Simple multi attribute rating technique (SMART) method on employee promotions

E Oktaviandi, N Komala, and F Nugrahani

Politeknik Negeri Jakarta, Indonesia
euis.oktaviandi@tik.pnj.ac.id

Abstract. Nowadays, many employee promotions in Indonesia are still done manually, so there are a lot of errors occur during the score calculation and also document loss. That’s why a system that can automatically calculate the results of promotions and provide recommendations for candidates who are eligible to be promoted is needed. SMART is chosen as a method in decision support system. The criterias set by HRD consist of experience, potential result, and performance value. The superior’s assessment of the normalization value of each criteria’s is 0.2 for experience, 0.4 for potential result, 0.3 of performance value and 0.1 of supervisor’s assessment. The results obtained between the system and the SMART methods are the same.

Keywords - SMART method, decision support system, promotion

1. Introduction
The promotion starts with the vacant position that must be filled, then the HRD staffs will be looking for the criteria required. Then, The HRD does the screening for employees who meet these criteria, assessment results, and the conditions of the promotion. The names of the employees who meet the criteria standards then will be submitted to the General Manager and will be discussed at the committee meeting. The results of the meeting is issued to announce who is appointed and eligible to be promoted.

In determining the names of employees who will be promoted, the HRD is still experiencing problems due to only using Ms. Excel. So, it takes about one or two weeks to work on the process, because the company has quite a number of employees. The criteria and value of each position often changes so that the process of selecting candidates becomes quite difficult, and errors occur in calculating the final score (Ariza, 2018).

Problem solving can be done by designing and making decision support systems to determine which candidates will be promoted according to the criteria required in each position. This system will determine the ranking of candidates who will be promoted according to the predetermined flow. With this system, the process of selecting candidates to be promoted will be easier and take shorter time.

2. Literature Review
2.1 Decision Support System
Decision support system (DSS) is an information system that helps to identify the opportunity decisions or provide information to assist in decision making process. It is also used to improve the process and quality of the decision-making results. DSS was built to produce the assessment calculation based on subjective and objective assessment criteria using 5C: character, capacity, capital, collateral and condition. The value of each criterion as the result of the weight vector, obtained from the input value of the comparison criteria which generates a sequence of the most recommended customers data. [1].
The goal of DSS is to help decision makers choose various alternative decisions through the process of obtaining information by using a decision-making model. The selected candidates are generated using the method of product value. Means, the system performs the calculation process of alternative data based on the criterion and denominates criteria by using the value of the interest rate. Based on the test result data of 4 (four) potential employees, it brings the rank of vector V according to their value, in which the most vector V value is seen as the main alternative candidates on new promoted employees [2].

2.2 SMART Method
The SMART (Simple Multi Attribute Rating Technique) method is a method that can solve multi-criteria decision-making problems. This method is a decision-making method developed by Edward in 1997. This multi-criteria decision-making technique is based on the theory that each alternative consists of a number of criteria that have values and each criterion has a weight that describes its importance level compared to other criteria. [4]

The formulas used in SMART are:

\[ u(a_i) = \sum_{j=1}^{m} w_j u_i(a_i), \quad i = 1, 2, ..., m \] (1)

Information:
- \( w_i \) = j-weighting criteria and k criteria.
- \( u(a_i) \) = i utility criteria value for criteria i.

The order in using the SMART method is as follows [5]:
1. Determining the number of used criteria
2. Determining the value for each criterion using the 1-100 intervals for each criterion with the most important priority
3. Calculating the normalization of each criterion by comparing the criteria generating values with the number of criteria weights.
4. Providing criteria parameter values of each criterion for each alternative.
5. Determining utility value by converting criteria values on each criterion to standard data criteria values.
6. Determining the final value of each criterion by diverting the value obtained from the normalization of the standard data criterion value with the normalization value of the criteria weight. Then adding the value of the multiplication.

\[ u(a_i) = \sum_{j=1}^{m} w_j u_i(a_i) \] (2)

Where \( u(a_i) \) is the total alternative values, \( w_j \) is the result of normalizing the criteria weight and \( u_i(a_i) \) is the result of determining the value of the utility.

3. Result
3.1 Application Program Description
Employee promotion decision support system is a system to assist the selection process of employee candidates who will be promoted according to the required positions. In this decision system, there are three roles namely admin, employee and manager. Admin is responsible for managing employee data, account data, employee talent data, and employee job history data. Managers are responsible for carrying out supervisor ratings while employees can see the results of the assessment. To determine the promotion process, admin staff can choose vacant positions that require suitable employees in accordance with the predetermined potential chart.
Furthermore, employees can fill out an approval form to clarify their willingness to occupy structural positions or to occupy functional positions. If the employee approves to occupy a structural position, the manager can evaluate the employer according to the aspects that have been determined. After all assessment, data can be processed based on the criteria and value that have been set and the ranking of the candidates who will be promoted will be obtained. Each employee can see the results of his own assessment and notification if he becomes a candidate to be promoted.

3.2 Application Program Design
Users can choose the employee promotion menu and the system will display the company's organization chart page. After that, they can choose a position and the system will display the employee candidate page that matches the position. Then, after clicking the results button, the system will display the ranking results of the employee candidates. The processes are shown in Figure 1, 2 and 3.
3.2.1 SMART Method Implementation

- Determine the number of criteria. In this system, there are four criteria needed based on the General Manager Regulation of PT. PLN Corporate University is shown in Table 1.

| Criteria | Weight |
|----------|--------|
| Work Experience (Experience) | 20% |
| Potential results | 40% |
| Performance Assessment | 30% |
| Assessment of superiors | 10% |

- Determine the weight of the criteria in each sub-criteria by using the interval 1-100 for each criterion with the most important priority as shown in Table 2. The weight is in accordance with the General Manager Regulation of PT. PLN Corporate University.

- Calculate the normalization of each criterion by comparing the weighting criteria with the number of criteria weights. Table 3 is the result of normalization of each criterion. Providing criteria values for each alternatives, this experiment uses 26 alternatives that will be rated as in Table 4.

| Sub criteria | Value |
|--------------|-------|
| Optimization | 100 |
| System       | 90    |

**Table 1. Criteria for increasing employee position**

| Criteria | Weight |
|----------|--------|
| Work Experience (Experience) | 20% |
| Potential results | 40% |
| Performance Assessment | 30% |
| Assessment of superiors | 10% |

**Table 2. Sub criteria**

| No. | Criteria | Value |
|-----|----------|-------|
| 1   | Optimization | 100 |
| 2   | System     | 90    |
| 3   | Optimization | 100 |
| 4   | System     | 90    |

**Table 3. Normalization of each criterion**

**Figure 3. Ranking Results page**
Never Occupied Structural Level Position in All Units 70
Specific
Have Occupied Top Supervisors Position in All Units and Functional 100
Position at Training Center
Have Occupied Top Supervisors Position in All Units 90
Have Occupied Basic Supervisor Position in all Units 80
Never Occupied Structural Level Position in All Units 70

2
Recommended (Priority I) 100
Recommended with Little Development (Priority II) 80
Recommended with intensive development (Priority III) 50

3
LBS 100
SOP/SPO 90
OPT 80
POT 50
KPO/PPS/PPE/SPP 0

4
Highly recommended 100
Recommended 80
Less recommended 50

Table 3. Results of normalization in each criterion

| Criteria Weight | Normalization |
|-----------------|---------------|
| Work Experience | 20% 0.2       |
| Potential results | 40% 0.4   |
| Performance Assessment | 30% 0.3 |
| Assessment of superiors | 10% 0.1 |

Table 4. Values in each alternative

| Alternative | Criteria 1 | Criteria 2 | Criteria 3 | Criterion 4 |
|-------------|------------|------------|------------|-------------|
| Alternative 1 | 90         | 50         | 86.6667    | 80          |
| Alternative 2 | 80         | 50         | 60         | 80          |
| Alternative 3 | 80         | 100        | 80         | 80          |
| Alternative 4 | 80         | 50         | 60         | 80          |
| Alternative 5 | 80         | 50         | 70         | 100         |
| Alternative 6 | 90         | 50         | 60         | 80          |
| Alternative 7 | 80         | 50         | 70         | 50          |
| Alternative 8 | 90         | 50         | 86.6667    | 80          |
| Alternative 9 | 70         | 50         | 70         | 50          |
| Alternative 10 | 90         | 80         | 70         | 80          |
| Alternative 11 | 90         | 80         | 50         | 80          |
| Alternative 12 | 90         | 80         | 70         | 80          |
| Alternative 13 | 90         | 50         | 33.3333    | 80          |
| Alternative 14 | 80         | 50         | 80         | 100         |
| Alternative 15 | 80         | 50         | 86.6667    | 80          |
| Alternative 16 | 80         | 80         | 80         | 50          |
| Alternative 17 | 80         | 80         | 60         | 80          |
| Alternative 18 | 80         | 80         | 80         | 50          |
| Alternative 19 | 80         | 50         | 60         | 80          |
| Alternative 20 | 80         | 50         | 70         | 50          |
| Alternative 21 | 80         | 80         | 73.3333    | 100         |
| Alternative 22 | 80         | 50         | 73.3333    | 50          |
| Alternative 23 | 80         | 50         | 80         | 100         |
| Alternative 24 | 80         | 80         | 73.3333    | 50          |
| Alternative 25 | 80         | 50         | 86.6667    | 80          |
| Alternative 26 | 80         | 80         | 80         | 80          |
• Determine utility value by converting criteria values on each criterion to standard data criteria values. Table 5 is the result of the utility value for each alternative value.

| Alternative | Utility value 1 | Utility value 2 | Utility value 3 | Utility value 4 |
|-------------|-----------------|-----------------|-----------------|-----------------|
| Alternative 1 | 0.666667 | 0 | 0.866667 | 0.6 |
| Alternative 2 | 0.333333 | 0 | 0.6 | 0.6 |
| Alternative 3 | 0.333333 | 1 | 0.8 | 0.6 |
| Alternative 4 | 0.333333 | 0 | 0.6 | 0.6 |
| Alternative 5 | 0.333333 | 0 | 0.7 | 1 |
| Alternative 6 | 0.666667 | 0 | 0.6 | 0.6 |
| Alternative 7 | 0.333333 | 0 | 0.7 | 0 |
| Alternative 8 | 0.666667 | 0 | 0.866667 | 0.6 |
| Alternative 9 | 0 | 0 | 0.7 | 0 |
| Alternative 10 | 0.666667 | 0.6 | 0.7 | 0.6 |
| Alternative 11 | 0.666667 | 0.6 | 0.5 | 0.6 |
| Alternative 12 | 0.666667 | 0.6 | 0.7 | 0.6 |
| Alternative 13 | 0.666667 | 0 | 0.333333 | 0.6 |
| Alternative 14 | 0.333333 | 0 | 0.8 | 1 |
| Alternative 15 | 0.333333 | 0.6 | 0.866667 | 0.6 |
| Alternative 16 | 0.333333 | 0.6 | 0.8 | 0 |
| Alternative 17 | 0.333333 | 0.6 | 0.6 | 0.6 |
| Alternative 18 | 0.333333 | 0.6 | 0.8 | 0 |
| Alternative 19 | 0.333333 | 0 | 0.6 | 0.6 |
| Alternative 20 | 0.333333 | 0 | 0.7 | 0 |
| Alternative 21 | 0.333333 | 0.6 | 0.333333 | 1 |
| Alternative 22 | 0.333333 | 0 | 0.333333 | 0 |
| Alternative 23 | 0.333333 | 0 | 0.8 | 1 |
| Alternative 24 | 0.333333 | 0.6 | 0.333333 | 0 |
| Alternative 25 | 0.333333 | 0 | 0.866667 | 0.6 |
| Alternative 26 | 0.333333 | 0.6 | 0.8 | 0.6 |

4. Conclusions
To analyze the results obtained from the system, first the system accuracy test will be carried out by comparing the calculation results obtained manually with the results of calculations obtained from the decision support system. The test was carried out using 26 assessment data. Table 6 shows the results of the tests that have been carried out.

| Alternative | Calculation |
|-------------|-------------|
| SMART Method | System |
| Candidate 1 | 0.4533 | 0.4533 |
| Candidate 2 | 0.3067 | 0.3067 |
| Candidate 3 | 0.7667 | 0.7667 |
| Candidate 4 | 0.3067 | 0.3067 |
| Candidate 5 | 0.3767 | 0.3767 |
| Candidate 6 | 0.3733 | 0.3733 |
| Candidate 7 | 0.2767 | 0.2767 |
| Candidate 8 | 0.4533 | 0.4533 |
| Candidate 9 | 0.21 | 0.21 |
| Candidate 10 | 0.6433 | 0.6433 |
| Candidate 11 | 0.5833 | 0.5833 |
|-------------|--------|--------|
| Candidate 12 | 0.6433 | 0.6433 |
| Candidate 13 | 0.2933 | 0.2933 |
| Candidate 14 | 0.4067 | 0.4067 |
| Candidate 15 | 0.6267 | 0.6267 |
| Candidate 16 | 0.5467 | 0.5467 |
| Candidate 17 | 0.5467 | 0.5467 |
| Candidate 18 | 0.5467 | 0.5467 |
| Candidate 19 | 0.3067 | 0.3067 |
| Candidate 20 | 0.2767 | 0.2767 |
| Candidate 21 | 0.6267 | 0.6267 |
| Candidate 22 | 0.2867 | 0.2867 |
| Candidate 23 | 0.4067 | 0.4067 |
| Candidate 24 | 0.5267 | 0.5267 |
| Candidate 25 | 0.3867 | 0.3867 |
| Candidate 26 | 0.6067 | 0.6067 |

Based on Table 6, the first rank obtained by candidate 3 has the highest value of 0.7667 and the last rank obtained by candidate 9 has the lowest result of 0.21. If there are candidates with the same value, the system will recalculate and rank the process based on the criteria and the biggest weighting of the assessment.

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