Determining Outstanding Employee Using Simple Multi-Attribute Rating Technique Method

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Abstract. Employees are one of the resources used as a means of movement in promoting a company. Employee performance is highly influential on the profits obtained by the company. Therefore, to stimulate employee performance in selecting outstanding employees each period by providing additional bonuses or salaries for selected employees. However, because the process of evaluating and selecting outstanding employees carried out by managers of Human Resource Development (HRD) still uses a conventional system and takes a lot of time, so a decision support system is needed to evaluate the performance of HRD managers to be more effective and efficient while saving time and energy compared to the current system. For this reason, the author proposes a decision support system and was used to determine outstanding employee by using the simple multi-attribute rating technique (SMART) method. The Decision Support System Application applies the SMART method to help decision maker to determine the outstanding employee and based on the table above, it was concluded that the employee recommended as an outstanding employee is employee C with the highest final score of 66.20.

1. Introduction

The development of Information Technology has now progressed very rapidly and computer media has an important role in data processing because it can produce accurate, precise and efficient information. Accurate means the information produced is free from errors and can reflect the intent and purpose so that it can produce a computerized information system. As time goes by, along with the development of the business world with the emergence of large companies in the world. Both in terms of business and human aspects must be aligned and in line so that the company can run smoothly. A factor could be represented by more than one type [1]. As for some companies that cannot last long due to internal factors faced by each company. One of the factors that run the company well is the human resources section or even generally called employees.

Employees have a huge impact on the success of a company. Without sophisticated machines, companies can still manage to operate manually, but without employees, the company will not be able to run at all. Deming believes that 85% of the factors that affect the employee’s performance stem from the system which is beyond the control of the employee, only 15% of the factors are attributable to the employee [2]. Pointed to the importance of linking the performance of employees to the
attainment of organizational goals, thus improving overall organizational effectiveness [3]. Selection of the best employee aimed to improve morale and employees performance in work [4]. Every employee also competes to show their respective capabilities in order to gain achievements and occupy positions that are better than their current position. They show from work spirit, discipline, craft, teamwork, leadership, neatness, and many other aspects of assessment. Importantly, the research has found that in order to be able to describe the necessary tasks, the HR department must first understand the problems of the current state, reason about possible ways to solve them and select the optimal solutions [5].

However, for the assessment of employees and in selecting outstanding employee is very time-consuming for the HR department because it cannot be completed in a day or two but within weeks as the HRD, however, needs to analyze a lot of the employee’s data. So that one of the main problems the HRD encountered in evaluating was the high percentage of mistakes [6]. And the process is not efficient. Human decision making performance decreasing because of task overload and the limitation of human decision making is expressed by called that bounded rationality [7].

From year to year, enterprises which engaged in the field of fertilizer trading and transportation services are growing rapidly with the increasing sales figures. With the development of the company, the number of employees who work increases as well. The increasing number of employees is highly affected in making decisions to determine outstanding employee. For this reason, the author proposes a decision support system [8]. It is used to determine outstanding employee by using the SMART method.

2. Theoretical Basis
2.1. Decision Support Systems
Decision Support Systems (DSS) are part of computer-based information systems including knowledge-based systems (knowledge management) that are used to support decision-making in a company organization or educational institution. Davis defines a DSS as a mechanism which facilitates complex decision making [9]. According to Moore and Chang, Decision Support Systems can be described as a system capable of supporting data analysis and decision modeling, decision-oriented, future planning orientation and used at unusual times. Implementing DSS may reinforce the rational perspective and overemphasize decision processes and decision making [10].

A simple DSS combines a small amount of data to deal with one particular problem [11]. The development of a DSS was based on the following steps: identification of user needs, development of functional specifications, determination of the architecture, system implementation, and evaluation/validation [12].

Beginning in the early 1990s, four powerful tools emerged for building DSS. The first new tool for decision support was the data warehouse. The two new tools that emerged following the introduction of data warehouses were on-line analytical processing (OLAP) and data mining. The fourth new toolset is the technology associated with the World Wide Web which is the most permanent technology at the beginning of the 21st century [13][14]. The advent of more and better reporting technologies has seen DSS start to emerge as a critical component of management design. Examples of this can be seen in the intense amount of discussion of DSS in the education environment. DSS also has a weak connection to the user interface paradigm of hypertext. Both the University of Vermont PROMIS system (for medical decision making) and the Carnegie Mellon ZOG/KMS system (for military and business decision making) were decision support systems which also were major breakthroughs in user interface research [15].

Furthermore, although hypertext researchers have generally been concerned with information overload, certain researchers, notably Douglas Engelbart, have been focused on decision makers in particular.

2.2. Simple Multi-Attribute Rating Technique (SMART)
Simple Multi-Attribute Rating Technique (SMART) is a multi-criteria 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 describes how important it is compared to other criteria, each one having its own function. Multiple-criteria approaches allow decision makers to set priorities [16]. Believe that generated weights may be more precise than weights produced by the decision-makers who may be more comfortable and confident with a simple ranking of the importance of each criterion swing, especially if it represents the considered outcome of a group of decision-makers.

This weighting is used to assess each alternative to obtain the best alternative. This method conveniently converts importance weights into actual numbers [17]. The main equipment of this model is a functional hierarchy with the main input is human perception [18].

3. Research Methods

The research methodology in the study of determining outstanding employee in enterprises is the SMART method. This method is widely used to complete decision making [19]. And aims to create a system called Decision Support System for Determining Outstanding Employee.

SMART uses linear additive models to predict the value of each alternative. For multiple attribute decision making or classification, the underlying relationship between attributes and goal variable is often highly uncertain and imprecise [20]. This method leverages input from the decision maker to ascertain the relative importance of various attributes of proposed solutions [21]. SMART is a flexible decision-making method and is more widely used because of its simplicity in responding to the needs of decision-makers and the way it analyses responses. The analysis involved is transparent so that this method provides a high understanding of the problem and can be accepted by the decision maker. The linear utility function model used by SMART is as follows:

$$SMART = \sum_{j=1}^{k} w_j u_{ij}$$  \hspace{1cm} (1)

Where $w_j$ is the criteria-$j$ weighting value from $k$ criteria, $u_{ij}$ is an alternative utility value $i$ in criteria-$j$. Decision selection is identifying which of the $n$ alternatives have the greatest function value. This function value can also be used to rank the alternative $n$

Calculating the value of the normalization weight:

$$nw_j = \frac{w_j}{\sum_{n=1}^{k} w_n}$$  \hspace{1cm} (2)

where $nw_j$ is the normalized weight of the criteria-$j$, $w_j$ is the weight value of the criteria-$j$, $k$ is the amount of the criteria, $w_n$ is the $n$-th criteria weight.

Calculating the value of the utility:

$$u_ia_i = \frac{(Cout - Cmin)}{(Cmax - Cmin)} \times 100$$  \hspace{1cm} (3)

where $u_ia_i$ is the utility value of criteria-$j$ for the alternative $i$, $Cmax$ is the maximum criteria value, $Cmin$ is the minimum criteria value, $Cout$ is the value of criteria-$i$
4. Results

In determining the best employee in the value based on several criteria and each level of assessment that is very good has an assessment of 9 to 10; good has an assessment from 7 to 8; medium has ratings from 5 to 6; medium less has ratings from 3 to 4; less has an assessment from 1 to 2. Assessment of criteria consisting of discipline, work attitude, cooperation, workability, discussion, adaptation, work motivation, commitment, initiative, independence, leadership, work managerial and responsible.

There are few stages taken in the formulation of the SMART method in determining the outstanding employee First stage is to declare the problem, which is the determination of outstanding employee in enterprises. Stage two, determine the criteria that are used in determining outstanding employee in enterprises. Each criterion has been considered as a different feature [22]. There are 13 criteria that will be used to determine outstanding employees, these criteria consist of Discipline, Work Attitude, Teamwork, Work Ability, Discussion, Adaptation, Work Motivation, Commitment, Initiative, Independence, Initiative, Independence, Leadership, Work Management and Responsibility

Stage three is determining the alternative to enter the calculation phase. The selection of decision is made on the total set of alternatives [23]. For example, choose 3 employees.

| Table 1. Determining Alternatives |
|------------------------------------|
| Index | Criteria (K) | Employee A | Employee B | Employee C |
| K1    | Discipline   | 6          | 6          | 7          |
| K2    | Work Attitude| 6          | 6          | 7          |
| K3    | Teamwork     | 6          | 6          | 6          |
| K4    | Work Ability | 4          | 6          | 5          |
| K5    | Discussion   | 5          | 6          | 8          |
| K6    | Adaptation   | 6          | 6          | 5          |
| K7    | Work Motivation| 7       | 6          | 9          |
| K8    | Commitment   | 5          | 6          | 9          |
| K9    | Initiative   | 3          | 6          | 6          |
| K10   | Independence | 5          | 6          | 6          |
| K11   | Leaderships  | 6          | 6          | 7          |
| K12   | Work Management| 7      | 6          | 7          |
| K13   | Responsibility| 7          | 6          | 8          |

Stage four, furthermore, the weighting stage will be carried out according to the order of importance to the next step is to look for normalization of weights. At this stage, the weight of each criterion will be divided with the results of the sum of all weights based on the most important criteria.

| Table 2. Weight Comparison |
|----------------------------|
| Index | Criteria (K) | Weight (%) | Per Criteria (%) |
| K1    | Discipline   | 30         | 7,5             |
| K2    | Work Attitude| 30         | 7,5             |
| K3    | Teamwork     | 30         | 7,5             |
| K4    | Work Ability | 30         | 7,5             |
| K5    | Discussion   | 30         | 7,5             |
| K6    | Adaptation   | 30         | 5               |
Normalize the weight of criteria by using Equation (2).

### Table 3. Weight Normalization

| Index | Criteria (K)          | Weight Per Criteria (%) | Relative Weight (W_j1) |
|-------|-----------------------|-------------------------|------------------------|
| K1    | Discipline            | 7,5/100                 | 0,075                  |
| K2    | Work Attitude         | 7,5/100                 | 0,075                  |
| K3    | Teamwork              | 7,5/100                 | 0,075                  |
| K4    | Work Ability          | 7,5/100                 | 0,075                  |
| K5    | Discussion            | 5/100                   | 0,05                   |
| K6    | Adaptation            | 5/100                   | 0,05                   |
| K7    | Work Motivation       | 5/100                   | 0,05                   |
| K8    | Commitment            | 5/100                   | 0,05                   |
| K9    | Initiative            | 5/100                   | 0,05                   |
| K10   | Independence          | 5/100                   | 0,05                   |
| K11   | Leaderships           | 13,333/100              | 0,13333                |
| K12   | Work Management       | 13,333/100              | 0,13333                |
| K13   | Responsibility        | 13,333/100              | 0,13333                |

Stage five, determine the utility value based on the character of the criteria itself by using Equation (3).

Criteria (K)
Max (K) = (1,2,3,4,5,6,7,8,9,10) = 10
Min (K) = (1,2,3,4,5,6,7,8,9,10) = 1

### Table 4. Utility Value

| Index | Criteria (K)          | Employee A | Employee B | Employee C |
|-------|-----------------------|------------|------------|------------|
| K1    | Discipline            | 55,56      | 55,56      | 66,67      |
| K2    | Work Attitude         | 55,56      | 55,56      | 66,67      |
| K3    | Teamwork              | 55,56      | 55,56      | 55,56      |
| K4    | Work Ability          | 33,33      | 55,56      | 44,44      |
| K5    | Discussion            | 44,44      | 55,56      | 77,78      |
| K6    | Adaptation            | 55,56      | 55,56      | 44,44      |
Stage six, calculate the overall value of alternatives by using Equation (1):

| Index | Criteria (K)            | Employee A | Maximize |
|-------|-------------------------|------------|----------|
|       |                         | $u_i$ | $nw_j$ |          |
| K7    | Work Motivation         | 66.67 | 55.56 | 88.89    |
| K8    | Commitment              | 44.44 | 55.56 | 88.89    |
| K9    | Initiative              | 22.22 | 55.56 | 55.56    |
| K10   | Independence            | 44.44 | 55.56 | 55.56    |
| K11   | Leaderships             | 55.56 | 55.56 | 66.67    |
| K12   | Work Management         | 66.67 | 55.56 | 66.67    |
| K13   | Responsibility          | 66.67 | 55.56 | 77.78    |

**Table 5. Maximize Employee A**

| Index | Criteria (K)         | Employee A | Maximize |
|-------|----------------------|------------|----------|
|       |                      | $u_i$ | $nw_j$ |          |
| K1    | Discipline           | 55.56 | 0.075  | 4.17     |
| K2    | Work Attitude        | 55.56 | 0.075  | 4.17     |
| K3    | Teamwork             | 55.56 | 0.075  | 4.17     |
| K4    | Work Ability         | 33.33 | 0.075  | 2.50     |
| K5    | Discussion           | 44.44 | 0.05   | 2.22     |
| K6    | Adaptation           | 55.56 | 0.05   | 2.78     |
| K7    | Work Motivation      | 66.67 | 0.05   | 3.33     |
| K8    | Commitment           | 44.44 | 0.05   | 2.22     |
| K9    | Initiative           | 22.22 | 0.05   | 1.11     |
| K10   | Independence         | 44.44 | 0.05   | 2.22     |
| K11   | Leaderships          | 55.56 | 0.1333 | 7.41     |
| K12   | Work Management      | 66.67 | 0.1333 | 8.89     |
| K13   | Responsibility       | 66.67 | 0.1333 | 8.89     |
|       | **Total**            |          |         | **54.08**|

**Table 6. Maximize Employee B**

| Index | Criteria (K)        | Employee B | Maximize |
|-------|---------------------|------------|----------|
|       |                     | $u_i$ | $nw_j$ |          |
| K1    | Discipline          | 55.56 | 0.075  | 4.17     |
| K2    | Work Attitude       | 55.56 | 0.075  | 4.17     |
| K3    | Teamwork            | 55.56 | 0.075  | 4.17     |
| K4    | Work Ability        | 55.56 | 0.075  | 4.17     |
| K5    | Discussion          | 55.56 | 0.05   | 2.78     |
| K6    | Adaptation          | 55.56 | 0.05   | 2.78     |
| K7    | Work Motivation     | 55.56 | 0.05   | 2.78     |
| K8    | Commitment          | 55.56 | 0.05   | 2.78     |
| K9    | Initiative          | 55.56 | 0.05   | 2.78     |
Stage seven, determine the final value. The following table is the final value obtained:

| Index | Criteria (K)       | \(u_{ij}\) | \(nw_{ij}\) | Maximize |
|-------|-------------------|-------------|--------------|----------|
| K1    | Discipline        | 66,67       | 0,075        | 5,00     |
| K2    | Work Attitude     | 66,67       | 0,075        | 5,00     |
| K3    | Teamwork          | 55,56       | 0,075        | 4,17     |
| K4    | Work Ability      | 44,44       | 0,075        | 3,33     |
| K5    | Discussion        | 77,78       | 0,05         | 3,89     |
| K6    | Adaptation        | 44,44       | 0,05         | 2,22     |
| K7    | Work Motivation   | 88,89       | 0,05         | 4,44     |
| K8    | Commitment        | 88,89       | 0,05         | 4,44     |
| K9    | Initiative        | 55,56       | 0,05         | 2,78     |
| K10   | Independence      | 55,56       | 0,05         | 2,78     |
| K11   | Leaderships       | 66,67       | 0,13333      | 8,89     |
| K12   | Work Management   | 66,67       | 0,13333      | 8,89     |
| K13   | Responsibility    | 77,78       | 0,13333      | 10,37    |

| Total | 55,59             |

### Table 7. Maximize Employee C

| Employee | Criteria Value | Final Score |
|----------|----------------|-------------|
| K1 K2 K3 K4 K5 K6 K7 K8 K9 K10 K11 K12 K13 | | |
| A 4,17 4,17 4,17 2,50 2,22 2,78 3,33 2,22 1,11 2,22 7,41 8,89 8,89 | 54,08 |
| B 4,17 4,17 4,17 4,17 2,78 2,78 2,78 2,78 2,78 2,78 7,41 7,41 7,41 | 55,59 |
| C 5,00 5,00 4,17 3,33 3,89 2,22 4,44 4,44 2,78 2,78 8,89 8,89 10,37 | 66,20 |

Stage eight, sort the Table of the final value obtained by ranking:

### Table 9. Final Results Based on the rank

| Employee | Criteria Value | Final Score |
|----------|----------------|-------------|
| K1 K2 K3 K4 K5 K6 K7 K8 K9 K10 K11 K12 K13 | | |
| C 5,00 5,00 4,17 3,33 3,89 2,22 4,44 4,44 2,78 2,78 8,89 8,89 10,37 | 66,20 |
| B 4,17 4,17 4,17 4,17 2,78 2,78 2,78 2,78 2,78 2,78 7,41 7,41 7,41 | 55,59 |
| A 4,17 4,17 4,17 2,50 2,22 2,78 3,33 2,22 1,11 2,22 7,41 8,89 8,89 | 54,08 |
5. Discussion

Based on the results of the previous table, it can be concluded that the criteria that meet as outstanding employee are employees C because the criteria obtained from each criterion are Discipline, Work Attitude, Cooperation, Work Ability, Deliberation, Adaptation, Work Motivation, Commitment Initiative, Independence, Leadership, Work Managerial, Responsibility. Employee C gets the total overall value by using the first calculation of 66.20 whereby using the same criteria and calculations each employee A gets the final score of 55.59 and employee A gets the final score of 54.08. So based on these results, employee C is an outstanding employee based on the Smart Method.

6. Conclusions

The Decision Support System Application applies the SMART method to help decision maker to determine the outstanding employee. Research efforts are also needed into the further development of solution methods and the comparison of proposed operations research techniques.

This system is only a helping tool for decision making, the final decision remains in the hands of the decision makers. Based on the direct testing at CV. Jaringan Servis Nusantara, it can be declared that the system is running well, there are no errors or bugs in the application. Although the application is still in beta, it can be used for the needs of the company in helping HRD to evaluate employees performance and determine the outstanding employee.

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