Indonesian Student Research Journal

Vol. 1, No. 1, October 2026

Decision Support System for the Selection of the Best Employee Using the Multi-Attribute Utility Theory (MAUT) Method

Aulia Azzura1, Alika Putri2, Sindy Patmala3, Riki Maiyudi4

[1]Faculty of Computer Science, Information Systems Study Program, STMIK Royal, Kisaran, Indonesia

[2]Faculty of Computer Science, Information Systems Study Program, STMIK Royal, Kisaran, Indonesia

[3]Faculty of Computer Science, Information Systems Study Program, STMIK Royal, Kisaran, Indonesia

[4]Faculty of Computer Science, Information Systems Study Program, STMIK Royal, Kisaran, Indonesia

Email: 1azzuraaulia16@gmail.com, 2missalikha4@gmail.com, 3Cindy.fatmala20@gmail.com, 4Rikimaiyudi@gmail.com

Abstract: The selection of the best employees is one of the important aspects in a company because superior and highly competent human resources can improve productivity and company performance, as well as create qualified prospective leaders in the future. The problem occurring in the best employee selection process at PT SNI (Sumber Nelayan Indonesia) is that candidate data processing is still carried out manually and does not yet have clear assessment standards, so it takes a long time and produces assessments that are less transparent, accurate, and reliable. Therefore, a Decision Support System is needed to assist in determining the best employees objectively. This study applies the Multi-Attribute Utility Theory (MAUT) method to conduct the assessment process based on several predetermined criteria. The results of the calculation using the MAUT method show that the alternative with the highest score was obtained by Joseph Martin Sinulingga with a score of 0.654, followed by Handika Priadi Siregar with a score of 0.625, and Mailinda with a score of 0.578. Based on these results, it can be concluded that the MAUT method is able to assist the company in determining the best employees more effectively, objectively, and in a structured manner, so Joseph Martin Sinulingga was determined as the best employee at PT SNI.

Keywords: Decision Support System, Best Employee Selection, Multi-Attribute Utility Theory (MAUT), PT SNI

Received June 2026 / Revised October 2026 / Accepted November 2026

1. INTRODUCTION

Employees are an important asset for a company to survive, grow, and compete with other companies. In an increasingly competitive business world, businesses must strive harder to improve quality, one of which is human resources [1]. High-quality employees are one of the components that determine a company's success. High-quality employees will help the company manage its activities so that the established goals can be achieved [2].

UD. Sumber Nelayan was founded due to the abundance of rebon shrimp produced by the sea along the coast of North Sumatra in 1983. Since its establishment, the company has successfully processed fresh rebon shrimp into shrimp paste (terasi) of the best quality and has created decent jobs. In 2014, UD Sumber Nelayan

transformed into a legally incorporated company, PT. Sumber Nelayan Indonesia. Over time, PT. Sumber Nelayan Indonesia began producing cooking seasonings with authentic Indonesian flavors [3]. This was done to further improve the company's performance so that it can compete better at the national level and can reach and sell high-quality products to the Indonesian people. Periodically, employees who meet the predetermined criteria will be awarded as the best employees. The best employees are those who behave in a manner consistent with the company's vision, mission, goals, culture, and values [4].

There are several previous studies that can serve as references, namely "Implementation of the Multi Attribute Utility Theory (MAUT) Method in a Decision Support System for Determining Credit Recipients". After the decision support system was used to determine credit recipients at PT. XYZ using the Multi Attribute Utility Theory (MAUT) method [5]. In the study "Decision Support System for Selecting the Best Housing Using the TOPSIS Method", after TOPSIS testing, it was found that of three housing samples, the third housing had a higher preference value of 0.6456, indicating that it was the best housing. Therefore, the TOPSIS method can produce faster and more accurate calculation results, and the information it produces can be used to support your decisions [6]. In the study "Design of an Employee Bonus Determination Information System Using the MAUT Method", the TOPSIS method was used to assess employee performance using the highest value option, allowing certain employees to receive the largest bonuses. This calculation method can facilitate employee performance assessment [7].

This research will create a decision support system called "Decision Support System for the Selection of the Best Employee Using the MAUT Method" based on the decision-making problem statement. This assessment is carried out every month and will give an award to the best employee based on several assessment points [8]. The authors hope that these two methods will produce effective and efficient results in determining high-achieving employees, and they may also recommend further research on determining high-achieving employees [9].

2. THEORETICAL FRAMEWORK

2.1 Decision Support System

A Decision Support System is a computer-based system that has the ability to provide suggestions for the decision-making process [10]. A DSS is a technique that can be designed with alternative data and criteria; if such data are available, then all problems or issues can be solved with a DSS [11].

To assist in decision making, a system designed based on usage needs is used to make decisions. Previously determined criteria and options are used to make these decisions, and weighting, which is structured and programmed in the form of weights, can be collected and normalized to produce a ranking [12].

2.2 Multi-Attribute Utility Theory (MAUT) Method

The final evaluation method is Multi-Attribute Utility Theory (MAUT), where v(x) of an object x is the weight summed with a value relevant to its dimensional value. Utility value is the term commonly used to describe it [13]. MAUT is used to convert various interests into numerical values on a scale of 0–1. A value of 0 indicates the worst option, and a value of 1 indicates the best option [14]. To start the Multi Attribute Utility Theory (MAUT) calculation, a decision matrix must be created using the following formula:

$$V(x) = \Sigma W_i V_i(x) \quad \ldots\ldots (1)$$

The function to normalize each attribute $v_i(x)$ into a 0–1 scale is called U(x), expressed by the following formula:

$$U(x) = (X - X_i^-) / (X_i^+ - X_i^-) \quad \ldots\ldots (2)$$

In the MAUT method, the total weight w_i is 1:

$$\Sigma W_i = 1 \quad (3)$$

2.3 Employee Performance Appraisal

Performance appraisal is a process to identify employees' strengths and areas of development, providing a basis for decision making regarding promotions, skills development, and recognition of good performance. Performance appraisal is not only a tool to determine individual success, but also to shape employees' personal and professional development and to provide a basis for management decisions regarding promotion, awards, or further development. With an effective performance appraisal process, companies can create a work environment that supports employee growth and improves overall organizational performance [12]. Employee performance appraisal is a critical process in human resource management that aims to measure, evaluate, and provide feedback on individual performance in the context of their work. This process involves collecting data from various sources, including supervisor evaluations, peer reviews, and employee self-assessments [15].

3. METHOD

The research stages to be carried out by the authors are as follows [16]:
1. Literature Study: At this stage, various references related to the Selection of the Best Employee using the Multi-Attribute Utility Theory (MAUT) Method are collected.
2. Problem Identification: In this process, the existing problems will be examined and how these problems can be solved will be determined.
3. Data Collection: In this process, data are collected based on research findings on the problems faced, and analyzed according to the objectives. In this case, data on the Selection of the Best Employee at PT SNI.
4. Decision Support System with the Multi-Attribute Utility Theory (MAUT) Method: the role of this method is very important in the research process. The method used is the Multi-Attribute Utility Theory (MAUT) Method. Results: This stage presents the results of the selection of the best employee at PT SNI.
5. Drawing Conclusions: its purpose is to carry out the ranking process for the selection of the best employee at PT SNI selected based on the criteria used.

4. RESULTS

Based on the data to be processed using the Multi-Attribute Utility Theory (MAUT) Method calculation, the process is as follows:

4.1 Determining the Criteria

The criteria required for the assessment of the best employee at PT Sumber Nelayan Indonesia are: Attendance, Teamwork, Responsibility, PPE Completeness, Initiative, and Length of Service.

Table 1. Criteria Data

No	Code	Criterion Name	Weight	Type
1	C1	Attendance	0.31	Cost
2	C2	Teamwork	0.17	Benefit
3	C3	Responsibility	0.21	Benefit
4	C4	PPE Completeness	0.13	Benefit
5	C5	Initiative	0.11	Benefit
6	C6	Length of Service	0.07	Benefit

The weighting of Attendance, Teamwork, Responsibility, PPE Completeness, Initiative, and Length of Service is presented in the following 5 tables.

Table 2. Attendance Assessment Data

Description	Weight
Absent 0–3 times	5
Absent 4–6 times	4
Absent 7–9 times	3
Absent 9–11 times	2
Absent >12 times	1

Table 3. Teamwork Assessment Data

Description	Weight
Able to collaborate in a team	5
Willingness to help coworkers	4
Openness to other people's ideas and input	3
Ability to listen well	2
Unwilling to cooperate	1

Table 4. Responsibility Assessment Data

Description	Weight
Ability to meet deadlines	5
Ability to solve problems	4
Concern for work results	3
Consistency in carrying out tasks	2
Much work left unfinished	1

Table 5. PPE Completeness Assessment Data

Description	Weight
Complete	5
Not wearing one item of PPE	2
Not wearing PPE	1

Table 6. Initiative Assessment Data

Description	Weight
Ability to create new solutions	4
Courage to take risks	3
Ability to evaluate	2
Takes no initiative at all	1

Table 7. Length of Service Assessment Data

Description	Weight
>5 years	5
4–5 years	4
3 years	3
2 years	2
<1 year	1

4.2 Determining the Alternatives

There are 10 alternative data for the selection of the best employee at PT Sumber Nelayan Indonesia, as follows:

Table 8. Alternative Data

No	Code	Employee Name
1	A1	Ilham Maulana
2	A2	Joseph Martin Sinulingga
3	A3	Frans Depari
4	A4	Mita Paramita
5	A5	Anggun Ramadhani Harahap
6	A6	Daniel Napitupulu
7	A7	Handika Priadi Siregar
8	A8	Mailinda
9	A9	Zaky Maulana
10	A10	Sultan Ahmad Nasution

The service frequency criterion is the frequency data of the best employee selection at PT Sumber Nelayan Indonesia. For this criterion, six sample data of the best employee selection at PT Sumber Nelayan Indonesia will be used. The following is Table 9, the sample data of the best employee selection at PT Sumber Nelayan Indonesia:

Table 9. Sample Data of the Best Employee Selection at PT Sumber Nelayan Indonesia

No	Alternative	Criteria					
		C1	C2	C3	C4	C5	C6
1	Ilham Maulana	Absent 0–3 times	Ability to listen well	Much work left unfinished	Complete	Takes no initiative at all	4–5 years
2	Joseph Martin Sinulingga	Absent 0–3 times	Ability to collaborate in a team	Adherence to deadlines	Complete	Ability to create new solutions	4–5 years
3	Frans Depari	Absent 7–9 times	Openness to other people's ideas and input	Consistency in carrying out tasks	Not wearing one item of PPE	Courage to take risks	4–5 years
4	Mita Paramita	Absent 0–3 times	Openness to other people's ideas and input	Concern for work results	Not wearing one item of PPE	Courage to take risks	<1 year
5	Anggun Ramadhani Harahap	Absent 4–6 times	Unwilling to cooperate	Adherence to deadlines	Complete	Courage to take risks	4–5 years
6	Daniel Napitupulu	Absent 9–11 times	Unwilling to cooperate	Consistency in carrying out tasks	Not wearing one item of PPE	Takes no initiative at all	2 years
7	Handika Priadi Siregar	Absent >12 times	Ability to listen well	Concern for work results	Complete	Ability to create new solutions	4–5 years
8	Mailinda	Absent >12 times	Ability to listen well	Adherence to deadlines	Not wearing one item of PPE	Courage to take risks	4–5 years
9	Zaky Maulana	Absent 9–11 times	Ability to listen well	Concern for work results	Not wearing one item of PPE	Ability to evaluate	<1 year

10	Sultan Ahmad Nasution	Absent 9–11 times	Openness to other people's ideas and input	Adherence to deadlines	Complete	Ability to evaluate	>5 years

After obtaining the best employee selection data at PT Sumber Nelayan Indonesia, criterion weights are then assigned to each best employee selection datum at PT Sumber Nelayan Indonesia. The following is Table 10, the criterion weights for each best employee selection at PT SNI:

Table 10. Criterion Weights for Each Best Employee Selection at PT SNI

	C1	C2	C3	C4	C5	C6
Ilham Maulana	5	2	1	5	1	4
Joseph Martin Sinulingga	5	5	5	5	4	4
Frans Depari	3	3	2	2	3	4
Mita Paramita	5	3	3	2	3	1
Anggun Ramadhani Harahap	4	1	5	5	3	4
Daniel Napitupulu	2	1	2	2	1	2
Handika Priadi Siregar	1	2	3	5	4	4
Mailinda	1	2	5	2	3	4
Zaky Maulana	2	2	3	2	2	1
Sultan Ahmad Nasution	2	3	5	5	2	5

4.3 Calculation Using the MAUT Method

C2, C3, C4, C5, and C6 are benefit criteria, while criterion C1 is a cost criterion. The related data can be seen below:

W = (0.31, 0.17, 0.21, 0.13, 0.11, 0.07)

After weighting each criterion, the normalized matrix values are then calculated by subtracting and dividing each criterion value by the maximum and minimum values; the maximum and minimum values are obtained from the alternative values that have been determined as calculation samples taken from 3 alternatives:

A1 = (1+1-5/5-1= 0)(2-1/5-1=0.25)(1-1/5-1=0)(5-2/5-2=1)(1-2/4-2=-0.5)(4-1/5-1=0.75)

A2 = (1+1-5/5-1=0)(5-1/5-1=1)(5-1/5-1=1)(5-2/5-2=1)(4-2/4-2=1)(4-1/5-1=0.75)

A3 = (1+1-3/5-1=0.5)(3-1/5-1=0.5)(2-1/5-1=0.25)(2-2/5-2=0)(3-2/4-2=0.5)(4-1/5-1=0.75)

The resulting normalized matrix values are then raised to the power of 2 to produce the marginal utility values U_{ij} , which will then be summed to obtain the vector value v [17]. The calculation process will then be carried out using 3 criteria:

A1 = EXP (0^2-1/1.71=0)(0.25^2-1/1.71=0.038)(0^2-1/1.71=0)(1^2-1/1.71=1.005)(-0.5^2-1/1.71=0.166)(0.75^2-1/1.71=0.442)
A2 = EXP (0^2-1/1.71=0)(1^2-1/1.71=1.005)(1^2-1/1.71=1.005)(1^2-1/1.71=1.005)(1^2-1/1.71=1.005)(0.75^2-1/1.71=0.442)
A3 = EXP (0.5^2-1/1.71=0.166)(0.5^2-1/1.71=0.166)(0.25^2-1/1.71=0.038)(0^2-1/1.71=0)(0.5^2-1/1.71=0.166)(0.75^2-1/1.71=0.442)

The resulting marginal utility values U_{ij} are then multiplied by the predetermined weights. The solution can be seen below:

W = (0.31, 0.17, 0.21, 0.13, 0.11, 0.07)
A1 = (0^0.31=0)(0.038^0.71=0.006)(0^0.21=0)(1.005^0.13=0.131)(0.166^0.11=0.018)(0.442^0.07=0.031)
A2 = (0^0.31=0)(1.005^0.71=0.171)(1.005^0.21=0.211)(1.005^0.13=0.131)(1.005^0.11=0.111)(0.442^0.07=0.031)
A3 = (0.166^0.31=0.051)(0.166^0.71=0.028)(0.038^0.21=0.035)(0^0.13=0)(0.166^0.11=0.018)(0.442^0.07=0.031)

After obtaining the results of multiplying the marginal utility values U_{ij} by the weights, they are summed to obtain the final value U_i. The solution can be seen below:

A1 = 0 + 0.006 + 0 + 0.131 + 0.018 + 0.031 = 0.186
A2 = 0 + 0.171 + 0.211 + 0.131 + 0.111 + 0.031 = 0.654
A3 = 0.051 + 0.028 + 0.008 = 0 + -0.018 + 0.031 = 0.137

The calculation for the other criteria is the same as the calculation performed above; the complete data for all criteria can be seen in the table below:

Table 11. Final Score U_i Results

Code	C1	C2	C3	C4	C5	C6	SCORE
Ilham Maulana	0.000	0.006	0.000	0.131	0.018	0.031	0.186
Joseph Martin Sinulingga	0.000	0.171	0.211	0.131	0.111	0.031	0.654
Frans Depari	0.051	0.028	0.008	0.000	0.018	0.031	0.137
Mita Paramita	0.000	0.028	0.035	0.000	0.018	0.000	0.081
Anggun Ramadhani Harahap	0.012	0.000	0.211	0.131	0.018	0.031	0.403
Daniel Napitupulu	0.137	0.000	0.008	0.000	0.018	0.003	0.166
Handika Priadi Siregar	0.312	0.006	0.035	0.131	0.111	0.031	0.625
Mailinda	0.312	0.006	0.211	0.000	0.018	0.031	0.578
Zaky Maulana	0.137	0.006	0.035	0.000	0.000	0.000	0.178
Sultan Ahmad	0.137	0.028	0.211	0.131	0.000	0.070	0.577

Nasution							

From the calculation results of the Final Value U_{ij} for the 10 best employee selection data at PT SNI, the ranking is made as follows:

Table 12. Ranking Results

Code	Score	Rank
A2	0.654	1
A7	0.625	2
A8	0.578	3
A10	0.577	4
A5	0.403	5
A10	0.186	6
A9	0.178	7
A6	0.166	8
A3	0.137	9
A4	0.081	10

Based on the MAUT calculation results for the best employee selection, the best alternative obtained is A2, namely Joseph Martin Sinulingga, with a score of 0.654.

4.4 Employee Performance Appraisal

Employee performance appraisal is a critical process in human resource management that aims to measure, evaluate, and provide feedback on individual performance in the context of their work. This process involves collecting data from various sources, including supervisor evaluations, peer reviews, and employee self-assessments [15]. With an effective performance appraisal process, companies can create a work environment that supports employee growth and improves overall organizational performance.

5. CONCLUSION

Based on the description of the problems occurring at PT SNI (Sumber Nelayan Indonesia), the best employee selection process, which is still carried out manually, causes the assessment process to take a long time and does not yet have clear assessment standards. These conditions result in assessment results that are less objective, transparent, and accurate. Therefore, a Decision Support System is needed that is able to assist the company in determining the best employee more effectively and in a structured manner by applying the Multi-Attribute Utility Theory (MAUT) method. Based on the results of the research entitled “Decision Support System for the Selection of the Best Employee Using the Multi Attribute Utility Theory (MAUT) Method”, the ranking of alternatives was obtained based on the final values generated from the MAUT method calculation process. The calculation results show that there are three alternatives with the highest scores, namely Joseph Martin Sinulingga in first place with a score of 0.654, Handika Priadi Siregar in second place with a score of 0.625, and Mailinda in third place with a score of 0.578. The application of the MAUT method in this study is able to provide more objective assessment results because each employee is assessed based on predetermined criteria. In addition, this method can help the company accelerate the decision-making process and reduce the possibility of errors or subjectivity in the assessment. Thus, it can be concluded that the MAUT method can be applied as a decision support system in the selection of the best employee at PT SNI. Based on the ranking results obtained, Joseph Martin Sinulingga is the alternative with the highest score and is therefore determined as the best employee at PT SNI. The results of this study are expected to serve as a reference for the company in evaluating and assessing employees more effectively, efficiently, and transparently in subsequent periods.

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