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## (Rekayasa Sistem dan Teknologi Informasi)

# Best Employee Decision Using Multi Attribute Utility Theory Method

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*Abstract*

*Selection of the best employee is a form of appreciation that can be shown by the company for the achievements of its employees. This appreciation can motivate employees to be more enthusiastic in improving their performance at work. Appropriate evaluation and decision-making methods need to be taken so that the best employee selection process runs objectively, transparently, and in accordance with established standards. This study aimed to select the best employee candidates at PT Kerry Express Indonesia using the multi attribute utility theory (MAUT) method. The criteria for the selection process as follows: attendance (weight = 2), output obtained (weight = 3), discipline (weight = 3), and reporting (weight= 2). The employees in this study were 30 respondents from 150 populations. The assessment was carried out for three months from January to April 2022. The calculations were carried out using the Microsoft Access tool. The results of calculations using the MAUT method show that the highest rank among all candidates has a score of 7.75 while the lowest rank had a score of 3.25. It can be concluded that the MAUT method can be used to select the best employees at PT. Kerry Express Indonesia effectively and efficiently.*

*Keywords: MAUT method, criteria, performance, best employee, decision making.*

## 1. Introduction

Appreciating employee performance can motivate employees to be more active and improve their performance at work and at the same time can be a gift from the company to employees who are considered outstanding. In companies, selecting the best employees is a valuable aspect of work management because it is part of the employee management decision-making process which can consist of training, transfers, promotions, awards, and other decisions [1],[2]. Unfortunately, the selection of employee candidates with the best performance is sometimes only limited to a due diligence assessment without taking into account the employee's ability to complete each job or performance evaluation without considering perseverance and other factors. Whereas the purpose of a performance evaluation is to motivate employees to do a good job so that the company can give appreciation which is manifested in the form of awards for the achievements obtained by its employees [3],[4]. Therefore, the company must set clear indicators in the selection of candidates and use the right decision support system so that the evaluation results become more accurate, objective, measurable, and fair, and

there is no more element of subjectivity in the selection process [5], [6].

In this study, the data needed was obtained from the Kerry Express headquartered in Cipayung, East Jakarta. The Kerry Express is a multinational logistics company that was founded in 2018 which is engaged in package delivery services with fast delivery offers and at reasonable prices. There are more than 10,000 employees, around 9,500 fleets, 500 branch offices, and serves around 15 million shipments per month. The company has 3,000 retail outlets spread across several countries, namely Thailand, Vietnam, Hong Kong, Taiwan, and Malaysia. In its management, the company has six divisions, namely the Human Resource Department (HRD) with 10 employees, Finance with 15 employees, Customer Relationships Management (CRM) with 35 employees, Information Technology (IT) with 10 employees, Operational with 75 employees, and Quality Control (QC) with 5 employees so that the total employees are 150 employees [7].

The company, which is headquartered in Cipayung, East Jakarta, evaluates employee performance every month using a predetermined weight from the company. Regarding the employee performance evaluation

process, the company evaluates the employee performance evaluation process manually without the help of the system so that it wastes a lot of time and effort. Based on the questionnaire, 68% of respondents expressed dissatisfaction when every time the best employees were announced regarding the process/mechanism and the results. Therefore, a more effective and efficient and digital-based assessment method is needed so that the employee performance evaluation process is more computerized, objective and effective.

There are many methods that can be used to evaluate employee performance and the decision-making for the selection of the best candidates, including the Analytic Hierarchy Process (AHP), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), Simple Additive Weighting (SAW), Fuzzy Multiple Attribute Decision Making (FMADM), Naïve Bayes, Weighted Product (WP), Simple Multi Attribute Rating (SMART), Profile Matching, and Multi Attribute Utility Theory (MAUT) methods [8][9][10][11][12].

The MAUT method is stated to have advantages, among others, it estimates uncertainty, to consider each solution option as a valuable utility function, which the decision maker wants to maximize in his selection. It can have utility at your disposal, which is not the quality that counts in the MCDM method [13] [14].

The multi attribute utility theory method is a ranking dimension method that is carried out by determining alternatives and criteria and then assigning weights to these criteria and then calculating the score for each alternative based on the results of reducing the weight of the alternative with the lowest weight of the criteria divided by the result of the highest weight reduction with the lowest weight of the criteria [15][16][17]. The final result of this method is the ranking of each alternative that can be used for decision making [18]. This method sorts the final score from highest to lowest.

The purpose of this study was to calculate the scores of the best candidates for employees at PT Kerry Express Indonesia using the multi attribute utility theory method using the criteria set by the company. By conducting this study, it is expected that the activities of giving rewards and motivation to employees by the company in the form of organizing the best employee selection program can be carried out efficiently and effectively and based on digital.

## 2. Research Methods

The research methodology is the design of the activities that will be carried out during the research which consists of searching, formulating, and analysing adapted to the procedures and available time where the results of which are used as a reference source for data analysis. It is needed to help address the article to the problem at hand [19].

2.1 Multi Attribute Utility Theory Method

The multi-attribute utility theory method is a quantitative comparison method that typically combines cost, risk, and benefit measurements in which each of the existing criteria has a number of alternatives that can provide solution that is closest to the expectation of the user. The alternative identification is carried out based on the results of multiplication against a predetermined priority scale so that the best and closest results from these alternatives will be taken as a solution[20][21].

This method is used to convert several alternatives into numbers on a scale of 0-1. A scale of 0 represents the worst option and a scale of 1 represents the best option so this scaling makes it possible to compare different dimensions directly. The steps for determining the best candidate using the MAUT method are as follows [22].

First, dividing decisions into individual decision.

Second, determine alternative weights for each dimension.

Third, list all options

Fourth, enter the utility for each option according to the attribute.

Fifth, multiply the utility by the weight to determine the value of each alternative like formula 1.

$$U(x) = \frac{x - xi^-}{xi^+ - xi^-} \qquad (1)$$

Where U(x) : Normalization of alternative weights x, x : alternative weight, $xi^-$ : the worst (minimum) weight of the $x^{th}$ criterion, $xi^+$ : the best (minimum) weight of the $x^{th}$ criterion.

Sixth, the final result of data processing using this method is a ranking that provides an overview of the available alternatives to be used in decision making. The overall evaluation value can be defined by followin formula 2 [23].

$$V(x) = \sum_{j=1}^{n} (W_j . X_{ij}) \qquad (2)$$

With conditions:
V(x) = evaluation value of the object $i^{th}$, $W_j$= priority weight, a weight that determines how useful the $i^{th}$ item is to other items, $x_{ij}$ = the weight of alternative, n= number of elements

2.2 Research Flow

Figure 1 illustrates the research flow In determining the best employees using the MAUT method, which includes several stages such as follows

First, identification of problems. This stage is carried out by collecting information about the activities carried out as part of the employee performance evaluation process. The information obtained can be used to identify deficiencies or weaknesses that exist in the company in order to find solutions.

Second, study of literature review is based on issues related to selecting the best employees and theories related to the MAUT method.

Third, data collection is carried out through observation, interviews, and searching for references in journals, books, articles, and other supporting theories.

Fourth, determining alternatives & criteria. This stage is the stage of identifying alternatives and determining the criteria for the best employees according to existing standards in the company.

Fifth, weighting. At this stage, the process of determining the weights related to the quality of work of employees is carried out based on the results of observations and interviews. For each criterion, the weight is determined.

Sixth, normalization and matrix multiplication. At this stage, the subtraction results between the weight of alternative of each candidate with the lowest weight criteria are divided by the subtraction results of the highest weight of criteria with the lowest weight of the criteria. From this stage, score of each candidate will be obtained to be sorted into rankings.

Seventh, Ranking. At this stage the ranking of each candidate obtained from the results of the normalization matrix multiplication is sorted. The highest score indicates the highest rank, which means that the candidate with the score is the employee with the best performance in terms of attendance, output, discipline, and reporting.
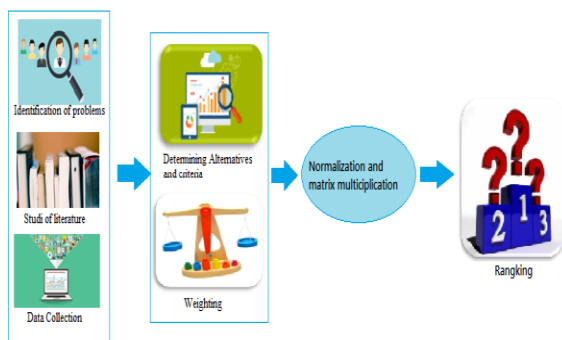


Figure 1. Research Flow

## 3. Result and Discussions

### 3.1 The block diagram of Multi Attribute Utility Theory (MAUT) Method

The process starts by inputting employee data, selecting employees as an alternative, then performing the value input process based on the criteria and sub-criteria so that the weight values on the bars and sub-criteria will be calculated using the MAUT method. The weights will be normalized and assessed using matrix calculations, then sorted by ranking the value of

employees. This will produce an output in the form of the best employee decision results with the highest final value. The block diagram flow is shown in Figure 2.
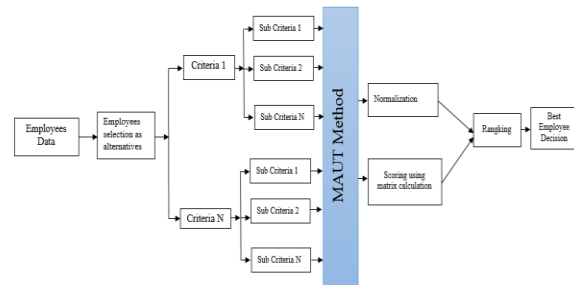


Figure 2. Block Diagram of MAUT Method

### 3.2 Alternatives Selection

In this study, the selection of candidates was conducted by taking employees from each division: Finance Division with 15 employees, Quality Control (QC) Division with 5 employees, and Information Technology (IT) Division with 10 employees. This stage is referred to as an alternative. The data for the selected candidates are presented in Table 1.

Table 1. Alternative

| No. | NIK | Initial |
| --- | --- | --- |
| 1 | 200207001 | A1 |
| 2 | 200407002 | A2 |
| 3 | 201709003 | A3 |
| 4 | 201407004 | A4 |
| 5 | 201310005 | A5 |
| 6 | 200402006 | A6 |
| 7 | 201310007 | A7 |
| 8 | 201310008 | A8 |
| 9 | 201407009 | A9 |
| 10 | 201603010 | A10 |
| 11 | 201609011 | A11 |
| 12 | 201608012 | A12 |
| 13 | 201507013 | A13 |
| 14 | 201507014 | A14 |
| 15 | 201701015 | A15 |
| 16 | 201707016 | A16 |
| 17 | 201712017 | A17 |
| 18 | 201710018 | A18 |
| 19 | 201811019 | A19 |
| 20 | 201807020 | A20 |
| 21 | 201907021 | A21 |
| 22 | 201907022 | A22 |
| 23 | 201907023 | A23 |
| 24 | 202007024 | A24 |
| 25 | 202006025 | A25 |
| 26 | 202209026 | A26 |
| 27 | 202209027 | A27 |
| 28 | 202209028 | A28 |
| 29 | 202201029 | A29 |
| 30 | 202203030 | A30 |

Data in Table 1 showed that the candidate chosen for the selection of the best employee were 30 candidates. Each candidate was assigned as alternative

### 3.3 Determining Criteria and Weighing

The criteria in selecting candidates and the weights have been determined based on company policy standards,

and are carried out based on the following criteria: candidate attendance, candidate achievement that exceeds the target every month (output), candidate discipline, and the timeliness of the candidate in making and collecting work results (reporting). The specified criteria and weights are presented in Table 2.

Table 2. Criteria and Weights

| Criteria | Initial | Weight |
|---|---|---|
| Attendance | C1 | 2 |
| Output | C2 | 3 |
| Discipline | C3 | 3 |
| Reporting | C4 | 2 |

The first step in calculating the MAUT method is to enter the sub-criteria value consisting of four sub-criteria for each alternative. Assessment data can be seen in Table 3

Table 3. Employee Assessment

| Alternative | C1 | C2 | C3 | C4 |
|---|---|---|---|---|
| A1 | 4 | 1 | 3 | 1 |
| A2 | 5 | 1 | 1 | 5 |
| A3 | 1 | 4 | 1 | 5 |
| A4 | 5 | 4 | 2 | 5 |
| A5 | 5 | 1 | 5 | 5 |
| A6 | 5 | 2 | 1 | 1 |
| A7 | 5 | 5 | 2 | 1 |
| A8 | 5 | 2 | 2 | 1 |
| A9 | 5 | 1 | 3 | 1 |
| A10 | 1 | 3 | 1 | 2 |
| A11 | 2 | 3 | 3 | 4 |
| A12 | 1 | 4 | 2 | 3 |
| A13 | 3 | 4 | 2 | 5 |
| A14 | 4 | 5 | 1 | 1 |
| A15 | 1 | 4 | 2 | 1 |
| A16 | 3 | 1 | 3 | 2 |
| A17 | 4 | 5 | 4 | 1 |
| A18 | 1 | 1 | 2 | 1 |
| A19 | 5 | 5 | 3 | 4 |
| A20 | 1 | 2 | 4 | 2 |
| A21 | 5 | 3 | 3 | 4 |
| A22 | 2 | 4 | 3 | 5 |
| A23 | 1 | 3 | 1 | 2 |
| A24 | 3 | 5 | 4 | 3 |
| A25 | 1 | 3 | 4 | 2 |
| A26 | 5 | 1 | 1 | 2 |
| A27 | 1 | 4 | 3 | 4 |
| A28 | 4 | 2 | 1 | 5 |
| A29 | 1 | 5 | 3 | 5 |
| A30 | 2 | 1 | 2 | 5 |
| Weight | 2 | 3 | 3 | 2 |

Determine the highest, lowest, and the difference between the highest and lowest values for each criterion. The calculation results of the highest, quietest, and different values can be seen in.

Table 4. Max, Min, and Difference. Values

| Score | C1 | C2 | C3 | C4 |
|---|---|---|---|---|
| Maximal | 5 | 4 | 5 | 5 |
| Minimal | 1 | 1 | 1 | 1 |
| Selisih | 4 | 3 | 4 | 4 |

3.4 Normalization and Matrix Multiplication

Furthermore, the normalization matrix was carried out on each employee value using equation (2) with an example calculation for one of the alternative names as follows:

Alternative: Anisah (A1)

$$A1_{(1)} = \frac{4-1}{5-1} = 0.75$$

$$A1_{(2)} = \frac{1-1}{4-1} = 0$$

$$A1_{(3)} = \frac{3-1}{5-1} = 0.5$$

$$A1_{(4)} = \frac{1-1}{5-1} = 0$$

The calculation of the normalization of the first criteria from the highest and lowest values (Utility) can be seen in Table 5.

Then calculate the results of the calculation of the normalization of the criteria multiplied by the weight using equation (1) with the following calculation example:

A1 = (0.75*2) + (0*3) + (0.5*3) + (0*2)
= 1.5 + 0 + 1.5 + 0 = **3**

The preference weight of each criterion can be seen in Table 2.

Table 5. Normalisasi Utilitas

| No | Alternative | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|
| 1 | 200207001 | 0.75 | 0 | 0.5 | 0 |
| 2 | 200407002 | 1 | 0 | 0 | 1 |
| 3 | 201709003 | 0 | 1 | 0 | 1 |
| 4 | 201407004 | 1 | 1 | 0.25 | 1 |
| 5 | 201310005 | 1 | 0 | 1 | 1 |
| 6 | 200402006 | 1 | 0.33 | 0 | 0 |
| 7 | 201310007 | 1 | 1.33 | 0.25 | 0 |
| 8 | 201310008 | 1 | 0.33 | 0.25 | 0 |
| 9 | 201407009 | 1 | 0 | 0.5 | 0 |
| 10 | 201603010 | 0 | 0.67 | 0 | 0.25 |
| 11 | 201609011 | 0.25 | 0.67 | 0,5 | 0.75 |
| 12 | 201608012 | 0 | 1 | 0.25 | 0.5 |
| 13 | 201507013 | 0.5 | 1 | 0.25 | 1 |
| 14 | 201507014 | 0.75 | 1.33 | 0 | 0 |
| 15 | 201701015 | 0 | 1 | 0.25 | 0 |
| 16 | 201707016 | 0.5 | 0 | 0.5 | 0.25 |
| 17 | 201712017 | 0.75 | 1.33 | 0.75 | 0 |
| 18 | 201710018 | 0 | 0 | 0.25 | 0 |
| 19 | 201811019 | 1 | 1.33 | 0.5 | 0.75 |
| 20 | 201807020 | 0 | 0.33 | 0.75 | 0.25 |
| 21 | 201907021 | 1 | 0.67 | 0.5 | 0.75 |
| 22 | 201907022 | 0.25 | 1 | 0.5 | 1 |
| 23 | 201907023 | 0 | 0.67 | 0 | 0.25 |
| 24 | 202007024 | 0.5 | 1.33 | 0.75 | 0.5 |
| 25 | 202006025 | 0 | 0.67 | 0.75 | 0.25 |
| 26 | 202209026 | 1 | 0 | 0 | 0.25 |
| 27 | 202209027 | 0 | 1 | 0.5 | 0.75 |

| 28 | 202209028 | 0.75 | 0.33 | 0 | 1 |
| 29 | 202201029 | 0 | 1.33 | 0.5 | 1 |
| 30 | 202203030 | 0.25 | 0 | 0.25 | 1 |
| Weight | | 2 | 3 | 3 | 2 |

| 22 | Renny | 7 |
| 23 | Reza | 2.5 |
| 24 | Asyifa | 8.25 |
| 25 | Rizky | 4.75 |
| 26 | Sakha | 2.5 |
| 27 | Sarah | 6 |
| 28 | Sari Juna | 4.5 |
| 29 | Selvy | 7.5 |
| 30 | Serin | 3.25 |

The results of the calculation of normalization times the weight value can be seen in Table 6.

Table 6. Normalization Results x Weight

| No | Alternative | C1 | C2 | C3 | C4 |
|---|---|---|---|---|---|
| 1 | 200207001 | 1.5 | 0 | 1.5 | 0 |
| 2 | 200407002 | 2 | 0 | 0 | 1 |
| 3 | 201709003 | 0 | 3 | 0 | 1 |
| 4 | 201407004 | 2 | 3 | 0.75 | 1 |
| 5 | 201310005 | 2 | 0 | 3 | 1 |
| 6 | 200402006 | 2 | 1 | 0 | 0 |
| 7 | 201310007 | 2 | 4 | 0.75 | 0 |
| 8 | 201310008 | 2 | 1 | 0.75 | 0 |
| 9 | 201407009 | 2 | 0 | 1.5 | 0 |
| 10 | 201603010 | 0 | 2 | 0 | 0.25 |
| 11 | 201609011 | 0.5 | 2 | 1.5 | 0.75 |
| 12 | 201608012 | 0 | 3 | 0.75 | 0.5 |
| 13 | 201507013 | 1 | 3 | 0.75 | 1 |
| 14 | 201507014 | 1.5 | 4 | 0 | 0 |
| 15 | 201701015 | 0 | 3 | 0.75 | 0 |
| 16 | 201707016 | 1 | 0 | 1.5 | 0.25 |
| 17 | 201712017 | 1.5 | 4 | 2.25 | 0 |
| 18 | 201710018 | 0 | 0 | 0.75 | 0 |
| 19 | 201811019 | 2 | 4 | 1.5 | 0.75 |
| 20 | 201807020 | 0 | 1 | 2.25 | 0.25 |
| 21 | 201907021 | 2 | 2 | 1.5 | 0.75 |
| 22 | 201907022 | 0.5 | 3 | 1.5 | 1 |
| 23 | 201907023 | 0 | 2 | 0 | 0.25 |
| 24 | 202007024 | 1 | 4 | 2.25 | 0.5 |
| 25 | 202006025 | 0 | 2 | 2.25 | 0.25 |
| 26 | 202209026 | 2 | 0 | 0 | 0.25 |
| 27 | 202209027 | 0 | 3 | 1.5 | 0.75 |
| 28 | 202209028 | 1.5 | 1 | 0 | 1 |
| 29 | 202201029 | 0 | 4 | 1.5 | 1 |
| 30 | 202203030 | 0.5 | 0 | 0.75 | 1 |
| Weight | | 2 | 3 | 3 | 2 |

The final stage determines the total value for each alternative which will then be ranked based on the order of the largest value to the smallest value. The final results can be seen in Table 7.

Table 7. Final Results

| No | Alternatives | Total Score |
|---|---|---|
| 1 | Anisah | 3 |
| 2 | Erlia | 4 |
| 3 | Tubagus | 5 |
| 4 | Rahmita | 7.75 |
| 5 | Aldian | 7 |
| 6 | Agung | 3 |
| 7 | Ahmad | 6.75 |
| 8 | Aji Yudha | 3.75 |
| 9 | Huda | 3.5 |
| 10 | Maulana | 2.5 |
| 11 | Cecep | 5.5 |
| 12 | Dio Anjas | 4.75 |
| 13 | Zainuddin | 6.75 |
| 14 | Erza | 5.5 |
| 15 | M. Agung | 3.75 |
| 16 | Prabowo | 3 |
| 17 | Pandji | 7.75 |
| 18 | Reinhad | 0.75 |
| 19 | Ricky | 9 |
| 20 | William | 3.75 |
| 21 | Rama | 7 |

The matrix multiplication result are presented in Table 8.

Table 8. Matrix Multiplication Result in Score Form

| No | Alternatives | Total Score | Ranking |
|---|---|---|---|
| 1 | 201811019 | 9 | 1 |
| 2 | 202007024 | 8,25 | 2 |
| 3 | 201407004 | 7,75 | 3 |
| 4 | 201712017 | 7,75 | 3 |
| 5 | 202201029 | 7,5 | 4 |
| 6 | 201310005 | 7 | 5 |
| 7 | 201907021 | 7 | 5 |
| 8 | 201907022 | 7 | 5 |
| 9 | 201310007 | 6,75 | 6 |
| 10 | 201507013 | 6,75 | 6 |
| 11 | 202209027 | 6 | 7 |
| 12 | 201609011 | 5,5 | 8 |
| 13 | 201507014 | 5,5 | 8 |
| 14 | 201709003 | 5 | 9 |
| 15 | 201608012 | 4,75 | 10 |
| 16 | 202006025 | 4,75 | 10 |
| 17 | 202209028 | 4,5 | 11 |
| 18 | 200407002 | 4 | 12 |
| 19 | 201310008 | 3,75 | 13 |
| 20 | 201701015 | 3,75 | 13 |
| 21 | 201807020 | 3,75 | 13 |
| 22 | 201407009 | 3,5 | 14 |
| 23 | 202203030 | 3,25 | 15 |
| 24 | 200207001 | 3 | 16 |
| 25 | 200402006 | 3 | 16 |
| 26 | 201707016 | 3 | 16 |
| 27 | 201603010 | 2,5 | 17 |
| 28 | 201907023 | 2,5 | 17 |
| 29 | 202209026 | 2,5 | 17 |
| 30 | 201710018 | 0,75 | 18 |

3.5 Ranking

Based on the score of each alternative obtained from the matrix multiplication of normalization, the ranking of each candidate were then be determined based on the score. The rank of each candidate is presented in Table 8.

Table 8. Ranking

| Ranking | Alternatives |
|---|---|
| 1 | 201811019 |
| 2 | 202007024 |
| 3 | 201407004 |
| 3 | 201712017 |
| 4 | 202201029 |
| 5 | 201310005 |
| 5 | 201907021 |
| 5 | 201907022 |
| 6 | 201310007 |
| 6 | 201507013 |
| 7 | 202209027 |
| 8 | 201609011 |
| 8 | 201507014 |
| 9 | 201709003 |

| 10 | 201608012 |
|----|-----------|
| 10 | 202006025 |
| 11 | 202209028 |
| 12 | 200407002 |
| 13 | 201310008 |
| 13 | 201701015 |
| 13 | 201807020 |
| 14 | 201407009 |
| 15 | 202203030 |
| 16 | 200207001 |
| 16 | 200402006 |
| 16 | 201707016 |
| 17 | 201603010 |
| 17 | 201907023 |
| 17 | 202209026 |
| 18 | 201710018 |

Based on preference value ranking of all the alternatives in Table 8, several alternatives have the same preference value to obtain the same rating value. The ranking results show that there are 18 rankings in the MAUT calculation results, with 8 equal rankings.

The selection of the best employees using the the multi-attribute utility theory method shows that the ranking of the candidates as the best employee is obtained from the determination of candidates as alternative. Based on the data of each candidate regarding the criteria predetermined before and the assignment of weights of the criteria, the score of each candidate can be obtained to use to determine the rank of each candidate. It is shown that the MAUT method can be used by the company to make a decision regarding employees who are entitled to receive awards for their performance at work in efficient and effective ways.

## 4. Conclusion

Based on the research that has been done, the researchers can conclude that The results of the selection of the best employees using the MAUT method showed of the 30 candidates who became alternatives based on the calculation of the data of candidates related to their attendance, output, discipline, and reports provided by the company which were then used as the criteria for determining the best candidate in the MAUT method, the results obtained were that the highest rank among all candidates had a score of 9 points while the lowest score was 0,75 points. In addition, by using the MAUT method can carry out the selection transparently and objectively because the criteria in selecting candidates and the weights have been determined based on company policy standards and are carried out based on the following criteria: candidate attendance, candidate achievement that exceeds the target each month (output), discipline candidates, and timeliness of candidates in making and collecting work results (reporting). Furthermore, Based on the results of this study, we can conclude that we can use the multi-attribute utility theory (MAUT) method to select the best employees at PT Kerry Express Indonesia.

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