IMPLEMENTATION OF THE AHP METHOD ON DECISION SUPPORT SYSTEM FOR SELECTING THE BEST RICE SEEDLINGS IN MADANG SUKU 1 SUB-DISTRICT

Putri Ela Citra Utami, Endang Lestari Ruskan*
[1,2] Information Systems, Sriwijaya University
Jl. Palembang – Prabumulih KM.32 Kabupaten Ogan Ilir, Sumatera Selatan, Indonesia
*E-mail : putrielacitra@gmail.com, endanglestari@unsri.ac.id **

ABSTRACT
Rice is one of the most widely grown staples in most rural areas in Indonesia. East OKU Regency is the Regency with the second largest rice production in South Sumatra Province, Madang Suku 1 District is one of the Districts in East OKU Regency and is the center of rice production. However, many farmers in Madang Suku 1 do not know the quality of rice seeds that are by the criteria that are suitable for the village where the farm is, resulting in unsatisfactory yields for farmers, which has an impact on the welfare of rice farmers. Therefore, to help overcome the problems that occur, a system is needed that can help farmers in choosing the best rice seeds that suit the conditions of the area. This decision support system uses the AHP method, this method can make decisions effectively with complex and then simplified in a hierarchical arrangement. In addition, this method can also take into account the level of consistency and inconsistency in the assessment carried out by comparing existing factors or criteria. This research resulted in the ranking of rice recommendations for Madang Sub-district Tribe 1 which is 1.855 obtained by MR, Inpari 42 = 1.470, Ciherang = 1.119, Inpari 32 = 1.000, and Ciliwung with a value of 0.558.

Keywords: *Decision Support Systems; Analytical Hierarchy Process; Rice Seedlings;*

INTRODUCTION

Agriculture is one of the most important sectors in Indonesia. Most people depend on this sector to produce rice, their main source of food[2]. One of the most widely grown staples in rural Indonesia is rice[3]. East Ogan Komering Ulu (OKU) Regency is the second largest rice-producing Regency in South Sumatra Province, Madang Suku 1 Sub-district in East OKU Regency is well-known as a rice-producing center[4]. Good quality rice seedlings are needed to increase production and business income. The quality of rice seedlings can be measured through the quality of rice produced, the amount of yield, the resistance of rice to pests and diseases, and the suitability of rice to its growing environment[5]. However, many farmers (based on interviews) in Madang Suku 1 do not know the quality of rice seeds that are following the above criteria that are suitable for the village where the farm, resulting in unsatisfactory yields for farmers, which has an impact on the welfare of rice farmers. So far, farmers have obtained information and knowledge about rice seeds that are considered superior, either from

the internet or social media or socialization that has been carried out in several villages. However, the results are not in line with expectations. The difference between the reality in the field and the information received by farmers indicates that the rice seedling selection system must be improved. Therefore, knowing how to select the best rice seeds is very important to adjust to the conditions in each area.

Based on the problems that have been stated, it is formulated as "how to make a system that can help farmers in choosing the best rice seeds that suit the conditions of the area?" A decision support system using the AHP method can be the right solution to the above problems. The Analytical Hierarchy Process (AHP) method can simplify the complex decision-making process into a hierarchical arrangement[6]. This study aims to determine and create a system to determine the selection of the best rice seeds using the AHP method to assist in recommending the best seed selection process that suits the agricultural conditions in the Madang Suku 1 area. A study conducted by Arda Gusema Susilowati and Purwanto entitled "Decision Support System for Selection of Superior Rice Seeds Using the Weighted Product Method" in Patean village in 2021, has criteria for Disease Resistance, Planting Season, Rice Texture, Yield Potential, Number of Seedlings, and Seedling Prices to get the best price ranking is Luhur 2 rice.[7]. Furthermore, the research "Decision Support System for Selection of Superior Rice Seeds using the Topsis Technique for Order Preference by Similarity to Ideal Solution" method in 2022 also discusses the selection of rice seeds having criteria for Seed Leaf Weight, Rice Seed Size, Rice Seed Color, and Seed Leaf Height which produces the best rice seeds, namely ciliwun with a preference of 0.75004.[8]. As for the research "Decision Support System for Superior Rice Seeds Using the AHP Method" in 2023 located in Pasapa Village using criteria including rice grains, plant friability, seed color, rice shape, and plant age produced Ciliwung rice with a value of 0.453 as the best seed[9]. Another research entitled "Application of AHP and TOPSIS Methods in the Application of Rice Seedling Selection Decision Support System" in 2023 uses a combination of AHP and TOPSIS methods and produces a value of 0.705 from the Inpari 3 variety in the first rank[10]. Then in the research "Decision Support System to Determine the Best Rice Seedlings using the Simple Additive Weighting (SAW) Method" in 2022 also has criteria including Weight, Yield, Resistance, Height, Color, and Clumps which produces the best alternative is the IR 64 variety which is worth 0.85[11].

Based on some of the research above, the researcher will design the best SPK formulation for rice seedlings in Madang Suku 1 District. Previous research is different from the research that the author will do because of the location and criteria used to select rice seedlings. This research

is expected to provide practical solutions for farmers in choosing the optimal variety of rice seedlings following local environmental conditions. This research will provide alternative recommendations for the best rice seedlings that are suitable for the conditions of the farm and help prevent problems that occur due to errors in planting rice seedlings that are less suitable for the existing agricultural location in Madang Suku 1 District.

RESEARCH CONTENT

2.1 Research Stages

In this research, the stages carried out by the author are as follows [12]:

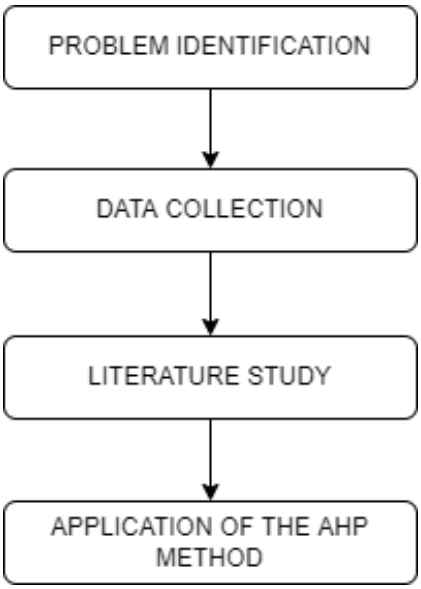

Figure 1. Research Stages

1. Problem identification

   Problem identification is carried out to analyze the problems that occur in the process of determining rice seeds.

2. Data collection

   Data was collected through direct inspection of farms in the Madang Suku 1 sub-district, conducting interviews related to the problem, and using questionnaires to determine criteria and weights.

3. Literature study

   A literature study is a way to learn and expand researchers' knowledge about the AHP (Analytical Hierarchy Process) method to solve the problem of selecting the best rice seeds.

4. Application of the AHP method

Stages of applying the AHP method:

a. Building the Hierarchy
b. Making pairwise comparisons
c. Synthesis
d. Measuring consistency

2.2 Decision Support System

DSS or Decision Support System is a system that can help companies or organizations make decisions. Systematic and relevant information is provided by the SPK to facilitate the complex decision-making process. Decision support systems contain data and information that are processed using mathematical or statistical methods to produce recommendations or options that can help decision-makers.[13]. Meanwhile, based on[14] decision support systems are the evolution of computerized management information systems that are made more interactive with users.

2.3 AHP Method (Analytical Hierarchy Process)

Thomas L. Saaty created the Analytical Hierarchy Process (AHP), a decision-support method that helps create hierarchies that result from decomposing complex multi-factor problems[15]. AHP is a multi-criteria decision-making method that allows ranking and evaluation of the relative importance of different criteria or alternatives[16].

The steps to solve problems using the AHP method include the following[17]:

a. Building a Hierarchy

   Hierarchy building is done by breaking down the criteria and alternatives of a complex system.

b. Making Pairwise Comparisons

   To assess the criteria, pairwise comparisons are required. The pairwise comparison scale is shown in Table 1 below.

Table 1. Pairwise Comparison Scale

Intensity of Importance	Description
1	Both elements are equally important
3	One element is slightly more important than the other
5	One element is moderately more important than the other element
7	One element is more important than the other element
9	One element is more important than another
2, 4, 6, 8	Valuation between two adjacent elements
Reciprocal	If one element has one of the above numbers compared to the other element, it has the opposite value.

c. Synthesis

There are several steps at this stage, including:

1. The value in each column is summed with the matrix value
2. Each value of the column is divided by the total column to get the matrix normalization value.
3. The value of each row is summed and then divided by the total elements to get the average value (priority)

d. Measuring consistency

To measure consistency, it can be done in the following way:

1. Sum each row of the sum result, divide by the relevant priority, and then add up the results.
2. Divide the sum result by the number of elements, then get λmax.
3. Consistency index is obtained by the formula:

$$CI = \frac{\lambda max - n}{\mathrm{n} - 1} \qquad (1)$$

Description :

CI : Consistency Index

λmax : Maximum Eigenvalue

n : Number of elements

4. The consistency ratio can be calculated using the formula:

$$CR = \frac{CI}{IR} \quad (2)$$

Description:

CR : Consistency Ratio

CI : Consistency Index

IR : Index Random Consistency

In calculating CR, the random consistency index shown in Table 2 below is required.

Table 2. Random Index

n	IR
1	0
2	0
3	0.58
4	0.9
5	1.12
6	1.24
7	1.32
8	1.41
9	1.46
10	1.49

RESULTS AND DISCUSSION

In this study using a questionnaire in data collection, based on data collection, the results of a questionnaire with 102 respondents were obtained which resulted in criteria that can be seen in table 3 and alternatives in table 4. Further discussion can be seen from the explanation below.

1. Data on Criteria and Alternatives

This research has several criteria and alternatives, including:

a. Criteria data

The criteria data on the selection of rice seeds in Madang Tribe 1 Sub-district are as follows:

Table 3. Criteria data

No.	Criteria Name	Criteria Code
1	Yield Potential	C1
2	Pest Resistance	C2
3	Soil Type	C3
4	Price	C4
5	Season	C5
6	Rice Texture	C6

b. Alternative data

The rice varieties data to be used as an alternative is as follows:

Table 4. Alternative data

No.	Alternative Name	Alternative Code
1	Inpari 42	A1
2	MR	A2
3	Inpari 32	A3
4	Ciliwung	A4
5	Ciherang	A5

2. AHP Method Calculation

The following are the calculations carried out to solve the problem with the Analytical Hierarchy Process (AHP) method:

Table 5. Pairwise Comparison Matrix

	C1	**C2**	**C3**	**C4**	**C5**	**C6**
C1	1	2,45	3,87	3,87	0,99	2,45
C2	0,41	1	3	3	0,99	1,22
C3	0,26	0	1	0,71	0,41	1,22

C4	0,26	0	1,41	1	0,77	0,26
C5	1,01	1,01	2,46	1,29	1	0,2
C6	0,41	0,82	0,82	3,89	5	1
Total	3,34	5,94	12,57	13,76	9,17	6,36

The results in the comparison matrix above are the results of comparing each criterion based on their respective levels of importance, the values that have been inputted are pairwise comparison values obtained from the questionnaire.

Table 6. Normalization matrix between criteria

	C1	**C2**	**C3**	**C4**	**C5**	**C6**
C1	0,30	0,41	0,31	0,28	0,11	0,39
C2	0,12	0,17	0,24	0,22	0,11	0,19
C3	0,08	0,06	0,08	0,05	0,04	0,19
C4	0,08	0,06	0,11	0,07	0,08	0,04
C5	0,30	0,17	0,20	0,09	0,11	0,03
C6	0,12	0,14	0,06	0,28	0,55	0,16
Total	1	1	1	1	1	1

The value contained in the normalization table above is the result of dividing each matrix element by the total row, namely the value of row c1 column c1 / total column c1, namely 1/3.34 = 0.30.

Table 7. Priority value and eigenvalue

Total	**Priority**	**Eigen Value**
1,80	0,299	1,00
1,05	0,175	1,04
0,50	0,084	1,05
0,44	0,074	1,02
0,90	0,150	1,38
1,31	0,218	1,39
6	1	6,9

Furthermore, the calculation of priority value and eigen value, to calculate the priority value, it is necessary to add up each row of each criterion. The sum of C1 = 0.30 + 0.41 + 0.31 + 0.28 + 0.11 + 0.39 = 1.80 and so on. After that, the result of the sum of 1.80/6 (6 because there are six criteria), the priority value is 0.299. Next to calculate the eigenvalue is to multiply the priority by the total column value in pairwise comparisons, namely 0.299 * 3.34 = 1.00.

After calculating all the values above, the next is to calculate λmax, namely: 6.9 (total eigenvalue)/6 (number of elements)=1.14 After obtaining the value of λmax, it can calculate the consistency index and consistency ratio:

$$CI = \frac{1{,}14 \ - \ 6}{6 \ - \ 1} = \ -1{,}81$$

$$\mathrm{CR} = \frac{-1{,}81}{1{,}24} = \ -1{,}46$$

The result of CR < 0.1, then the data is considered consistent.

Calculating CI and CR can be found in formulas (1) and (2) above, the IR value is obtained based on Saaty's theory shown in table 2, the value of 1.24 is obtained because there are 6 elements.

After calculating the criteria, then calculate the comparison between alternatives based on the criteria.

Table 8. Comparison of alternatives with (C1)

	A1	**A2**	**A3**	**A4**	**A5**
A1	1	0,33	3,00	0,41	0,99
A2	3,03	1	3,87	3,87	3,87
A3	0,33	0	1	0,99	0,33
A4	2,46	0	1,01	1	0,33
A5	1,01	0,26	3,03	3,03	1
Total	7,83	2,10	11,91	9,30	6,53

Table 9. Comparison of alternatives with (C2)

	A1	**A2**	**A3**	**A4**	**A5**
A1	1	0,81	3,16	1,58	1,00

A2	1,23	1	2,45	1,22	1,58
A3	0,32	0	1	1,28	0,26
A4	0,63	1	0,78	1	0,20
A5	1,00	0,63	3,89	5,00	1
Total	4,18	3,67	11,28	10,09	4,04

Table 10. Comparison of alternatives with (C3)

	A1	**A2**	**A3**	**A4**	**A5**
A1	1	2,45	2,24	3,87	1,28
A2	0,41	1	0,99	2,45	3,87
A3	0,45	1	1	3,00	1,22
A4	0,26	0	0,33	1	0,50
A5	0,78	0,26	0,82	2,00	1
Total	2,89	5,12	5,38	12,32	7,88

Table 11. Comparison of alternatives with (C4)

	A1	**A2**	**A3**	**A4**	**A5**
A1	1	0,26	0,99	0,99	0,99
A2	3,89	1	3,87	5,00	3,87
A3	1,01	0	1	3,00	0,99
A4	1,01	0	0,33	1	0,33
A5	1,01	0,26	1,01	3,03	1
Total	7,91	1,97	7,21	13,03	7,19

Table 12. Comparison of alternatives with (C5)

	A1	**A2**	**A3**	**A4**	**A5**
A1	1	1,22	1,58	3,87	0,99
A2	0,82	1	1,12	3,00	3,87
A3	0,63	1	1	3,87	0,99
A4	0,26	0	0,26	1	0,33
A5	1,01	0,26	1,01	3,03	1
Total	3,71	3,71	4,96	14,78	7,19

Table 13. Comparison of alternatives with (C6)

	A1	**A2**	**A3**	**A4**	**A5**
A1	1	3,00	1,22	5,00	3,00
A2	0,33	1	0,35	2,45	0,99
A3	0,82	3	1	1,58	3,00
A4	0,20	0	0,63	1	0,33
A5	0,33	1,01	0,33	3,03	1
Total	2,68	8,24	3,54	13,06	8,32

For normalization calculations, priority values calculating eigenvalue, and measuring consistency can be seen in the steps above. Then the following results will be obtained:

Table 14. Alternative comparison results with each criterion

	C1	**C2**	**C3**	**C4**	**C5**	**C6**
A1	0,147	0,229	0,343	0,122	0,264	0,365
A2	0,439	0,259	0,242	0,492	0,291	0,130
A3	0,081	0,093	0,187	0,153	0,203	0,282
A4	0,136	0,118	0,075	0,079	0,065	0,084
A5	0,197	0,300	0,152	0,154	0,177	0,138

The value data above is the priority value resulting from the calculation of alternative comparisons with each criterion, then an alternative ranking will be obtained which is shown in Table 15 below:

Table 15. Alternative Ranking

Name	**Total Value**	**Ranking**
MR	1,855	1
Inpari 42	1,470	2
Ciherang	1,119	3
Inpari 32	1,000	4
Ciliwung	0,558	5

From Table 15 above, it is obtained that MR gets the first rank with a value of 1.855, Inpari 42 = 1.470, Ciherang = 1.119, Inpari 32 = 1.000, and Ciliwung = 0.558.

CONCLUSION

The results showed that this research will produce a system that can help farmers choose the best rice seeds that suit their needs in Madang Suku 1 District based on the criteria that have been set, namely Yield Potential, Pest Resistance, Soil Type, Price, Season and Rice Texture. So the system produces the highest value of 1.855 obtained by MR, Inpari 42 = 1.470, Ciherang = 1.119, Inpari 32 = 1.000, and Ciliwung = 0.558. So the quality rice seeds recommended by researchers are the MR and Inpari 42 varieties as the best rice seeds that suit the conditions of agricultural land in Madang Suku 1 District.

REFERENCES

Economy, "INDONESIA ECONOMIC GROWTH TRIWULAN II-2013 INDONESIA ECONOMY TRIWULAN II-2013 GROWS 5.81 PERCENT," 2013.

D. Adittia, N. Hidayat, and F. Abdurrachman Bachtiar, "Application of the Analytical Hierarchy Process-Simple Additive Weighting (AHP-SAW) Method in Determining Superior Rice Varieties," 2018. [Online]. Available: http://j-ptiik.ub.ac.id

R. Adawiyah, H. Harpowo, and M. Z. Mazwan, "Welfare Analysis of Rice Farmers in Jurangsapi Village, Tapen Subdistrict, Bondowoso Regency Before and During the Covid-19 Pandemic," AGRIMOR, vol. 8, no. 3, pp. 101-107, Aug. 2023, doi: 10.32938/ag.v8i3.1735.

V. Destiana, "Comparative Analysis of Cost of Goods and Household Income of Organic and Inorganic Rice Farmers in Karang Sari Village, Belitang III District, East Oku Regency," KAPITA: Journal of Agribusiness & Agricultural Development, vol. 1, no. 1, pp. 21-32, Jan. 2022, doi: 10.52562/kapita.v1i1.303.

I. M. Khusna and N. Mariana, "Decision Support System for Selection of Quality Rice Seedlings with AHP and Topsis Methods," Journal of Sisfokom (Information and Computer Systems), vol. 10, no. 2, pp. 162-169, Jul. 2021, doi: 10.32736/sisfokom.v10i2.1145.

D. Pribadi, R. A. Saputra, J. M. Hudin, and Gunawan, Decision Support System, vol. 1. GRAHA SCIENCE, 2020.

A. Gusema Susilowati, DECISION SUPPORT SYSTEM FOR SELECTION OF PREFERRED PADI BREEDS USING WEIGHTED PRODUCT METHOD. 2021.

I. As and N. Kurniati, "Bulletin of Information Systems and Islamic Technology Decision Support System for Selection of Superior Rice Seedlings using Topsis Method Technique for Order Preference by Similarity to Ideal Solution ABSTRACT ARTICLE INFORMATION," vol. 3, no. 4, pp. 258-267, 2022.

C. N. Insani, I. Indra, N. Arifin, and I. Indriani, "Decision Support System for Selection of Superior Rice Seeds Using AHP Method," Journal of Minfo Polgan, vol. 12, no. 1, pp. 205-210, Mar. 2023, doi: 10.33395/jmp.v12i1.12345.

I. M. Khusna and N. Mariana, "Decision Support System for Selection of Quality Rice Seedlings with AHP and Topsis Methods," Journal of Sisfokom (Information and Computer Systems), vol. 10, no. 2, pp. 162-169, Jul. 2021, doi: 10.32736/sisfokom.v10i2.1145.

A. Prasetia Nanda, E. Yunaeti Anggraeni, and J. Wisma Rini, "DECISION SUPPORT SYSTEM FOR DETERMINING THE BEST BREED OF PADI USING SIMPLE ADDITIVE WEIGHTING (SAW) METHODS Information Systems Study Program STMIKPringsewu Lampung Informatics Management Study Program STMIKPringsewu Lampung."

R. D. Widoproyo and P. A. R. Devi, "Decision Support System in Determining Position Promotion Using AHP and SMART Methods," Journal of Computer Systems and Informatics (JSON), vol. 3, no. 3, p. 223, Mar. 2022, doi: 10.30865/json.v3i3.3882.

H. T., & E. S. Sihotang, Decision Support Systems: Theory, Concepts & Implementation Methods. Cattleya Darmaya Fortuna, 2022.

G. S. Mahendra, I. Putu, and Y. Indrawan, "METHOD AHP-TOPSIS PADA SISTEM PENDUKUNG KEPUTUSAN PENENTUAN PENEMPATAN AUTOMATED TELLER MACHINE," 2020.

S. Praptomo, "Car Purchasing Decision Support System with AHP Method at Bintang Motor Muara Bungo," 2023.

S. Abadi, M. Gumanti, D. Susianto, and H. Ariningrum, "Determinants of Success Factors for Micro, Small and Medium Enterprises: Integration of Critical Success Factors (CSFs) and Analytic Hierarchy Process (AHP) Methods," MALCOM: Indonesian Journal of Machine Learning and Computer Science, vol. 3, no. 2, pp. 302-311, Nov. 2023, doi. 2023, doi: 10.57152/malcom.v3i2.946.

U. Habibah and M. Rosyda, "Decision Support System for Direct Cash Assistance Recipients of Village Funds in Pekandangan Using the AHP-TOPSIS Method," JOURNAL MEDIA INFORMATIKA BUDIDARMA, vol. 6, no. 1, p. 404, Jan. 2022, doi: 10.30865/mib.v6i1.3471.