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Design and Build a Decision Support System for Assessing the Feasibility of Weather Conditions to Support the Implementation of Oil Palm Harvesting Using the Simple Additive Weighting (SAW) Method

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Abstract

Weather conditions play an important role in supporting the effectiveness and safety of oil palm harvesting activities. However, weather feasibility assessment is often conducted manually and subjectively, which may result in inconsistent decision-making. This study aims to design and develop a web-based Decision Support System (DSS) for assessing weather conditions to support oil palm harvesting using the Simple Additive Weighting (SAW) method. The research employed field research and a Prototype development model. Weather data were obtained from the Meteorology, Climatology, and Geophysical Agency (BMKG), while system requirements were identified through observation and literature studies. The assessment involved four criteria: rainfall, average temperature, humidity, and solar radiation intensity. Each criterion was converted into a rating scale and processed through the SAW stages, including decision matrix formation, normalization, weighting, preference value calculation, and ranking. The results indicate that the developed system can generate a structured ranking of weather conditions based on their feasibility for harvesting activities. The system also provides weather data management, criteria management, automated SAW calculations, recommendations, and ranking results. Black-box testing showed that the main system functions operated according to the specified requirements. Therefore, the proposed DSS can support faster, more objective, and systematic decision-making in oil palm harvesting activities.

Keywords:
Decision Support System; Simple Additive Weighting; Weather Conditions; Oil Palm Harvesting; Prototype.

1. INTRODUCTION

Indonesia is an agrarian country with great natural resource potential, especially in the plantation sector. One of the leading commodities that has a strategic role in the national economy is palm oil (Elaeis guineensis), which is the world's main source of vegetable oil as well as the largest contributor of foreign exchange to the country in the agricultural sector. Based on Agency data According to the Center for Statistics (BPS, 2024), Indonesia is listed as the largest palm oil producer in the world with an export volume of more than 48 million tons per year. This commodity not only contributes significantly to the Gross Domestic Product (GDP) of the agricultural sector, but also becomes a source of livelihood for millions of workers in rural areas. Oil palm plantations are spread across various tropical regions of Indonesia, especially on the islands of Sumatra, Kalimantan, Sulawesi, and Papua. A tropical climate with an average temperature of 25–28°C, high rainfall, and stable humidity make Indonesia an ideal location for the growth of oil palm plants (Wandana et al., 2024). However, unpredictable weather changes and increasing extreme weather events are challenges in the management of oil palm plantations. These conditions not only affect plant growth, but also have a direct impact on the smooth implementation of harvesting (Badrul Mundir et al., 2024).

The implementation of harvesting is one of the important stages in oil palm plantation management because it affects the quality of fresh fruit bunches (FFB) and operational efficiency (Idiatsyah et al., 2024). Harvesting activities require supportive conditions so that the process of cutting, collecting, and transporting crops can be carried out optimally (Faridha et al., 2024). Therefore, a weather feasibility assessment before harvesting is an important aspect in supporting the smooth running of harvest activities.

Weather is a crucial factor in determining the success of palm oil production. Extreme climate changes such as excessive rainfall, high temperatures, and long droughts can affect plant physiological processes and reduce the quality of fresh fruit bunches (FFB). The BPDPKS report (2024) states that extreme weather anomalies can cause a decrease in production of up to 15–20% per year. Therefore, a mechanism for determining the best weather conditions objectively and based on data is needed to keep the production process stable and efficient. An information systems-based approach and decision analysis can be a solution to support this process (Hidayati et al., 2020).

The development of a web-based Decision Support System provides convenience in data processing, information presentation, and supports the decision-making process more effectively and efficiently (Rizkyawan, 2024). This system utilizes weather data obtained from the Meteorology, Climatology, and Geophysics Agency (BMKG) as a basis for assessing the feasibility of weather conditions to support the implementation of oil palm harvesting. Through the application of the Simple Additive Weighting (SAW) method, the system is expected to be able to produce an objective assessment based on predetermined criteria so that it can help users in determining the harvest implementation time more precisely (Taufiq et al. 2021).

This research focuses on the design of a Decision Support System to assess the feasibility of weather conditions in supporting the implementation of oil palm harvesting using the Simple Additive Weighting (SAW) method (Akmal et al., 2018). The developed system is expected to assist users in assessing weather conditions objectively based on predetermined criteria so that they can support decision-making related to harvest implementation. With this system, the process of determining the timing of harvesting is expected to be carried out more effectively, efficiently, and data-based, thereby supporting the smooth running of harvesting activities and improving the quality of decision-making in the oil palm plantation environment (Tarwaca, 2015).

Based on the description in the background, the main problem in this study is the lack of a system that is able to conduct an objective and measurable assessment of the feasibility of weather conditions to support the implementation of oil palm harvesting. Assessment of weather conditions is still largely carried out based on observations and experiences in the field, so the resulting decisions tend to be subjective and have the potential to cause inaccuracies in determining the timing of harvest implementation. This condition shows the need for a computer-based Decision Support System (SPK) that is able to process weather data based on predetermined criteria, such as rainfall, air temperature, air humidity, and solar radiation intensity. By applying the Simple Additive Weighting (SAW) method, the system is expected to provide an objective assessment of the feasibility of weather conditions as a basis for supporting decision-making on the implementation of oil palm harvesting.

2. RESEARCH METHOD

The research stages in the development of this decision support system are systematically arranged to ensure that the process carried out is directed, clear, and in accordance with the research objectives. All stages are arranged sequentially so that the research has a logical workflow, starting from the process of identifying problems in the field, data collection, needs analysis, to designing, implementing, and testing the system. By following this stage, it is hoped that the results of the research can produce a decision support system that is able to assist plantations in determining weather suitability more effectively, objectively, and measurably using the web-based SAW method.

The research was carried out in the time range from January to May 2026, which included all stages from preparation, data collection, system development, to testing. This research was conducted in a group of 80 farmers in West Pasaman district, West Sumatra Province. This location was chosen because it has the availability of relevant data and adequate access to conduct observations and interviews with related parties.

The dataset used in this study comes from climatological data published by BMKG, data from field observations in plantation areas, and several scientific literatures that supports the determination of the best weather criteria. The data source was chosen to ensure that the information used was accurate, relevant, and in accordance with the analytical needs of the Simple Additive Weighting (SAW) method (Dewi & Indahyanti, 2021).

This research uses a field research approach and a Prototype system development method. Field research was conducted to obtain information about the implementation process of oil palm harvesting, user needs, and data needed in the development of the system. Weather data was obtained from the Meteorology, Climatology, and Geophysics Agency (BMKG), while the needs of the system were obtained through observation and literature studies related to the implementation of oil palm harvesting (Elistri et al., 2014).

This study developed a web-based Decision Support System (SPK) using the Simple Additive Weighting (SAW) method to assess the feasibility of weather conditions based on predetermined criteria. This approach is used because there is no system that is able to assess weather conditions objectively, systematically, and measurably to support the implementation of oil palm harvesting.

The development of the system uses the Prototype model chosen because the research is oriented towards the design of the system. The stages include gathering requirements, making an initial prototype, evaluating users, repairing prototypes, developing the final system, and testing the system. Evaluation and improvement are carried out based on user input so that the developed system is in accordance with the needs and conditions of the field.

The combination of field research and the Prototype model produces a web-based decision support system that is expected to be able to meet functional needs and provide objective and measurable recommendations for the feasibility of weather conditions to support oil palm harvesting operations.

The system analysis was carried out to identify the current system conditions, user needs, problems faced, and solutions needed in assessing the feasibility of weather conditions to support the implementation of oil palm harvesting. In the ongoing process, weather data including rainfall, air temperature, air humidity, and solar radiation intensity were obtained from the Meteorology, Climatology, and Geophysics Agency (BMKG). The data is still used as a consideration manually without a structured weighting and assessment process, so the resulting decisions still depend on user consideration.

To overcome these problems, the proposed system applies the Simple Additive Weighting (SAW) method as a multi-criteria decision-making method. Weather data is processed based on predetermined criteria and given weight according to its level of importance. Furthermore, a normalization process and the calculation of preference values are carried out to produce the feasibility level of weather conditions. The results are used as recommendations to support decision-making in the implementation of oil palm harvest.

The developed system produces information in the form of preference values for each alternative weather condition, the results of normalization of each criterion, and the level of feasibility such as Feasible, Moderately Feasible, or Not Feasible. In addition, the system provides weather condition ranking information and data recapitulation reports along with the results of their assessments so that they can help users evaluate and make decisions based on data.

The results of the analysis of the current system show several problems, namely the assessment process is still subjective, there is no uniform weather condition assessment standard, manual data processing takes time and has the potential to cause errors, and there is no ranking mechanism to determine the most suitable alternative weather conditions. Long-term data management is also not optimal, making it difficult to document and analyze previous weather data.

Based on these problems, the system developed requires a number of main functions, including managing weather data, managing criteria and weights, automatically calculating SAW, presenting recommendations and rankings, and making reports. The system is also equipped with user management through a login and logout mechanism. From the non-functional side, the system is designed with performance, security, ease of use, reliability, and compatibility in mind so that it can be used stably and easily through available devices.

The problem-solving strategy in this study is prepared to ensure that the feasibility assessment process of weather conditions in supporting the implementation of oil palm harvest can be carried out objectively, systematically, and measurably. The approach used aims to overcome obstacles in the assessment process that has been carried out manually, so that it has the potential to cause decisions that are subjective, less consistent, and require a relatively longer time (Maimunah M.K., 2022).

Therefore, the problem-solving strategy is focused on the development of a web-based Decision Support System (SPK) by applying the Simple Additive Weighting (SAW) method. The SAW method is used to process weather data based on predetermined criteria, namely rainfall, air temperature, air humidity, and solar irradiation intensity. The results of the calculation of the SAW method in the form of preference values are used as a basis for assessing the feasibility level of weather conditions, so that the system can provide recommendations that support decision-making in the implementation of oil palm harvesting in a more objective, effective, and measurable manner (Siregar et al., 2025).

The research design is prepared to provide a systematic overview of the stages carried out during the research process, starting from data collection, system needs analysis, system design, implementation, to system testing. The design of this research aims to ensure that the process of developing Decision Support Systems can be carried out in a targeted manner in accordance with the research objectives, namely building a system that is able to assess the feasibility of weather conditions to support the implementation of oil palm harvesting using the Simple Additive Weighting (SAW) method.

At the system design stage, this study uses Unified Modeling Language (UML) as a tool to model system needs and work processes. UML is used to describe the structure, behavior, and interaction between system components to facilitate the process of analysis, design, and implementation of applications (Al-fedaghi, 2021).

3. RESULTS AND DISCUSSION

3.1. Weather Alternative Data

Alternative data is a set of weather condition data that is used as an assessment object in the Decision Support System to determine the level of feasibility of weather conditions in supporting the implementation of oil palm harvesting. In this study, the alternative used was in the form of daily weather condition data during the period from March 1, 2026 to March 30, 2026. Each observation date is treated as an alternative because it has different characteristics of weather conditions. Each alternative was assessed based on four criteria, namely rainfall, average temperature, air humidity, and sunlight intensity. Furthermore, the data was processed using the Simple Additive Weighting (SAW) method to obtain preference values and ratings of the feasibility level of weather conditions. The results of the assessment are recommendations for users in considering the most suitable weather conditions to support the implementation of oil palm harvesting.

Table 1. Weather Data

Date	Namely Rainfall (mm)	Average Temperature (°C)	Air Humidity (%)	Sunlight Intensity (Hours)
01-03-2026	0,0	27,7	69	6,4
02-03-2026	0,0	27,1	70	6,5
03-03-2026	0,0	28,0	72	6,8
04-03-2026	0,0	28,6	74	7,5
05-03-2026	8,4	27,8	78	4,7
06-03-2026	0,4	27,1	82	3,8
07-03-2026	5,0	27,9	76	1,6
08-03-2026	0,0	28,7	78	6,7
09-03-2026	37,5	27,3	84	6,7
10-03-2026	3,3	27,6	81	3,7
11-03-2026	0,2	28,0	78	5,9
12-03-2026	5,4	27,6	80	8,0
13-03-2026	0,0	28,0	79	8,0
14-03-2026	7,2	27,8	78	8,0
15-03-2026	2,1	27,5	78	4,1
16-03-2026	0,0	27,6	80	7,4
17-03-2026	31,1	28,1	79	6,0
18-03-2026	1,0	28,2	74	6,8
19-03-2026	0,0	28,8	76	8,0
20-03-2026	0,2	28,1	77	5,0
21-03-2026	0,0	28,1	79	8,0
22-03-2026	0,5	28,4	79	1,8
23-03-2026	0,0	28,7	77	8,0
24-03-2026	0,0	29,1	76	8,0
25-03-2026	9,0	28,3	78	6,9
26-03-2026	0,0	28,3	77	4,4
27-03-2026	0,0	28,6	75	8,0
28-03-2026	0,0	28,5	76	5,5
29-03-2026	0,0	28,7	75	6,0
30-03-2026	64,8	27,3	79	2,9

Based on the table, 30 alternatives were processed using the Simple Additive Weighting (SAW) method. Each alternative represents a daily weather condition with values for rainfall, average temperature, air humidity, and solar radiation intensity. These values were organized into a decision matrix as the basis for normalization, preference value calculation, and ranking of weather suitability to support oil palm harvesting.

3.2. Determination of Criteria, Attributes, and Weights

Determining criteria is an important stage in the application of the Simple Additive Weighting (SAW) method because it is the basis for assessing each alternative. The criteria in this study are determined based on weather parameters that affect the feasibility of weather conditions to support the implementation of oil palm harvest. Each alternative was assessed based on the value of each criterion to determine the most feasible weather conditions as a recommendation for harvest implementation (Ibrahim & Surya, 2019).

This study uses four criteria, namely rainfall (C1), average temperature (C2), air humidity (C3), and sunlight intensity (C4). These four parameters are used to represent weather conditions that can affect the smooth implementation of harvesting, both in terms of land conditions, work comfort, environmental conditions, and lighting in plantation areas.

Each criterion is then given a benefit or cost attribute according to the characteristics of the assessment. The benefit attribute shows that the larger the value is prioritized, while the cost attribute indicates that the smaller the value the better. The determination of these attributes is the basis for the normalization process so that the calculation of SAW is in accordance with the characteristics of each criterion. (Maiyendra & Wahyuni, 2020).

Furthermore, each criterion is given weight based on its level of importance to the feasibility of implementing oil palm harvesting. Weights indicate the magnitude of the influence of each criterion on the final value of the calculation, so that criteria with greater weight have a greater contribution in determining the results of recommendations. The determination of weights is carried out based on the level of influence of weather parameters on the conditions of harvest implementation so that the assessment results can provide more objective recommendations and in accordance with field conditions.

Table 2. Criteria

Code	Criteria	Attribute	Weight
C1	Namely Rainfall	Benefit	35%
C2	Average Temperature	Benefit	25%
C3	Air Humidity	Benefit	20%
C4	Sunlight Intensity	Benefit	20%

The determination of the weight of the criteria is based on the level of importance of each weather parameter to the feasibility of the implementation of oil palm harvest. Rainfall gets the largest weight at 35% because it is considered the most influential on the smooth running of harvest activities. High rainfall can cause garden roads to become slippery, hinder the mobility of workers and vehicles transporting fresh fruit bunches (FFB), and increase the risk of late harvest. Air temperature is given a weight of 25% because it affects the comfort and effectiveness of the workforce, while the intensity of sunlight and air humidity each gain a weight of 20% because it is related to lighting and environmental conditions during harvesting activities. (Rafli et al., 2025).

Although rainfall is characteristically a factor that is lower the better, all criteria in the SAW process are set as benefit attributes. This is because the value used in the calculation is a suitability rating, not a direct weather measurement value. Thus, the higher the rating, the more suitable the weather conditions are to support the implementation of the harvest. Therefore, the process of normalizing all criteria uses the benefit attribute formula, in accordance with the characteristics of the data and the purpose of decision-making (Ramadhani et al., 2023). The determination of weights is also prepared based on the level of influence of each parameter on the smooth harvest by referring to the literature review and research objectives.

Once the alternatives, criteria, attributes, and weights have been determined, the next stage in the Simple Additive Weighting (SAW) method is the preparation of the decision matrix. The decision matrix represents the value of each alternative against all criteria used as the basis for the normalization process and the calculation of preference values. In this study, daily weather data for the period 1–30 March 2026 was used as 30 alternatives (A1–A30), with four criteria, namely rainfall (C1), average temperature (C2), air humidity (C3), and sunlight intensity (C4). The preparation of the matrix allows each alternative to be objectively compared according to the SAW method (Ibrahim & Surya, 2019).

Before the normalization process, weather data obtained from BMKG was converted into an assessment scale of 1–5. The conversion is carried out to standardize the scale of each criterion so that it can be used in the evaluation process and the calculation of preference values. The rating was based on a range of suitable climatic conditions for oil palm plants based on the literature and adjusted to the research objectives in assessing the feasibility of weather conditions to support the implementation of oil palm harvesting (Kurniawan, 2018). The conversion results are then used as a decision matrix in the process of normalization and alternative ranking.

Table 3. Result Matrix

Alternative	C1	C2	C3	C4
A1	5	5	2	4
A2	5	5	3	4
A3	5	5	3	4
A4	5	4	3	5
A5	4	5	4	2
A6	5	5	5	1
A7	5	5	4	1
A8	5	4	4	4
A9	2	5	5	4
A10	5	5	5	1
A11	5	5	4	3
A12	4	5	5	5

Alternative	C1	C2	C3	C4
A13	5	5	4	5
A14	4	5	4	5
A15	5	5	4	2
A16	5	5	5	5
A17	2	4	4	4
A18	5	4	3	4
A19	5	4	4	5
A20	5	4	4	3
A21	5	4	4	5
A22	5	4	4	1
A23	5	4	4	5
A24	5	3	4	5
A25	4	4	4	4
A26	5	4	4	2
A27	5	4	4	5
A28	5	4	4	3
A29	5	4	4	4
A30	1	5	4	1

Each criterion in the Simple Additive Weighting (SAW) method has assessment characteristics that are adjusted to its effect on the feasibility of weather conditions. Rainfall (C1) is categorized as a cost criterion because too high rainfall can hinder plantation access, the process of transporting Fresh Fruit Bunches (FFB), and the effectiveness of harvesting activities. Therefore, ideal rainfall conditions obtain higher values than excessive rainfall conditions. Meanwhile, temperature (C2), humidity (C3), and light intensity (C4) were categorized as benefit criteria because the value that was increasingly in line with the needs of oil palm plants showed a higher level of feasibility.(Nugraha & Halim Mursyidin, 2024)

All criteria were converted into a scale of 1–5, with a value of 1 indicating a non-conforming condition and a value of 5 indicating a highly appropriate condition. The value is then used as the basis for the calculation of SAW to determine the feasibility level and ranking of each alternative weather condition.

The difference in values in each alternative indicates the variation in weather conditions during the observation period. Furthermore, the values in the assessment matrix are normalized using the SAW formula to have a uniform scale, then used in the calculation of preference values. The alternative with the highest preference value indicates the most feasible weather conditions based on the criteria and weights that have been determined so that it can be used as a recommendation in supporting the implementation of oil palm harvesting.

3.3. Matrix Normalization

After the decision matrix is compiled, the next stage in the Simple Additive Weighting (SAW) method is to carry out the normalization process. Normalization aims to equalize the scale of the values of each criterion so that all alternatives can be compared proportionally even though they have different units of measurement. Through this process, each value in the decision matrix is converted into a value that is in the same range so that it can be used in the next stage of calculation. The normalization formula used is:

$$\text{rij} = \frac{x_{ij}}{max(x_{ij})}$$

Description:
(r_{ij}) = The value of the alternative normalization result to-(i) on the criteria to-(j).
(x_{ij}) = Alternative Value-(i) on Criteria-(j).
(\max(x_j)) = maximum value on each criteria.

Table 4. Matrix Normalization

Alt	C1	C2	C3	C4
A1	1,000	1,000	0,400	0,800
A2	1,000	1,000	0,600	0,800
A3	1,000	1,000	0,600	0,800
A4	1,000	0,800	0,600	1,000
A5	0,800	1,000	0,800	0,400
A6	1,000	1,000	1,000	0,200
A7	1,000	1,000	0,800	0,200
A8	1,000	0,800	0,800	0,800
A9	0,400	1,000	1,000	0,800

A10	1,000	1,000	1,000	0,200
A11	1,000	1,000	0,800	0,600
A12	0,800	1,000	1,000	1,000
A13	1,000	1,000	0,800	1,000
A14	0,800	1,000	0,800	1,000
A15	1,000	1,000	0,800	0,400
A16	1,000	1,000	1,000	1,000
A17	0,400	1,000	0,940	0,800
A18	1,000	1,000	0,881	0,800
A19	1,000	0,800	0,800	1,000
A20	1,000	0,800	0,800	0,600
A21	1,000	0,800	0,800	1,000
A22	1,000	0,800	0,800	0,200
A23	1,000	0,800	0,800	1,000
A24	1,000	0,600	0,800	1,000
A25	0,800	0,800	0,800	0,800
A26	1,000	0,800	0,800	0,400
A27	1,000	0,800	0,800	1,000
A28	1,000	0,800	0,800	0,600
A29	1,000	0,800	0,800	0,800
A30	0,200	1,000	0,800	0,200

Based on the normalization results in the table, all alternative values have been in the range of 0 to 1 so that they can be compared directly. Values that are getting closer to 1 indicate that the alternative has a better value on the criteria being assessed. This normalization matrix is then used as a basis in the process of calculating preference values, namely by multiplying each normalization value by the weight of the criteria that have been determined. The results of the calculation will be used to determine alternative rankings and obtain the best weather conditions for oil palm production using the Simple Additive Weighting (SAW) method.

Table 5. Rankings

Ranking	Alternative	Value Preferences	Decisions
1	A16	1.000	Highly Feasible
2	A13	0.960	Highly Feasible
3	A12	0.930	Highly Feasible
4	A19	0.910	Highly Feasible
5	A21	0.910	Highly Feasible
6	A23	0.910	Highly Feasible
7	A27	0.910	Highly Feasible
8	A14	0.890	Highly Feasible
9	A11	0.880	Highly Feasible
10	A2	0.880	Highly Feasible
11	A3	0.880	Highly Feasible
12	A8	0.870	Highly Feasible
13	A29	0.870	Highly Feasible
14	A4	0.870	Highly Feasible
15	A24	0.860	Highly Feasible
16	A6	0.840	Feasible
17	A10	0.840	Feasible
18	A15	0.840	Feasible
19	A20	0.840	Feasible
20	A28	0.830	Feasible
21	A1	0.830	Feasible
22	A18	0.830	Feasible
23	A25	0.800	Feasible
24	A7	0.800	Feasible
25	A9	0.790	Feasible
26	A26	0.770	Feasible
27	A5	0.750	Feasible
28	A22	0.750	Moderately Feasible
29	A17	0.660	Moderately Feasible
30	A30	0.520	Less Feasible

After obtaining the preference value of each alternative using the Simple Additive Weighting (SAW) method, the ranking results were classified into suitability categories to facilitate the interpretation of weather conditions for supporting oil palm harvesting activities. The results showed that alternative A16 obtained the highest preference value of 1.000 and was classified as Highly Feasible, whereas A30 obtained a value of 0.520 and was classified as Less Feasible. These results indicate differences in weather suitability based on rainfall, air temperature, humidity, and solar radiation intensity.

This study developed a web-based Decision Support System (DSS) designed to provide recommendations regarding weather suitability for supporting oil palm harvesting activities. The research was conducted in West Pasaman Regency, West Sumatra Province, using weather data obtained from the Meteorology, Climatology, and Geophysical Agency (BMKG). The data consisted of rainfall, air temperature, humidity, and solar radiation intensity, which were used as the assessment criteria. Daily weather data collected throughout March 2026 were treated as alternatives and processed using the SAW method based on the weight assigned to each criterion.

The data processing consisted of decision matrix construction, normalization, preference value calculation, and alternative ranking. Differences in weather conditions among the alternatives resulted in different preference values. Alternatives with higher preference values indicated more suitable weather conditions, while lower values represented less suitable conditions for supporting oil palm harvesting activities.

The developed web-based system provides facilities for weather data management, automated SAW calculations, and presentation of suitability assessment and ranking results. Overall, the application of the SAW method was able to systematically assess weather conditions based on multiple criteria and produce rankings that can serve as recommendations for considering suitable weather conditions for oil palm harvesting activities.

3.4. System Interface and Functionality Implementation

The implementation of the system interface and functionality represents the stage of transforming the system design into a functional application that can be accessed by users. At this stage, the previously designed interface is implemented as a web-based system integrated with a database and the Simple Additive Weighting (SAW) method.

The developed Decision Support System (DSS) for determining the most suitable weather conditions for oil palm production is designed to assist users in managing weather data, assigning criterion values, performing SAW calculations, and presenting information in the form of rankings of weather conditions that support oil palm production.

3.4.1. Login Page

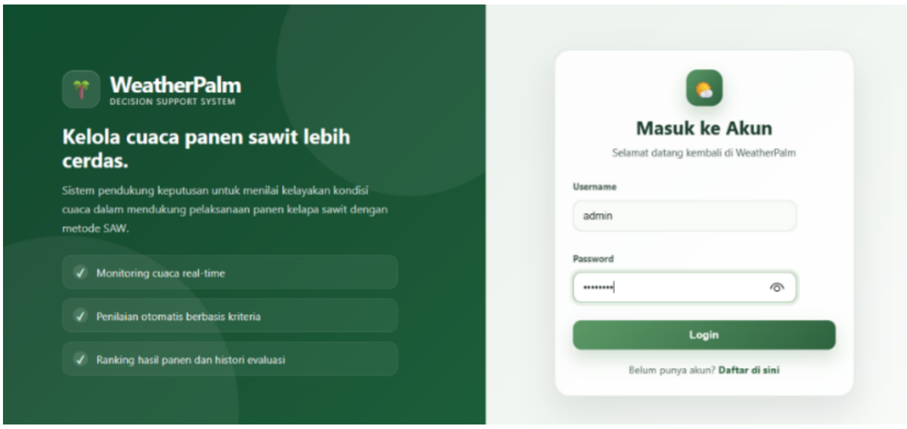


Figure 1. Login Page

The login page serves as the initial interface through which users access the system. Users are required to enter their registered username and password to ensure that only authorized users can access and operate the Decision Support System. The login interface consists of two main components, namely the username and password fields. After the credentials are entered correctly, the system verifies the information and redirects the user to the dashboard page.

3.4.2. Dashboard Page

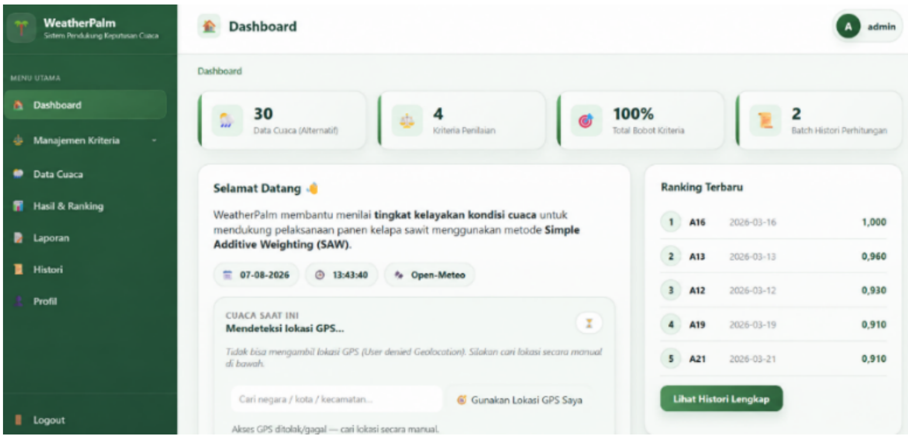


Figure 2. Dashboard Page

The dashboard page serves as the main interface displayed after users successfully log in and functions as the central navigation area for accessing all features of the decision support system. It provides access to key menus, including weather data, criteria management, alternative data, SAW calculations, and SAW results. The weather data menu manages weather-related information used as a data source for decision-making, while the criteria management menu allows users to add, modify, and delete criteria and assign weights representing their relative importance. The alternative data menu manages the objects to be evaluated based on the predetermined criteria, which are subsequently processed to obtain preference values and rankings. The SAW calculation menu performs the Simple Additive Weighting (SAW) process, including normalization, weighting, and calculation of the final preference values for each alternative. Meanwhile, the SAW results menu presents the final preference values and alternative rankings, enabling users to identify the highest-ranked alternative as the recommended decision. Overall, the dashboard integrates data management, SAW processing, and decision results in a structured and systematic interface.

3.4.3. Criteria Management Page

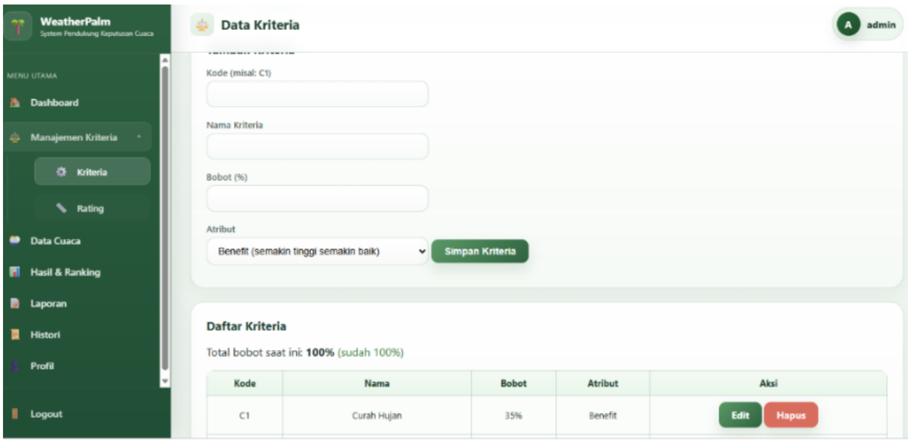


Figure 3. Criteria Management Page

The Criteria Management page allows administrators to manage the criteria used in the Simple Additive Weighting (SAW) calculation. Administrators can add new criteria by specifying the criterion name, weight, and criterion type.

In the presented example, the administrator inputs “Rainfall” with a weight of 30% and assigns the “benefit” type. After all required data are entered, the administrator selects the “Add” button to save the criterion to the system. This feature enables structured criteria management and supports the decision-making process for determining suitable weather conditions for oil palm cultivation.

3.4.4. Alternative Data Page

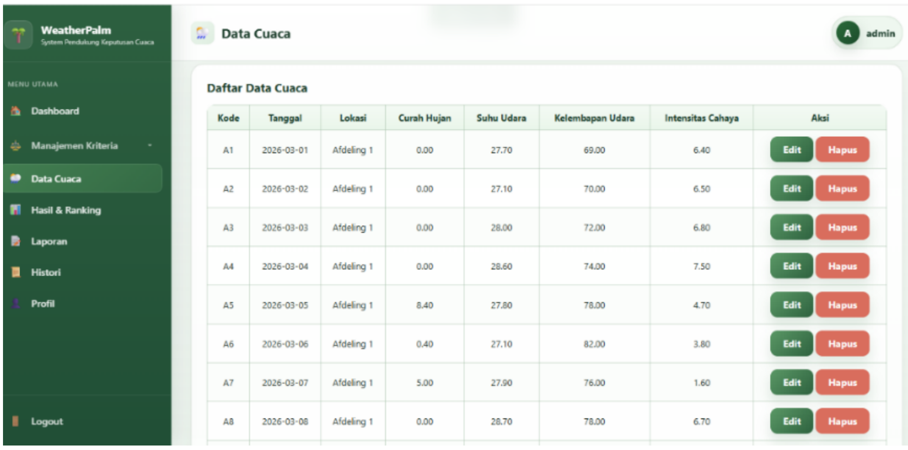


Figure 4. Alternative Page

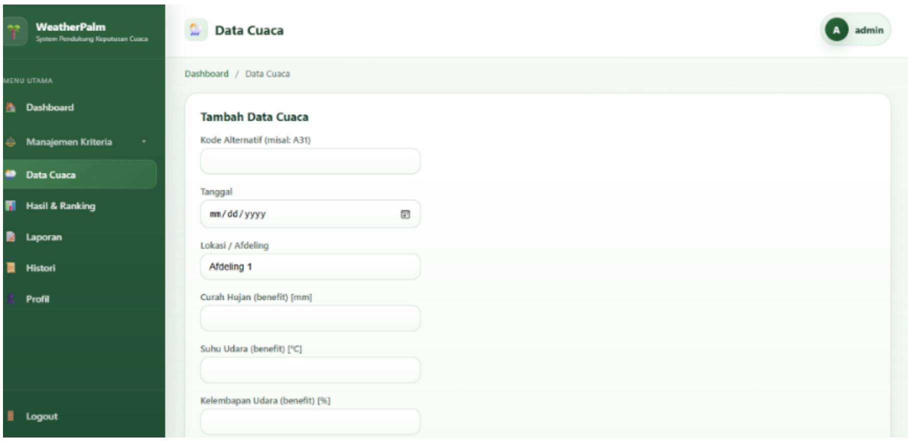
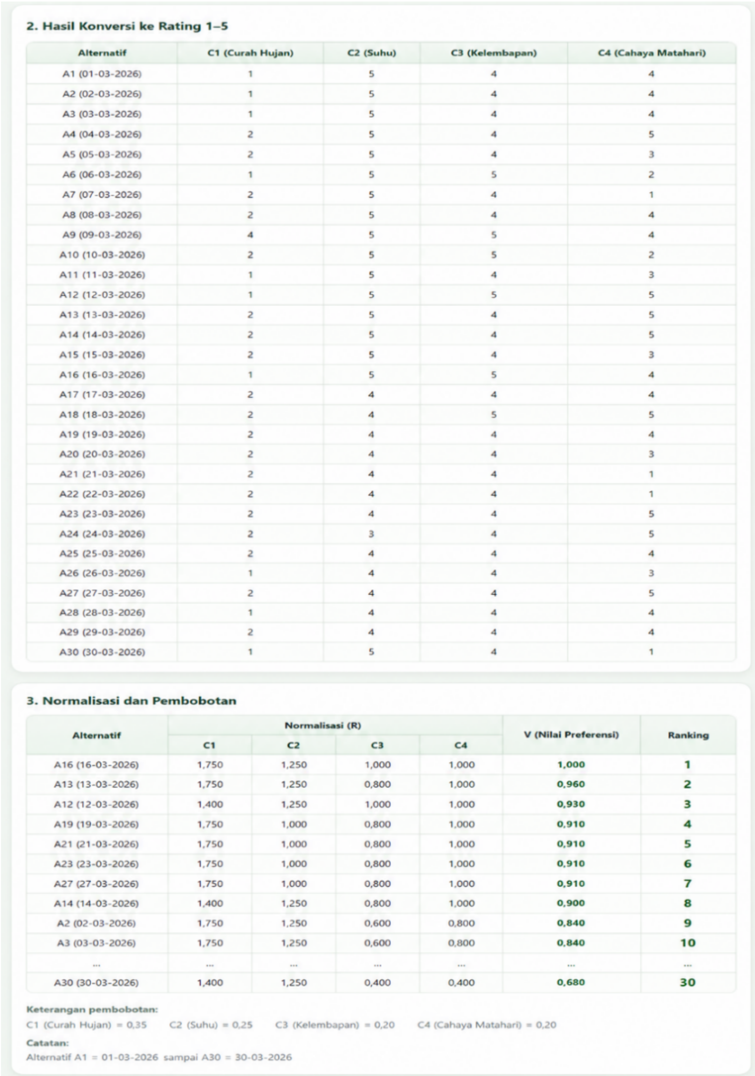


Figure 5. Alternative Page

The Alternative Data page is used to manage weather condition alternatives processed using the Simple Additive Weighting (SAW) method. The alternatives are derived from daily weather data obtained from the Teluk Bayur Maritime Meteorological Station during March 2026. Users can enter rainfall, average temperature, air humidity, and solar radiation intensity for each weather alternative. These data serve as the basis for the subsequent SAW calculation.

3.4.5. SAW Calculation Process Page



2. Hasil Konversi ke Rating 1–5

Alternatif	C1 (Curah Hujan)	C2 (Suhu)	C3 (Kelembapan)	C4 (Cahaya Matahari)
A1 (01-03-2026)	1	5	4	4
A2 (02-03-2026)	1	5	4	4
A3 (03-03-2026)	1	5	4	4
A4 (04-03-2026)	2	5	4	5
A5 (05-03-2026)	2	5	4	3
A6 (06-03-2026)	1	5	5	2
A7 (07-03-2026)	2	5	4	1
A8 (08-03-2026)	2	5	4	4
A9 (09-03-2026)	4	5	5	4
A10 (10-03-2026)	2	5	5	2
A11 (11-03-2026)	1	5	4	3
A12 (12-03-2026)	1	5	5	5
A13 (13-03-2026)	2	5	4	5
A14 (14-03-2026)	2	5	4	5
A15 (15-03-2026)	2	5	4	3
A16 (16-03-2026)	1	5	5	4
A17 (17-03-2026)	2	4	4	4
A18 (18-03-2026)	2	4	5	5
A19 (19-03-2026)	2	4	4	4
A20 (20-03-2026)	2	4	4	3
A21 (21-03-2026)	2	4	4	1
A22 (22-03-2026)	2	4	4	1
A23 (23-03-2026)	2	4	4	5
A24 (24-03-2026)	2	3	4	5
A25 (25-03-2026)	2	4	4	4
A26 (26-03-2026)	1	4	4	3
A27 (27-03-2026)	2	4	4	5
A28 (28-03-2026)	1	4	4	4
A29 (29-03-2026)	2	4	4	4
A30 (30-03-2026)	1	5	4	1

3. Normalisasi dan Pembobotan

Alternatif	Normalisasi (R)				V (Nilai Preferensi)	Ranking
	C1	C2	C3	C4		
A16 (16-03-2026)	1,750	1,250	1,000	1,000	1,000	1
A13 (13-03-2026)	1,750	1,250	0,800	1,000	0,960	2
A12 (12-03-2026)	1,400	1,250	1,000	1,000	0,930	3
A19 (19-03-2026)	1,750	1,000	0,800	1,000	0,910	4
A21 (21-03-2026)	1,750	1,000	0,800	1,000	0,910	5
A23 (23-03-2026)	1,750	1,000	0,800	1,000	0,910	6
A27 (27-03-2026)	1,750	1,000	0,800	1,000	0,910	7
A14 (14-03-2026)	1,400	1,250	0,800	1,000	0,900	8
A2 (02-03-2026)	1,750	1,250	0,600	0,800	0,840	9
A3 (03-03-2026)	1,750	1,250	0,600	0,800	0,840	10
...	...	...	...	...	...	...
A30 (30-03-2026)	1,400	1,250	0,400	0,400	0,680	30

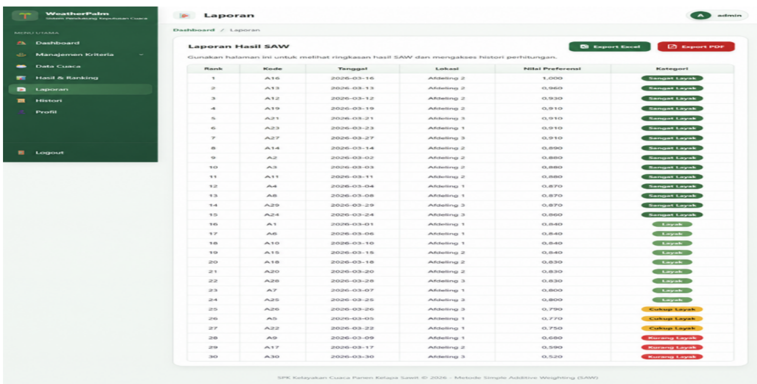
Keterangan pembobotan:
C1 (Curah Hujan) = 0,35 C2 (Suhu) = 0,25 C3 (Kelembapan) = 0,20 C4 (Cahaya Matahari) = 0,20

Catatan:
Alternatif A1 = 01-03-2026 sampai A30 = 30-03-2026

Figure 6. Calculation Process page

The SAW Calculation Process page performs the Simple Additive Weighting (SAW) method, beginning with the construction of a decision matrix based on the entered alternatives. The system then normalizes the criterion values according to their attribute types, namely benefit or cost. Subsequently, preference values are calculated by summing the products of the normalized values and the corresponding criterion weights. The alternative with the highest preference value is selected as the most suitable weather condition for supporting oil palm production.

3.4.6. Decision Result Page



Laporan Hasil SAW

Gunakan halaman ini untuk melihat ringkasan hasil SAW dan mengakses histori perhitungan.

Rank	Kode	Tanggal	Lokasi	Nilai Preferensi	Kategori
1	A16	2026-03-16	Afdeling 2	1,000	Sangat Layak
2	A13	2026-03-13	Afdeling 2	0,960	Sangat Layak
3	A12	2026-03-12	Afdeling 2	0,930	Sangat Layak
4	A19	2026-03-19	Afdeling 2	0,910	Sangat Layak
5	A21	2026-03-21	Afdeling 3	0,910	Sangat Layak
6	A23	2026-03-23	Afdeling 1	0,910	Sangat Layak
7	A27	2026-03-27	Afdeling 3	0,910	Sangat Layak
8	A14	2026-03-14	Afdeling 2	0,890	Sangat Layak
9	A2	2026-03-02	Afdeling 2	0,880	Sangat Layak
10	A3	2026-03-03	Afdeling 2	0,880	Sangat Layak
11	A11	2026-03-11	Afdeling 2	0,880	Sangat Layak
12	A4	2026-03-04	Afdeling 1	0,870	Sangat Layak
13	A8	2026-03-08	Afdeling 1	0,870	Sangat Layak
14	A29	2026-03-29	Afdeling 3	0,870	Sangat Layak
15	A24	2026-03-24	Afdeling 3	0,860	Sangat Layak
16	A1	2026-03-01	Afdeling 1	0,840	Layak
17	A6	2026-03-06	Afdeling 1	0,840	Layak
18	A10	2026-03-10	Afdeling 1	0,840	Layak
19	A15	2026-03-15	Afdeling 2	0,840	Layak
20	A18	2026-03-18	Afdeling 2	0,830	Layak
21	A20	2026-03-20	Afdeling 2	0,830	Layak
22	A28	2026-03-28	Afdeling 3	0,830	Layak
23	A7	2026-03-07	Afdeling 1	0,800	Layak
24	A25	2026-03-25	Afdeling 3	0,800	Layak
25	A26	2026-03-26	Afdeling 3	0,790	Cukup Layak
26	A5	2026-03-05	Afdeling 1	0,770	Cukup Layak
27	A22	2026-03-22	Afdeling 1	0,750	Cukup Layak
28	A9	2026-03-09	Afdeling 1	0,680	Kurang Layak
29	A17	2026-03-17	Afdeling 2	0,590	Kurang Layak
30	A30	2026-03-30	Afdeling 3	0,520	Kurang Layak

SPK Kelayakan Cuaca Panen Kelapa Sawit © 2026 - Metode Simple Additive Weighting (SAW)

Figure 7. Decision Result Page

The Decision Results page presents the final outcomes of the Simple Additive Weighting (SAW) calculation, including the preference values and rankings of each weather alternative. The ranking indicates the order of weather conditions from the most to the least suitable for oil palm production, enabling users to identify the optimal conditions based on the SAW results.

Overall, the implementation of the web-based system developed in this study supports faster, more objective, and efficient identification of suitable weather conditions for oil palm production using the Simple Additive Weighting (SAW) method.

3.5. Discussion of System Test Result

Based on the results of the test using the Black Box Testing method that has been carried out, it can be seen that all the main functions of the web-based decision support system can run according to the design that has been made. Testing was carried out on several main features, namely the user login process, weather data management, criteria management, alternative data management, the calculation process of the Simple Additive Weighting (SAW) method, and the display of decision results.

In the login page test, the system is able to carry out a validation process on user data. Users who enter the appropriate username and password can successfully log in to the system and be directed to the dashboard page. Meanwhile, users who enter inappropriate data will get a notification that the login process failed. This indicates that the system already has a well-functioning authentication mechanism.

In data management testing, such as weather data, criteria, and alternatives, the system is able to perform the functions of add, change, and delete data properly. The data entered by the user can be stored in the database and can be displayed back on the system page. In addition, changes and deletions of data can also be done according to the needs of the user.

At the testing stage of the calculation process of the Simple Additive Weighting (SAW) method, the system is able to process data based on predetermined criteria and weights. The process of normalizing values, calculating weights, and producing preference values for each alternative can be carried out automatically by the system. The results of the calculation are then used to determine the order of alternative rankings.

Based on the results of the test results of the decision results, the system successfully displays the preference values and ranking order of each alternative. The results provide information on the most optimal weather conditions to support the increase in oil palm production based on the criteria used in the study.

From the overall test results, it can be concluded that the system built has met the functional needs that have been designed. The application of the Simple Additive Weighting (SAW) method in this decision support system is able to help the process of analyzing weather conditions on oil palm production by producing faster, objective, and structured decisions.

4. CONCLUSION

Based on the results of the research, a web-based Decision Support System (SPK) has been successfully designed and built to assess the feasibility of weather conditions in supporting the implementation of oil palm harvesting. The system provides management of weather data, criteria, alternatives, calculation processes using the Simple Additive Weighting (SAW) method, as well as the presentation of assessment and ranking results.
The SAW method was successfully applied through the stages of data conversion, decision matrix formation, normalization, weighting, preference value calculation, and ranking. The results are able to provide recommendations for the feasibility of weather conditions based on four criteria, namely rainfall, air temperature, air humidity, and sunlight intensity. The resulting rankings help users identify the most feasible and least feasible weather conditions so that the decision-making process becomes more objective, consistent, and measurable.

The results of the test using the Black Box Testing method show that the main functions of the system, ranging from login, data management, the SAW calculation process, to the presentation of assessment and ranking results, can run as needed. The system can also help the weather assessment process in a faster, more effective, and structured manner than manual processes.

For further development, the system can use weather data with longer observation periods and cover different seasons to make the assessment results more representative. Additional criteria such as crop road conditions, land conditions, wind speed, freshfruit bunch (FFB) maturity level, and other operational factors can also be considered to produce a more comprehensive assessment. In addition, the system can be developed by integrating weather data sources automatically through BMKG or other weather APIs so that data updates can be done faster. Subsequent research can also compare the SAW method with other methods such as WP, TOPSIS, or MOORA to find out a more appropriate approach. In terms of implementation, the system can be developed to be more optimally accessible through smartphones and tablets to support use in the field.

REFERENCES

Akmal, F., Ramdani, F., & Pinandito, A. (2018). Sistem informasi pengelolaan perkebunan kelapa sawit berbasis web gis. Jurnal Pengembangan Teknologi dan Ilmu Komputer, 2(5), 1894-1901.

Al-fedaghi, S. (2021). UML sequence diagram: an alternative model. arXiv preprint arXiv:2105.15152. https://doi.org/10.48550/arXiv.2105.15152

Badrul Mundir, A., Wirianata, H., & Nugraha Budi Santosa, T. (2024). Pengaruh Curah Hujan terhadap Produktivitas Kelapa Sawit pada Beberapa Jenis Tanah. AGROFORETECH, 2(3), 1290–1300. Diambil dari https://jurnal.instiperjogja.ac.id/index.php/JOM/article/view/1465

BPS. (2024). Exports of palm oil by major countries of destination, 2012–2024. BPS-Statistics Indonesia.

Dewi, L. P., & Indahyanti, U. (2021). Pemodelan proses bisnis menggunakan activity diagram uml dan bpmn (studi kasus frs online). Informatika, 1(9).

Elistri, M., Wahyudi, J., & Supardi, R. (2014). Penerapan metode saw dalam sistem pendukung keputusan pemilihan jurusan pada Sekolah Menengah Atas Negeri 8 Seluma. Jurnal Media Infotama, 10(2). https://doi.org/10.37676/jmi.v10i2.239

Faridha, S., Yulianti, S., & Sugiarti, Y. (2024). Metode Perancangan User Interface yang Paling Umum Digunakan: Systematic Literature Review. Bit-Tech, 7(1), 58–67. https://doi.org/10.32877/bt.v7i1.1467

Hidayati, J., Suryani, A., & Miftah Fauzi, A. (2020). Identifikasi revitalisasi perkebunan kelapa sawit di Sumatera Utara. Jurnal Teknologi Industri Pertanian, 26(3).

Ibrahim, A., & Surya, R. A. (2019). The Implementation of Simple Additive Weighting (SAW) Method in Decision Support System for the Best School Selection in Jambi. Journal of Physics: Conference Series, 1338(1). https://doi.org/10.1088/1742-6596/1338/1/012054

Idiatsyah, R. A., Junaedi, A., & Sudradjat. (2024). Manajemen Pemanenan Kelapa Sawit (Elaeis guineensis Jacq.) di Labuhanbatu, Sumatera Utara. Buletin Agrohorti, 12(3), 391–402. https://doi.org/10.29244/agrob.v12i3.59490

Kurniawan, T. A. (2018). Pemodelan Use Case (UML): Evaluasi Terhadap Beberapa Kesalahan Dalam Praktik Use Case (UML) Modeling: Evaluation on Some Pitfalls in Practices. 5(1), 77–86. https://doi.org/10.25126/jtiik.201851610.

Maimunah M.K., S. Si. (2022). Perancangan Input dan Output. 1–14.

Maiyendra, N. A., & Wahyuni, R. (2020). Website Designing As A Media For Promotion And Information On Karang Setio Batik (Perancangan Website Sebagai Media Promosi Dan Informasi Pada Batik Karang Setio). Jurnal KomtekInfo, 7(2), 120–132. https://doi.org/10.35134/komtekinfo.v7i2.72

Nugraha, A. M. P., & Halim Mursyidin, I. (2024). Sistem Pendukung Keputusan Penilaian Kinerja Guru Menggunakan Metode SAW. Bit-Tech, 7(1), 174–183. https://doi.org/10.32877/bt.v7i1.1608.

Rafli, M., Hidayah, N., & Wahyuni, F. (2025). Studi Evaluatif Pelaksanaan Konsultasi Karir di SMK: Tinjauan dari Perspektif Kolaboratif Guru, Orang Tua, dan Peserta Didik. Jurnal Evaluasi Pendidikan, 16(1), 41–49. https://doi.org/10.21009/jep.v16i1.55632

Ramadhani, S., Andrayani, Y., Misliyana, P., & Taruk, M. (2023). Perancangan Aplikasi Digital Farming Untuk Menentukan Replanting Tanaman Kelapa Sawit Menggunakan Metode TOPSIS Dan SAW. Jurnal Rekayasa Teknologi Informasi (JURTI). https://doi.org/10.30872/jurti.v7i1.9264

Rizkyawan, F. (2024). Sistem Pendukung Keputusan Pemilihan Bibit Kelapa Sawit Dengan Menggunakan Metode Simple Additive Weighting (SAW) Berbasis Web. Jurnal Ilmu Komputer, Sistem Informasi, Teknik Informatika, 3(1), 41-48.

Siregar, S. W., Puspasawi Wijaya, D., Danianti, D., & Pramuntadi, A. (2025). Sistem Pendukung Keputusan dalam Menentukan Kualitas Bibit Kelapa Sawit Menggunakan Metode SAW. Jurnal Riset dan Aplikasi Mahasiswa Informatika (JRAMI), 6(03), 704-713. https://doi.org/10.30998/jrami.v6i03.11291

Tarwaca Susila Putra, E. (2015). Tanggapan produktivitas kelapa sawit (Elaeis guineensis Jacq.) terhadap variasi iklim. Vegetalika, 4(4), 21-34. https://doi.org/10.22146/veg.23941

Taufiq, R., Hambali, A., & Saifudin, A. (2021). Rancang Bangun Sistem Pendukung Keputusan Penilaian Karyawan Terbaik Pada PT. Surya Toto Indonesia, Tbk Menggunakan Metode Simple Additive Weighting (SAW) Berbasis WEB. Jurnal Informatika Universitas Pamulang, 6(1), 188-194. https://doi.org/10.32493/informatika.v6i1.9836

Wandana, F. A., Hamid, A., Wahyuni, S., & Dhora, A. (2024). Dampak perubahan iklim terhadap produktivitas kelapa sawit (Elaeis guineensis Jacq) di PT Inti Indosawit Subur Desa Delima Jaya Koperasi Mulus Rahayu. Jurnal Teknik Industri Terintegrasi, 7(4), 2511–2517. https://doi.org/10.31004/jutin.v7i4.37313