DECISION SUPPORT SYSTEMS EMPLOYEE DISCIPLINE IDENTIFICATION USING THE SIMPLE MULTI ATTRIBUTE RATING TECHNIQUE (SMART) METHOD

Rizer Fahlepi
STIKes Hang Tuah Pekanbaru
rizerf@htp.ac.id

ABSTRACT

Discipline is a very important aspect to support the quality of these human resources. If there are insufficient or undisciplined resources, it will affect the quality of human resources. In its implementation the process of evaluating employee discipline is still done manually so it takes a long time. For this reason, a decision support system is needed to identify the level of discipline of staff and employees at STIKes and STMIK Hang Tuah Pekanbaru. The method used to develop this Decision Support Systems is Simple Multi Attribute Rating Technique (SMART) with 6 attributes, namely performance, warning letters, absenteeism, discipline, complience to regulations, and compliance to superior's order. The final result are divided into 3 categories, namely Very Good, Enough, Do Coaching. From the application of this method, it was found that 120 people got Very Good evaluation results, 11 people got Enough results, and 2 people got the results of Do Coaching. Decision support system with SMART method can identify the level of discipline of staff and, to later be given guidance to staff who get evaluation results. Do Coaching to become more disciplined and improve the quality of human resources in STIKes and STMIK Hang Tuah Pekanbaru.

Keywords: *Decision Support Systems, SMART, Employee, Discipline..*

1. INTRODUCTION

Work Discipline is the attitude and behavior of employees to comply with applicable regulations and adjust organizations to be based on self-awareness. Indicators of work discipline, namely the frequency of attendance at the office on weekdays and the accuracy of hours of entry and return, compliance with applicable regulations, compliance with specified work standards, and employee work ethics at the Institute (Thaief, Baharuddin, Priyono, and Idrus, 2015) .

The assessment conducted by the staff department at STIKes and STMIK Hang Tuah Pekanbaru still uses manual methods with unclear weighting values that cause uncertainty about the results of staff and employee evaluations at STIKES and STMIK Hang Tuah Pekanbaru, thereby affecting the selection of staff and employees who have to get fostered so that more disciplined and who do not need to get fostered.

The above problems can be overcome by building a Decision Support System using the Simple Multi Attribute Rating Technique (SMART) method. This method can identify a problem with multiple attributes.

2. LITERATURE REVIEW

The concept of Decision Support Systems (DSS) was introduced into the information and computing systems literature by Gorry and Scott Morton in 1971 (Power, Sharda, and Burstein, 2015). DSS simulates the function of human cognitive decision making based on artificial intelligence methodologies (including expert systems, data mining, machine learning, connectionism, logistic reasoning, etc.) (Jao, 2010).

Modeling in the construction of DSS is carried out the following steps (Wanto and Damanik, 2015):

1. Feasibility Study (intelligence)
   In this step, determining objectives and finding procedures, collecting data, identifying problems, classifying problems, until the problem statement is formed
2. Design
   In this step the model will be formulated to be used and determine the criteria. Then, look for alternative models that can solve the problem.
3. Election (Choice)

In this step, a model selection is carried out, including the solution of the model. After that, sensitivity analysis is carried out by replacing several variables

4. Making DSS

After the model is determined, proceed with its implementation into the DSS application.

The SMART method is a method used for multi-criteria decision making that was developed by Edward in 1977(Taylor & Love, 2014). This method is based on the theory that each alternative consists of a number of criteria that have values and each of these criteria has a weight that illustrates how important these criteria are compared to other criteria. The grading of these weights is used to assess each alternative in order to get the best alternative (Suryanto and Safrizal, 2015).

The SMART method is based on the additive liner model. This means that the overall value of the given alternatives is calculated as the total value of each criterion (attribute) multiplied by the weight of the criterion (Barfod and Leleur, 2013; Bray, 2015).

The calculation steps using SMART, namely:

1. Step 1: determine the number of criteria to be used
2. Step 2: provide a scale of 0-100 based on the priorities that have been inputted and then normalized

$$nw_j = \frac{w_j}{\sum_{n=1}^{k} w_n} \quad ....(1)$$

Where:

nwj is normalization of criteria weight j

wj is the weight value of the jth criterion

k is the number of criteria

wn is the weight of the nth criterion

3. Step 3: each alternative is given a criterion value
4. Step 4: calculate the utility value for each criterion

Calculating utility value:

$$u_i(a_i) = 100 \frac{(C_{max} - C_{out\,i})}{(C_{max} - C_{min})} \% \quad ....(2)$$

Information:

ui (ai): Utility value of criterion 1 for criterion i

Cmax: Maximum criteria value

Cmin: Minimum criterion value

Cout i: The value of the i criteria

5. Step 5: calculate the final value of each

$$Maximize = \sum_{j=1}^{k} w_j . u_{ij}, \forall\, i = 1, ..., n \quad ....(3)$$

3. RESEARCH METHOD

The stage of the research framework starts from Problem Identification, Data Requirement Analysis, Systems Analysis Using SMART, Design, Implementation of the SMART Method, Testing, and Drawing Conclusions. The framework in this study can be illustrated in Figure 1 below:
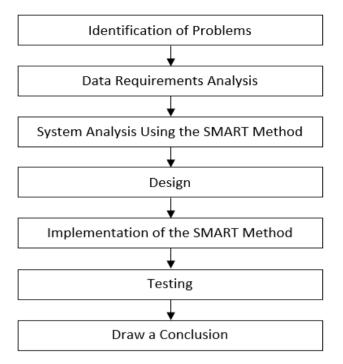
Figure 1. Research Methodology

4. RESEARCH RESULTS AND DISCUSSION

1. Criteria Identification

At this stage the process of determining what criteria are used in evaluating the performance of staff and employees in the STIKES and STMIK Hang Tuah Pekanbaru. In this study the number of criteria used was as many as 6 criteria for employee appraisal namely Warning, Performance, Attendance, Discipline, Obedience, and Compliance.

2. Alternative Identification

At this stage the process of determining alternative alternatives will be carried out. Alternatives in the form of the names of staff and employees at STIKES and STMIK Hang Tuah Pekanbaru namely, Yuda Irawan, S.Kom., M.Kom, Rian Ordila, S.Kom., M.Kom, Leon Chandra, SKM., M.Kes , Jufri, Mardeni, S.Kom., M.Kom.

3. Criteria Weighting

Weighting the assessment criteria is given relatively with the provisions of the criteria that have the highest level of importance based on the data of the importance of the criteria in Table 1 given a value of 100 and a minimum value of 10.

Table 1. Criteria Weight

No	Criteria	Weight
1	Commemorative Latter	100
2	Performance	87,5
3	Attendance	70
4	Discipline	62,5
5	Obedience	40
6	Compliance	40
	Total	400

4. Criteria Normalization

After the criteria weight value is given, the next step is to calculate the normalized value of each criteria weight value by using equation (1):

$w_1 = Commerative\ Latter$

$$nw_1 = \frac{100}{w_1 + w_2 + w_3 + w_4 + w_5 + w_6}$$

$$nw_1 = \frac{100}{100 + 87,5 + 70 + 62,5 + 40 + 40}$$

$$nw_1 = \frac{100}{400}$$

$$nw_1 = 0,25$$

$w_2 = Performance$

$$nw_2 = \frac{87,5}{w_1 + w_2 + w_3 + w_4 + w_5 + w_6}$$

$$nw_2 = \frac{100}{100 + 87,5 + 70 + 62,5 + 40 + 40}$$

$$nw_2 = \frac{87,5}{400}$$

$$nw_2 = 0,21875$$

$w_3 = Attendance$

$$nw_3 = \frac{70}{w_1 + w_2 + w_3 + w_4 + w_5 + w_6}$$

$$nw_3 = \frac{70}{100 + 87,5 + 70 + 62,5 + 40 + 40}$$

$$nw_3 = \frac{70}{400}$$

$$nw_3 = 0,175$$

$w_4 = Discipline$

$$nw_4 = \frac{62,5}{w_1 + w_2 + w_3 + w_4 + w_5 + w_6}$$

$$nw_4 = \frac{62,5}{100 + 87,5 + 70 + 62,5 + 40 + 40}$$

$$nw_4 = \frac{62,5}{400}$$

$$nw_4 = 0,15625$$

$w_5 = Obedience$

$$nw_5 = \frac{40}{w_1 + w_2 + w_3 + w_4 + w_5 + w_6}$$

$$nw_5 = \frac{40}{100 + 87,5 + 70 + 62,5 + 40 + 40}$$
$$nw_5 = \frac{40}{400}$$
$$nw_5 = 0,1$$

$$w_6 = Complience$$
$$nw_6 = \frac{40}{w_1 + w_2 + w_3 + w_4 + w_5 + w_6}$$
$$nw_6 = \frac{40}{100 + 87,5 + 70 + 62,5 + 40 + 40}$$
$$nw_6 = \frac{40}{400}$$
$$nw_6 = 0,1$$

The results of the calculation of normalization of relative weights can be seen in the following table:

Table 2. Normalization Criteria Weights

No	Criteria	Weight	Relative Weight (wj)
1	Commemorative Latter	100/400	0,25
2	Performance	87,5/400	0,21875
3	Attendance	70/400	0,175
4	Discipline	62,5/400	0,15625
5	Obedience	40/400	0,1
6	Compliance	40/400	0,1

5. Single Development - Attribute Utilities

The next step is to develop single-attribute utilities based on the values given to each alternative. Each criterion is given sub-criteria and the value of the sub-criteria is as seen in table 3.

Table 3. Development of Single-Attribute Utilities

No	Criteria	Sub Criteria	Value
1	Commemorative Latter	There is No	100
		SP 1	85
		SP 2	75
		SP 3	50
2	Performance	Very good	100
		Well	85
		Pretty good	75
		Not good	50
3	Discipline	Very good	100
		Well	85
		Pretty good	75
		Not good	50
4	Attendance	Very good	100
		Well	85
		Pretty good	75
		Not good	50
5	Obedience	Very good	100
		Well	85
		Pretty good	75
		Not good	50

6	Compliance	Very good	100
		Well	85
		Pretty good	75
		Not good	50

After the value of Single-Attribute Utilities is determined, the next step is to determine each criterion value of each staff and employee based on table 3.

Table 4. Value of Each Criteria

No	Employee Name	Commemorative Later	Performance	Attendace	Discipline	Obedience	Compliance
1	Yuda Irawan	100	85	85	85	85	85
2	Rian Ordila	100	85	100	85	85	85
3	Leon Chandra	100	85	85	75	85	85
4	Jufri	75	75	75	50	75	75
5	Mardeni	100	85	100	100	85	85

After the value of each criterion for each employee is determined, then the utilities value calculation process for each employee's criteria is calculated as follows:

Commemorative Latter

$$u_{ij} = 100 \frac{(c\ Out - c\ Min)}{(c\ Max - c\ Min)}\ \%$$

$$u_{ij} Commemorative\ Latter\ (Yuda\ Irawan) = 100 \frac{(100 - 30)}{(100 - 30)}$$

$$u_{ij} Commemorative\ Latter\ (Yuda\ Irawan) = 100 \frac{(70)}{(70)}$$

$$u_{ij} Commemorative\ Latter\ (Yuda\ Irawan) = 100$$

$$u_{ij} Commemorative\ Latter\ (Rian\ Ordila) = 100 \frac{(100 - 30)}{(100 - 30)}$$

$$u_{ij} Commemorative\ Latter\ (Rian\ Ordila) = 100 \frac{(70)}{(70)}$$

$$u_{ij} Commemorative\ Latter\ (Rian\ Ordila) = 100$$

Performance

$$u_{ij} = 100 \frac{(c\ Out - c\ Min)}{(c\ Max - c\ Min)} \%$$

$$u_{ij} Performance(Yuda\ Irawan) = 100 \frac{(85 - 50)}{(100 - 50)}$$

$$u_{ij} Performance\ (Yuda\ Irawan) = 100 \frac{(35)}{(50)}$$

$$u_{ij} Performance(Yuda\ Irawan) = 70$$

$$u_{ij} Performance(Rian\ Ordila) = 100 \frac{(85 - 50)}{(100 - 50)}$$

$$u_{ij} Performance(Rian\ Ordila) = 100 \frac{(35)}{(50)}$$

$$u_{ij} Performance(Rian\ Ordila) = 70$$

Attendance

$$u_{ij} = 100 \frac{(c\ Out - c\ Min)}{(c\ Max - c\ Min)} \%$$

$$u_{ij} Attendace(Yuda\ Irawan) = 100 \frac{(85 - 50)}{(100 - 50)}$$

$$u_{ij} Attendace(Yuda\ Irawan) = 100 \frac{(35)}{(50)}$$

$$u_{ij} Attendace(Yuda\ Irawan) = 70$$

$$u_{ij} Attendace(Rian\ Ordila) = 100 \frac{(100 - 50)}{(100 - 50)}$$

$$u_{ij} Attendace(Rian\ Ordila) = 100 \frac{(50)}{(50)}$$

$$u_{ij} Attendace(Rian\ Ordila) = 100$$

Discipline

$$u_{ij} = 100 \frac{(c\ Out - c\ Min)}{(c\ Max - c\ Min)} \%$$

$$u_{ij} Discipline(Yuda\ Irawan) = 100 \frac{(85 - 50)}{(100 - 50)}$$

$$u_{ij} Discipline(Yuda\ Irawan) = 100 \frac{(35)}{(50)}$$

$$u_{ij} Discipline(Yuda\ Irawan) = 70$$

$$u_{ij} Discipline(Rian\ Ordila) = 100 \frac{(85 - 50)}{(100 - 50)}$$

$$u_{ij} Discipline(Rian\ Ordila) = 100 \frac{(35)}{(50)}$$

$$u_{ij} Discipline(Rian\ Ordila) = 70$$

Obedience

$$u_{ij} = 100 \frac{(c\ Out - c\ Min)}{(c\ Max - c\ Min)} \%$$

$$u_{ij}Obedience(Yuda\ Irawan) = 100\frac{(85-50)}{(100-50)}$$

$$u_{ij}Obedience(Yuda\ Irawan) = 100\frac{(35)}{(50)}$$

$$u_{ij}Obedience(Yuda\ Irawan) = 70$$

$$u_{ij}Obedience(Rian\ Ordila) = 100\frac{(85-50)}{(100-50)}$$

$$u_{ij}Obedience(Rian\ Ordila) = 100\frac{(35)}{(50)}$$

$$u_{ij}Obedience(Rian\ Ordila) = 70$$

Complience

$$u_{ij} = 100\frac{(c\ Out - c\ Min)}{(c\ Max - c\ Min)}\ \%$$

$$u_{ij}Complience(Yuda\ Irawan) = 100\frac{(85-50)}{(100-50)}$$

$$u_{ij}Complience(Yuda\ Irawan) = 100\frac{(35)}{(50)}$$

$$u_{ij}Complience(Yuda\ Irawan) = 70$$

$$u_{ij}Complience(Rian\ Ordila) = 100\frac{(85-50)}{(100-50)}$$

$$u_{ij}Complience(Rian\ Ordila) = 100\frac{(35)}{(50)}$$

$$u_{ij}Complience(Rian\ Ordila) = 70$$

After calculating the overall utility values for each criterion, the results are as shown in table 5.

Table 5. Alternative Utilities Values

No	Employee Name	Criteria Name	Utility Value
1	Yuda Irawan	Commemorative letter	100
		Performance	70
		Attendance	70
		Discipline	70
		Obedience	70
		Compliance	70
2	Rian Ordila	Commemorative letter	100
		Performance	70
		Attendance	100
		Discipline	70
		Obedience	70
		Compliance	70
3	Leon Candra	Commemorative letter	100
		Performance	70
		Attendance	70
		Discipline	50
		Obedience	70
		Compliance	70
4	Jufri	Commemorative letter	50
		Performance	50

		Attendance	50
		Discipline	0
		Obedience	50
		Compliance	50
5	Mardeni	Commemorative letter	100
		Performance	70
		Attendance	100
		Discipline	100
		Obedience	70
		Compliance	70

6. Calculate End Value

After the utility values of each criteria for each staff and employee are obtained, the next step is to calculate the final grade using Eq. (3):

$$Yuda\ Irawan = (w_{Commemorative\ Letter} \times u_{Commemorative\ Letter}) + (w_{Performance} \times u_{Performance}) + (w_{Attendance} \times u_{Attendace}) + (w_{Discipline} \times u_{Discipline}) + (w_{Obedience} \times u_{Obedience}) + (w_{Compliance} \times u_{Compliance})$$
$$Yuda\ Irawan = (0,25 \times 100) + (0,21875 \times 70) + (0,175 \times 70) + (0,15625 \times 70) + (0,1 \times 70) + (0,1 \times 70)$$
$$Yuda\ Irawan = 25 + 15,3125 + 12,25 + 10,9375 + 7 + 7$$
$$Yuda\ Irawan = 77.5$$

$$Rian\ Ordila = (w_{Commemorative\ Letter} \times u_{Commemorative\ Letter}) + (w_{Performance} \times u_{Performance}) + (w_{Attendance} \times u_{Attendace}) + (w_{Discipline} \times u_{Discipline}) + (w_{Obedience} \times u_{Obedience}) + (w_{Compliance} \times u_{Compliance})$$
$$Rian\ Ordila = (0,25 \times 100) + (0,21875 \times 70) + (0,175 \times 100) + (0,15625 \times 70) + (0,1 \times 70) + (0,1 \times 70)$$
$$Rian\ Ordila = 25 + 15,3125 + 17,5 + 10,9375 + 7 + 7$$
$$Rian\ Ordila = 82,75$$

Based on the ranking of values obtained, the value can be categorized to:

Table 6. Categories of Assessment Results

No	Value Range	Category
1	76-100	Very well
2	50-75	Enough
3	0-49	Do Fostering

So from the calculation results obtained by the assessment results as in table 7.

Table 7. Employee Performance Assessment Results

No	Employee Name	Rating Result	Category
1	Yuda Irawan	77,5	Very Good
2	Rian Ordila	82,75	Very Good

3	Leon Candra	74,375	Moderate
4	Jufri	42.19	Do Coaching
5	Mardeni	87,4375	Very Good

5. CONCLUSIONS

From the results of the implementation of the SMART method for identifying employee performance at the STIKES and STMIK Hang Tuah Pekanbaru conclusions can be drawn as follows:

1. The SMART method was successfully implemented into a system developed using the PHP and MySQL programming languages in accordance with the analysis and design created
2. The SMART method can be used to identify employee performance that has 6 criteria. Assessment is carried out by weighting each criterion and producing 3 categories of assessment, namely Very Good, Enough, and Perform Coaching
3. The SMART method can provide more accurate assessment results by weighting each criterion. That way we get more accurate calculation results.
4. From the results of system testing, it is known that the results of the calculation of the SMART method on the developed system are in accordance with the results of manual calculations.

Suggestions given by the author for further research are:

1. It is expected that in subsequent studies it can compare the SMART method with several other methods that can be used to identify employee performance.
2. It is expected that in future studies the SMART method can be used in a more complex case analysis or a case that has more criteria used.

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