

Implementation of A Decision Making System of Giving Bonus To Employees Using Fuzzy Logic Method

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Abstract

Each company has its own standards in giving bonuses to outstanding employees in accordance with the company's rules. So we need a system that is able to solve the problem so that the bonus is given according to the performance of each employee. The problem that often occurs today is in the form of a lack of user knowledge in providing bonuses according to employee performance, so that this research can be used as a reference in giving bonuses to each employee according to performance. The solution for giving this bonus uses a decision-making system using Sugeno's Fuzzy Logic. The Sugeno method is to determine the input variable and the output variable which is a firm set, the second step is to change the input variable to a fuzzy set with a fuzzification process, then the third step is to process the fuzzy set data with the minimum method. And the last or fourth step is to change the output into a firm set with a defuzzification process using the centroid method, so that the desired result will be obtained on the output variable. Solving production problems using a comparison of the Sugeno and Mamdani methods. This method uses constants or mathematical functions of the input variables, and in the defuzzification process uses the centralized average method.

Keywords; Decision Making System, Employee Bonus, Sugeno Method

1. Introduction

In the business world, there are many companies that exist and compete with each other. The success of a company is determined by its ability to achieve the targets and goals desired by the company. Employees are the main driving tool owned by the company in achieving company goals. In achieving the desired goals, employee performance is highly prioritized by the company. Therefore, it can be said that employees are one of the most important assets in a company. However, not all employees who work in a company are able to work as expected by the company. Some employees can work as expected by the company and there are also employees who cannot work as expected by the company. Salary allowances are the results provided by the company for employee performance. The amount of salary allowances is determined by many things and each company is certainly different in determining the salary earned by employees. To determine the salary at PT. Companies tend to give higher salaries to employees who have worked for the company longer than employees who have not worked for the company for a long time. Therefore, some employees at PT. who can work well have not received a more decent salary. Considerations that should determine the salary of employee benefits.

A good relationship between employees and the company can be created if the employees and the company can understand each other's needs. On the one hand, the company aims to maximize profits. On the other hand, employees expect appropriate rewards from the company for the work they do to meet their daily needs [1]. Salary benefits are rewards given by the company for the work of employees. The amount of salary allowances is determined by many things and each company is certainly different

in determining the salary earned by employees. In order for a good relationship between employees and the company to be created, the company needs to provide salary allowances that are appropriate and appropriate for these employees. A decision support system (DSS) is a system that can assist a person in making decisions from various types of choices that are made accurately and in accordance with the desired goals. Many problems can be solved by using a decision support system [2]. Meanwhile, according to , Decision Support System is an information system that provides information, modeling and manipulating data. The system is used to assist decision making in semi-structured situations, where no one knows for sure how decisions should be made [3].

According to Kusrini (2007), the purpose of the Decision Support System is

- a) Assist managers in making decisions on semi-structured issues Provide support for the manager's judgment and are not intended to replace
- b) manager function
- c) Increased productivity
- d) Competitive [4].

With the various special characteristics of the Decision Support System, DSS (Decision Support System) can provide various benefits and advantages. The advantages that can be taken from SPK are:

- a) Able to support finding solutions to complex problems.
- b) Quick response to unexpected situations in changing conditions.
- c) Able to apply different strategies in different configurations quickly and precisely.
- d) New views and learnings.
- e) Facilitating communication.
- f) Improve management control and performance.
- g) Save costs.
- h) Faster decision.
- i) Increase analysis productivity [4].

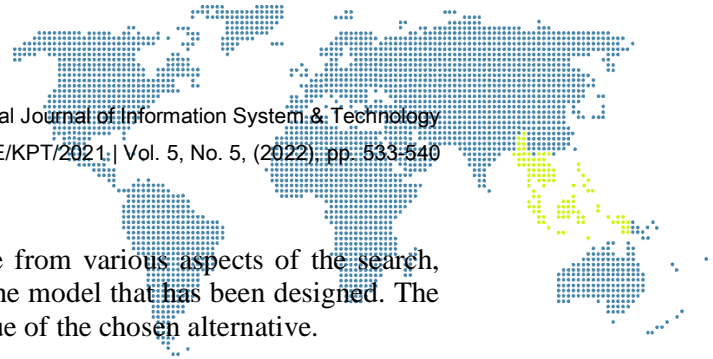
The method used in the DSS research on motorcycle selection uses the Analytical Hierarchy Process (AHP) because complex problems can be easily simplified so as to speed up the decision-making process by compiling a hierarchy, providing a comparative value for each criterion to determine the criteria value. The motorcycle selection decision support system designed using the AHP method can be used for all selection processes while the determination of the criteria can be changed according to the interests of consumers [5]. The decision-making system can be used in various cases, including some previous research related to the topic of lending contained in published journals, including the Decision Support System for providing credit at the Mitra Mandiri Sejahtera Cooperative in Semarang City using the Simple Additive Weighting method, the criteria used include: guarantees, loan, salary, installment, term [6]. Interconnected and sequential stages in making decisions. The four processes is:

a) Intelligence

Intelligence can be defined in many ways: logical understanding, self-awareness, learning, empirical knowledge, reasoning, planning, creativity, critical thinking, and problem solving. In general it can be described as the ability to perceive information, and retain it as knowledge is applied.

b) Design

Design is a plan for specifications for the construction of objects or systems for the implementation of an activity or process, or the results of the plan or specifications in the form of prototypes, products and processes, the verb design expresses the process of developing a system.



c) Choice

This stage is carried out to determine a choice from various aspects of the search, evaluation and completion made according to the model that has been designed. The solution by applying a model is the specific value of the chosen alternative.

d) Implementation

Implementation is applied to technology to describe the interaction of elements in programming languages, applications are used to recognize and use code elements or programming resources that are written into programs [7].

In the late 19th century until the end of the 20th century, probability theory played an important role in solving the problem of uncertainty. This theory continued to be developed until finally in 1965, Lotfi A. Zadeh introduced the fuzzy set theory, which implies that not only probability theory can be used to represent uncertainty problems. However, fuzzy set theory is not a substitute for probability theory. In fuzzy set theory, the main component that is very influential is the membership function. The membership function represents the degree of proximity of an object to a certain attribute. While the probability theory is more on the use of relative frequencies [8]. Fuzzy set (Fuzzy set) is a set of x objects with each object has a membership value (membership function). or also called the truth value and this value is mapped into a range (0,1). If x is a set of objects whose members are represented by x , then the fuzzy set of A in x is the set with a pair of members.

$$A = \{(x, A(x)) \mid x \in X\} \quad (1)$$

The domain of the fuzzy set is the entire allowable value in the universe of conversation and may be operated in a fuzzy set [8]. The membership function is a curve that shows the mapping of data input points into membership values which have an interval between 0 to 1. One way that can be used to get the membership value is through a function approach.

2. Research Methodology

This research process carried out several stages to get good results. The steps of this research are:

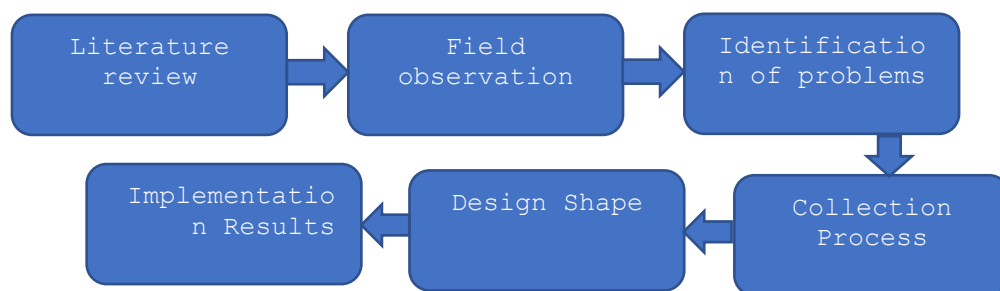


Figure 1. Research Methodology

3. Results and Discussion

In this study, there are 4 input variables including, Absence, Personality, Performance, Target and output variables in the form of large, medium or small in the form of decisions. The explanation is in table 1.

Table 1. Fuzzy Set

Fungsion	Name Function	Universe of Conversation
Input	Roll call	[0-100]
	Personality	[0-100]
	Performance	[0-140]
	Target	[0-100]

Fungsi	Name Function	Universe of Conversation
Output	Decision	[0-100]

The fuzzy set domain table describes the domain range used in determining the domain range in the fuzzy set in table 3. Domains of Fuzzy Sets

1) Absent Variable

The absent variable is divided into three parts, namely discipline, moderate and not stored. The membership function process uses the trim function.

Table 2. Fuzzy Set Absent

Universe of Conversation	Fuzzy set name	MF Model models	Parameter	Domain
0-16	Very Disciplined	Trimf	[0 8 10]	0-10
0-16	Discipline	Trimf	[9 11 13]	9-13
0-16	Undisciplined	Trimf	[12 14 16]	12-16

The process of forming fuzzy sets on the Absent variable

$$\mu_{\text{Undisciplined}}[x] = \begin{cases} 1 & ; x \leq 8 \\ \frac{10-x}{10-8} & ; 8 \leq x \leq 10 \\ 0 & ; x \geq 10 \end{cases}$$

$$\mu_{\text{Discipline}}[x] = \begin{cases} 0 & ; x \leq 9 \text{ atau } \geq 13 \\ \frac{x-9}{11-9} & ; 9 \leq x \leq 11 \\ \frac{13-x}{13-11} & ; 11 \leq x \leq 13 \end{cases}$$

$$\mu_{\text{Very Disciplined}}[x] = \begin{cases} 0 & ; x \leq 12 \\ \frac{x-12}{14-12} & ; 12 \leq x \leq 14 \\ 1 & ; 14 \leq x \leq 16 \end{cases}$$

2) Personality Variables

Personality variables are divided into three parts, namely Very Good, Good and Not Good. The membership function process uses the trim function.

Table 3. Fuzzy Set Personality Variables

Universe of Conversation	Fuzzy set name	MF Model models	Parameter	Domain
0-8	Very good	Trimf	[0 4 5]	0-5
0-8	Good	Trimf	[4 5 6]	4-6
0-8	Not good	Trimf	[6 7 8]	6-8

The process of forming fuzzy sets on the Personality variable

$$\mu_{\text{Not Good}}[x] = \begin{cases} 1 & ; x \leq 4 \\ \frac{5-x}{5-4} & ; 4 \leq x \leq 5 \\ 0 & ; x \geq 5 \end{cases}$$

$$\mu_{\text{Good}}[x] = \begin{cases} 0 & ; x \leq 4 \text{ atau } \geq 5 \\ \frac{x-4}{5-4} & ; 4 \leq x \leq 5 \\ \frac{6-x}{6-5} & ; 5 \leq x \leq 6 \end{cases}$$

$$\mu_{\text{Very Good}}[x] = \begin{cases} 0 & ; x \leq 6 \\ \frac{x-6}{7-6} & ; 6 \leq x \leq 7 \\ 1 & ; 7 \leq x \leq 8 \end{cases}$$

3) Performance Variables

Personality variables are divided into three parts, namely Very Good, Good and Not Good. The membership function process uses the trim function.

Table 4. Fuzzy Set Performance Variables

Universe of Conversation	Fuzzy set name	MF Model models	Parameter	Domain
0-12	Very good	Trimf	[0 4 6]	0-6
0-12	Good	Trimf	[5 7 9]	5-9
0-12	Not good	Trimf	[8 10 12]	8-12

The process of forming fuzzy sets on the Performance variable

$$\mu_{\text{Not Good}}[x] = \begin{cases} 1 & ; & x \leq 4 \\ \frac{6-x}{6-4} & ; & 4 \leq x \leq 6 \\ 0 & ; & x \geq 6 \end{cases}$$

$$\mu_{\text{Good}}[x] = \begin{cases} 0 & ; & x \leq 5 \text{ atau } \geq 9 \\ \frac{x-5}{7-5} & ; & 5 \leq x \leq 7 \\ \frac{9-x}{9-7} & ; & 7 \leq x \leq 9 \end{cases}$$

$$\mu_{\text{Very Good}}[x] = \begin{cases} 0 & ; & x \leq 8 \\ \frac{x-8}{10-8} & ; & 8 \leq x \leq 10 \\ 1 & ; & 10 \leq x \leq 12 \end{cases}$$

4) Target Variable

Target variables are divided into three parts, namely many, moderate, little. The membership function process uses the trim function.

Table 5. Fuzzy Set Target Variables

Universe of Conversation	Fuzzy set name	MF Model models	Parameter	Domain
0-25	Lots	Trimf	[0 15 17]	0-17
0-25	Currently	Trimf	[16 18 21]	16-21
0-25	A Little	Trimf	[20 22 25]	20-25

The process of forming fuzzy sets on the Target variable

$$\mu_{\text{Alittle}}[x] = \begin{cases} 1 & ; & x \leq 15 \\ \frac{17-x}{17-15} & ; & 15 \leq x \leq 17 \\ 0 & ; & x \geq 17 \end{cases}$$

$$\mu_{\text{Currently}}[x] = \begin{cases} 0 & ; & x \leq 16 \text{ atau } \geq 21 \\ \frac{x-16}{17-16} & ; & 16 \leq x \leq 17 \\ \frac{21-x}{21-17} & ; & 17 \leq x \leq 21 \end{cases}$$

$$\mu_{\text{Lots}}[x] = \begin{cases} 0 & ; & x \leq 20 \\ \frac{x-20}{22-20} & ; & 20 \leq x \leq 22 \\ 1 & ; & 22 \leq x \leq 25 \end{cases}$$

5) Variabel Otput

Output variables are divided into 3 parts, namely small, medium and large by using the Mambership function Trimf.

Table 6. Fuzzy Set Output

Variables	Table 5. Fuzzy Set Performance Variables	Table 5. Fuzzy Set Performance Variables	Table 5. Fuzzy Set Performance Variables	Table 5. Fuzzy Set Performance Variables
4-13	Big	Trimf	[9 11 13]	9-13
4-13	Currently	Trimf	[7 9 10]	7-11
4-13	A little	Trimf	[4 7 8]	4-8

From the mapping, it can be seen that the maximum rules are as follows: From the rules formed, the rules that are appropriate and possible with the knowledge base there are 19 rules, namely:

- a) [R1] If Absence is NOT DISCIPLINE, and Personality is NOT GOOD, and Performance is NOT GOOD, and Target is SMALL, then the Result of Decision is SMALL RECEIVE BONUS.
- b) [R2] If there is no discipline, and the personality is not good, and the performance is not good, and the target is SMALL, then the result of the decision is SMALL RECEIVE THE BONUS.
- c) [R3] If Absence is VERY DISCIPLINED, and Personality is NOT GOOD, and Performance is NOT GOOD, and Target is SMALL, then the Result of Decision is SMALL RECEIVE BONUS.
- d) [R4] If Absence is NOT DISCIPLINE, and Personality is GOOD, and Performance is NOT GOOD, and Target is SMALL, then the Result of Decision is SMALL RECEIVE BONUS.
- e) [R5] If Absence is NOT DISCIPLINED, and Personality is VERY GOOD, and Performance is NOT GOOD, and Target is SMALL, then SMALL Decision Results RECEIVE BONUS.
- f) [R6] If Absence is NOT DISCIPLINE, and Personality is NOT GOOD, and Performance is GOOD, and Target is SMALL, then the Result of Decision is SMALL RECEIVE BONUS.
- g) [R7] If Absence is NOT DISCIPLINE, and Personality is NOT GOOD, and Performance is VERY GOOD, and Target is SMALL, then the Result of Decision is SMALL RECEIVE BONUS.
- h) [R8] If Absence is NOT DISCIPLINED, and Personality is NOT GOOD, and Performance is NOT GOOD, and Target is MEDIUM, then the result of a SMALL decision will receive a BONUS.
- i) [R9] If Absence is NOT DISCIPLINED, and Personality is NOT GOOD, and Performance is NOT GOOD, and Targets are A LOT, then the result of a SMALL decision will receive a BONUS.
- j) [R10] If Absent is VERY DISCIPLINED, and Personality is VERY GOOD, and Performance is VERY GOOD, and Targets A LOT, then the result of the decision is BIG RECEIVING BONUS.
- k) [R11] If there is no discipline, and the personality is VERY GOOD, and the performance is VERY GOOD, and the targets are MANY, then the result of the decision is BIG RECEIVING BONUS
- l) [R12] If Absent is VERY DISCIPLINED, and Personality is GOOD, and Performance is VERY GOOD, and Targets MANY, then the result of the decision is BIG RECEIVING BONUS.
- m) [R13] If Absent is VERY DISCIPLINE, and Personality is VERY GOOD, and PERFORMANCE IS GOOD, and Targets A LOT, then the result of the decision is BIG RECEIVING BONUS.
- n) [R14] If Absent is VERY DISCIPLINED, and Personality is VERY GOOD, and Performance is VERY GOOD, and Target is MEDIUM, then the result of the decision is BIG RECEIVING BONUS.

- o) [R15] If there is no discipline, and the personality is good, and the performance is VERY GOOD, and the targets are MANY, then the result of the decision is BIG RECEIVING BONUS.
- p) [R16] If Absent is VERY DISCIPLINED, and Personality is VERY GOOD, and Performance is GOOD, and Target is MEDIUM, then the result of the decision is BIG RECEIVE BONUS.
- q) [R17] If there is no discipline, and the personality is VERY GOOD, and the performance is VERY GOOD, and the target is MEDIUM, then the result of the decision is BIG RECEIVE BONUS.
- r) [R18] If Absent is VERY DISCIPLINED, and Personality is GOOD, and Performance is GOOD, and Targets A LOT, then the result of the decision is BIG RECEIVING BONUS.
- s) [R19] If Absent is VERY DISCIPLINED, and Personality is GOOD, and Performance is VERY GOOD, and Target is MEDIUM, then the result of the decision is BIG RECEIVING BONUS.

Defuzification Results

- 1) Value x (10)=0.5
Value x(13) =0.5
- 2) Value of x(4.5)= 0.5
Value x (6.5)=0.5
- 3) Value x (8)=0.5
Value x (11)=0.5
- 4) Value x (16)=0.5
Value x(21)=0.5

After obtaining each x value, the next step is to find the Centralized Average, the process can be seen below:

$$\begin{aligned}
 &= ((10)*(0,5)+(13)*(0,5)+(4,5)*(0,5)+(6,5)*(0,5)+(8)*(0,5)+(11)*(0,5)+ \\
 &\quad (16)*(0,5)+(21))/4 \\
 &= (0,5+0,5+0,5+0,5+0,5+0,5+0,5+0,5)/4 \\
 &= 45/4 \\
 &= 11,25
 \end{aligned}$$

The output for Defuzification obtained a value of 11.25 which is in the Large range. To find another x value, all you have to do is calculate the x value used. In Matlab software the data has been input into fuzzy Sugeno, so to get the output value, you just need to enter each x value of the variable used.

4. Conclusion

In determining the distribution of bonuses to employees, the following conclusions can be drawn, To calculate the value of giving bonuses to employees, four input variables and one output variable are needed. The input variables include absent, performance, personality and targets, while the output results are small, medium and large bonuses obtained by employees. The Sugeno method is able to solve problems in determining the award of bonuses to employees with predetermined criteria. The Decision Making System can be used as a reference in resolving cases of giving bonuses so that the bonus results are in accordance with the performance that has been done

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