2*0.08)+(0.5*0.1)+(1*0.1)+(0.75*0.08)+(0.8*0.15)+(1*0.07)+(0.4*0.1))
=(0.08+0.03+0.016+0.05+0.1+0.06+0.12+0.07+0.04) = 0.566 = 0.57

From the calculation results above, it can be concluded that the best superior rice seeds are HMS 700 superior seeds with a value of 0.85.

3.2. AHP Method

The steps in calculating the AHP method are as follows:

a. Pairwise comparison matrix

Table 3. Pairwise Comparison Matrix

Criteria	Certified seeds (seed origin)	Healthy and undamaged seeds	Viability	Resistant to disease or pests	Shorter harvest time	Increased harvest quantity	Soil type	Altitude	Rainfall pattern
Certified seeds (seed origin)	1	2	3	3	4	5	3	5	6
Healthy and undamaged seeds	0,5	1	2	2	3	4	2	4	5
Viability	0,333	0,5	1	1	2	3	1	3	4
Resistant to disease or pests	0,333	0,5	1	1	2	3	1	3	4
Shorter harvest time	0,25	0,333	0,5	0,5	1	2	1	2	3

.

Increased harvest quantity	0,2	0,25	0,333	0,333	0,5	1	0,5	1	2
Soil type	0,333	0,5	1	1	1	2	1	2	3
Altitude	0,2	0,25	0,333	0,333	0,5	1	0,5	1	2
Rainfall pattern	0,167	0,2	0,25	0,25	0,333	0,5	0,33	0,5	1
	3	6	9	9	14	22	10	22	30

In table 3 Pairwise Comparison Matrix is used in the AHP method to calculate the priority weight of the criteria.

b. Calculating Alternative CI Consistency Values

Determine whether the comparison matrix (of alternatives or criteria) is consistent enough to be used in decision making.

Table 4. Calculating Alternative CI

Amount	**83,33854453**
Criteria	9
Lamda Max	9,259838281
CI	0,0324797
CR	0,022399851

Because the CR value <= 0.1 then the calculation is consistent.

c. Ranking

Based on the results of the preference calculations in the table above, the alternative superior rice seeds are in order:

Table 5. Results

Alternative Name	**Results**
Inpari 42	0,176385
IF17	0,161076
Inpari 32	0,148168
IF16	0,145467
HMS 700	0,136663
Bima Sakti	0,119897
IF 18	0,112344

Based on the results of the preference calculations in the table above, the best alternatives are Inpari 42 with a value of 0.176.

3.3. Comparison Results of SAW and AHP Methods

The comparison results can be seen in table 6 as follows.

Table 6. Comparison Results

Comparison			
Number	**Alternative Name**	**SAW**	**AHP**
1.	HMS 700	1	3
2.	Inpari 42	5	1

3.	IF17	3	2
4.	IF16	2	4
5.	IF18	4	7
6.	Inpari 32	6	6
7.	Bima Sakti	7	5

HMS 700 is the best alternative according to the SAW method but ranks only third according to AHP. Inpari 42 ranks first in AHP but only fifth in SAW. IF17 consistently achieves high rankings in both methods (third in SAW and second in AHP). IF18 ranks low in AHP (seventh) but performs relatively well in SAW (fourth). Inpari 32 and Bima Sakti are relatively consistent in occupying the lower rankings in both methods. The SAW method places greater emphasis on the total value of all criteria, whereas AHP considers the hierarchical structure and consistency among the criteria.

3.4. *Implementation results*

3.4.1. Dashboard

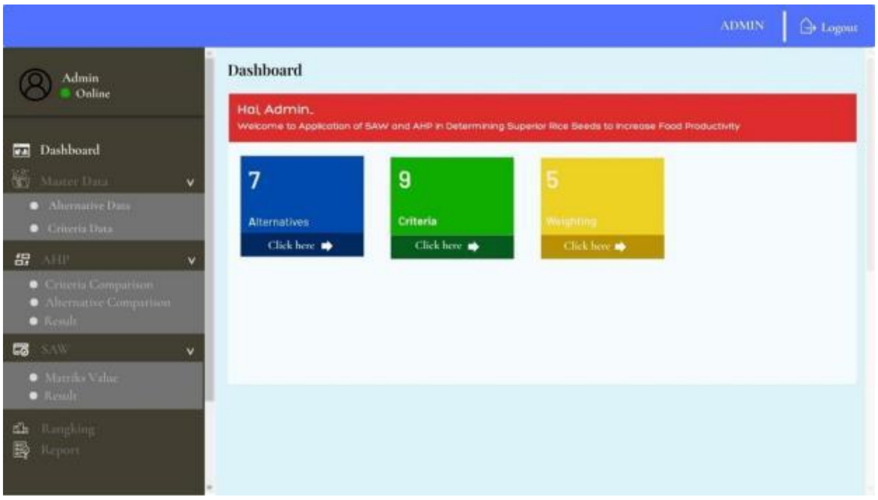

Figure 3. Dashboard

Figure 3 shows the admin dashboard of the decision support system. The dashboard displays information on the number of alternatives, the number of criteria, and the number of weightings entered. The navigation menu on the dashboard allows the admin to easily access each system feature.

3.4.2. Criteria Data View

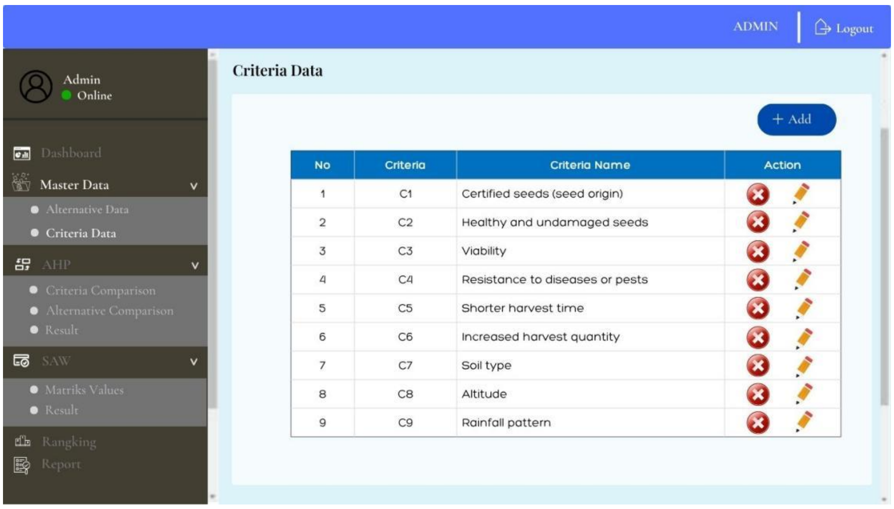

Figure 4. Criteria Data View

Figure 4 shows the criteria data table in the decision support system for selecting superior rice seeds. The table contains the criteria codes, criteria names, and action features for editing or deleting the data. These data serve as the basis for scoring in the weighting process and for calculating the best alternative.

3.4.3. Result View

Figure 5. Result View

Figure 5 shows the calculation results table from the SAW or AHP method used in the system. The table contains the names of alternative seeds, calculation results, and rankings based on the highest scores. These results help determine the most optimal superior rice seeds to improve food productivity

4. CONCLUSION

This study concludes that the Decision Support System developed using the Simple Additive Weighting (SAW) and Analytic Hierarchy Process (AHP) methods is effective for selecting superior rice seeds based on multiple criteria. According to the SAW method, HMS 700 achieved the highest final score of 0.85, while the AHP method identified Inpari 42 as the top-ranked alternative with a priority value of 0.176. The analysis shows that IF16 and IF17 consistently rank high in both methods, making them strong overall candidates, whereas IF18 and Inpari 32 show variability between the two approaches. This difference highlights that SAW emphasizes the total weighted value, while AHP incorporates pairwise comparisons and consistency across criteria. Furthermore, the system has been successfully implemented as a web-based application, enabling farmers to access it easily and make informed, data-driven decisions regarding the selection of superior rice seeds. This contributes to improved food productivity and better agricultural yields. For future improvements, it is recommended that the system be expanded by integrating additional criteria and alternatives, thereby enhancing its accuracy and applicability to a broader agricultural context.

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