Web-based Performances Evaluation Analysis of Civil Servants in Banjarmasin City Government Using Fuzzy Method

Husnul Ma'ad Junaidi [*], Siti Cholifah [*],

Amrul Hadiyanoor [*], Asrani [*]

Abstract

The problem with reporting civil servants activities with the current system is that each activity uses points where civil servants who have many activities can easily collect points in a relatively short time. As well as the difficulty of determining civil servants who are diligent and who are not. In this study, a program was created to determine the diligent and not diligent civil servants using the web-based Fuzzy Tsukamoto method with the Laravel framework. This study uses 3 indicators, namely the number of activities, the number of minutes of activity and the percentage of attendance. Of the 3 indicators, for the first stage, the fuzzification value is sought, then from the results of the fuzzification value, inference and defuzzification can be calculated. The results obtained are the classification of civil servants, namely diligent and not diligent. From this final score, the government can determine the level of discipline of civil servants and can provide disciplinary awards or punishments.

Keywords: Defuzzification, laragon, laravel, tsukamoto fuzzy.

1 Introduction

The use of information technology to produce efficiency in national and regional development policies and programs needs to be supported by the availability of regional data and information owned by all regions, down to the smallest. Such information is very important material for planning, controlling and evaluating regional development in general or even specifically according to certain regions.

Performance evaluation is part of human resource management activities that observe employee improvement in carrying out their work. Performance appraisal is carried out to determine the quality and quantity of employees. Every civil servant at the beginning of the year is required to set employee work targets based on the agency's annual work plan, civil servants who do not set employee work targets will receive sanctions in accordance with the provisions of the laws and regulations governing civil servant discipline. The purpose of this study was to determine the level of discipline in the performance of civil servants in structural positions of civil servants in the Banjarmasin City Regional Personnel Agency. The framework used in this study is Laravel [1], because it is far more popular than other PHP frameworks [2]. The method used for performance evaluation is Fuzzy Tsukamoto [3]. Based on the results of the report it can be seen that the Civil Servant Performance Appraisal Process is an assessment carried out on civil servants[4],

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[*] Indonesian College of Informatics and Computer Management, Banjarmasin, Indonesia

so that civil servants are more disciplined and responsible in carrying out their duties, namely Employee Work. Targets are set at the beginning of each year by civil servants and must be approved by their direct supervisor/evaluator. The Performance Evaluation Process consists of the completion of Employee Work Targets by employees. Then each activity activity is filled in, each employee activity must be processed by the direct supervisor.

The problem in reporting civil servants activities is in verifying activities by superiors where supervisors can be replaced by civil servants who carry out activities and the current system for each activity uses a point system where civil servants who have many activities can easily collect points in a relatively short time. short time. short time. As well as the difficulty in determining employees who are diligent and who are not.

2   Research Objective

This study only retrieves civil servant data within the Banjarmasin City Regional Civil Service Agency. The indicators needed to analyze civil servant performance consist of 3, namely the number of activities, the number of minutes of work activity, and the percentage of attendance.

3   Methods

The following are the applications and methods used in this study.

3.1   Laravel Frameworks

Laravel framework simplifies the website development process with the help of several excellent features, such as the Template Engine, Routing, and Modularity. Laravel offers several advantages when you develop websites based on this framework.

1.   First, the website becomes more scalable (easier to develop).

2.   Second, there are namespaces and views that help you organize and manage website resources.

3.   Third, the development process is faster so it saves time because Laravel can be combined with several components from other frameworks to develop websites.

3.2   Tsukamoto Fuzzy

Fuzzy is defined as cryptic which means a value can be true or false simultaneously. In fuzzy it is known that the degree of membership has a value range from 0 to 1. Fuzzy logic is the right way to map an input space into an output space and has a continuous value. Fuzzy expressed in degrees of membership and degrees of truth. Therefore, fuzzy can be said to be partly true and partly wrong [5].

Fuzzy Inference System is a way of mapping the input space to the output space using fuzzy logic. The knowledge base is a collection of rules in the form of if-then statements made by experts. Fuzzification is the process of changing non-fuzzy sets into fuzzy sets, non-fuzzy inputs are mapped into fuzzy sets [6]. The membership function is an important component. Inference is the process of changing fuzzy input into fuzzy output by following the rules (if-then) that have

been defined in the Fuzzy Knowledge Base [7]. Defuzzification is the process of changing the results of the inference stage into output with a firm value (crips) using a predetermined membership function [8].

The Tsukamoto Fuzzy method is a method that is very flexible and has tolerance for data. The advantages of the Tsukamoto method are that it is intuitive and can provide responses based on information that is qualitative, inaccurate, and ambiguous [9]. In the Tsukamoto method, each rule is represented by a fuzzy set with a monotone membership function called fuzzification. As a result, the inference/output of each rule is in the form of a real value based on the predicate α or the minimum value of each rule and the Z value. The final result is obtained by defuzzification of the weighted average [10].

3.3 Rules

The indicators for the case study of civil servant activity performances in Banjarmasin City Government are as follows:

1. The number of activities less than 90 activities is considered a few and more than 60 is considered a lot.

2. Activity duration less than 9000 minutes is considered a little and more than 6000 minutes is considered a lot.

3. Attendance of less than 70 is considered a small number, and more than 60 is considered a large number.

In this study use the rules from Banjarmasin City Regional Civil Service Agency are as follows:

Rule 1 = Few Activities, Few Minutes of Activity, Few Attendances, So Not Diligent

Rule 2 = Few Activities, Few Minutes of Activity, Many Attendances, So Not Diligent

Rule 3 = Few Activities, Lots of Activity Minutes, Few Attendances, So Not Diligent

Rule 4 = Few Activities, Many Minutes of Activity, Many Attendances, Then Be Diligent

Rule 5 = Lots of Activities, Few Minutes of Activity, Few Attendances, So Not Diligent

Rule 6 = Lots of Activities, Few Minutes of Activity, Lots of Attendance, Then Be Diligent

Rule 7 = Lots of Activity, Lots of Activity Minutes, Few Attendances, Then Be Diligent

Rule 8 = Lots of Activity, Lots of Activity Minutes, Lots of Attendance, So Be Diligent.

In this study, there are 3 input variables consisting of the number of activities, activity types and the percentage of attendance of the civil servants themselves, while the output variables have 2 values, namely Diligent or Not Diligent. formed the rules contained in the Table 1.

Table 1: Indicator Rules

Number of Activities	Activitiy (Minutes)	Attendance	Conclusion
Few	Few	Few	Not Diligent
Few	Few	Many	Not Diligent
Few	Many	Few	Not Diligent
Few	Many	Many	Diligent
Many	Many	Few	Not Diligent
Many	Few	Many	Diligent
Many	Few	Few	Diligent
Many	Many	Many	Diligent

3.4 Fuzzification

Following are membership functions for all indicators, first is Number of Activities as in Figure 1 , indicator formula for less activities(few) shown at Eq. (1) and for a lot of activities (many) shown at Eq. (2).
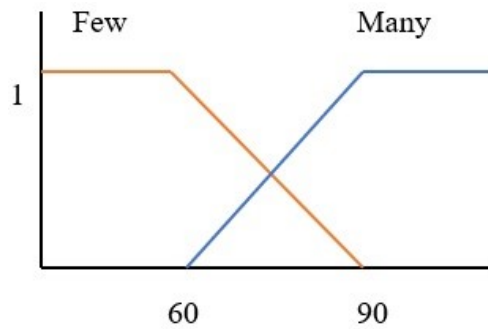

Figure 1: Number of Activities

$$\mu(x) = \begin{cases} 0 \; ; x \geq 90 \\ \frac{90-x}{90-60} \quad 60 \leq x \leq 90 \\ 1 \; ; x \leq 60 \end{cases} \tag{1}$$

$$\mu(x) = \begin{cases} 0 \; ; x \leq 90 \\ \frac{x-60}{90-60} \quad 60 \leq x \leq 90 \\ 1 \; ; x \geq 60 \end{cases} \tag{2}$$

Membership function for minute of activities as in Figure 2 with indicator formula for less activity duration(few) shown at Eq. (3) and for a lot of activity duration(many) shown at Eq. (4).

And membership function for attendances as in Figure 3 with indicator formula for few attendances shown at Eq. (5) and for many attendances shown at Eq. (6).
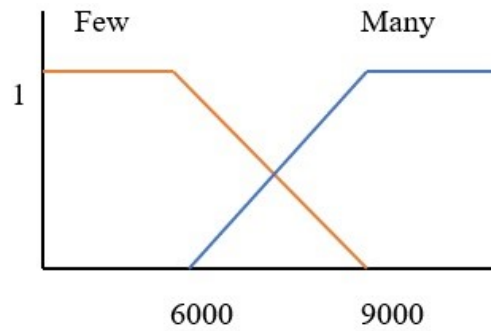
Figure 2: Number of Activities in Minutes

$$\mu(x)=\begin{cases} 0\;; x \geq 9000 \\ \dfrac{9000-x}{9000-6000} \quad 6000 \leq x \leq 9000 \\ 1\;; x \leq 6000 \end{cases} \qquad (3)$$

$$\mu(x)=\begin{cases} 0\;; x \leq 9000 \\ \dfrac{x-6000}{9000-6000} \quad 6000 \leq x \leq 9000 \\ 1\;; x \geq 6000 \end{cases} \qquad (4)$$
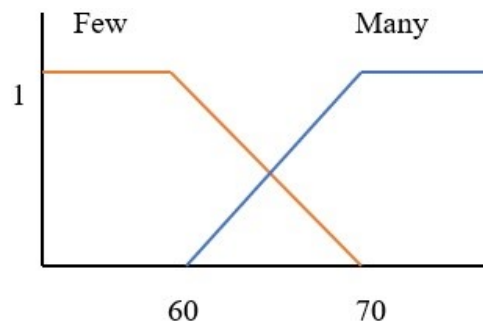

Figure 3: Number of Attendances

$$\mu(x)=\begin{cases} 0\;; x \geq 70 \\ \dfrac{70-x}{70-60} \quad 6000 \leq x \leq 9000 \\ 1\;; x \leq 60 \end{cases} \qquad (5)$$

$$\mu(x)=\begin{cases} 0\;; x \leq 70 \\ \dfrac{x-60}{70-60} \quad 60 \leq x \leq 70 \\ 1\;; x \geq 70 \end{cases} \qquad (6)$$

3.5 Inference System

In this study using the AND operator on each fuzzy rule to get the minimum elements as in (7). There are 3 basic operators according to [11], namely AND, OR and Not.

$$\mu A \cap B = \min(\mu A[x], \mu B[x]) \qquad (7)$$

In this inference system, both fuzzy set theory and fuzzy rules are used to draw conclusions [12][13].

3.6 Defuzzification

The last process is defuzzification, this process converts the fuzzy output into a firm value [14]. The defuzzification equation shown in Eq. (8) , in this process uses Weighted Average [15].

$$Z = \sum \alpha_i z_i / \sum \alpha_i \qquad (8)$$

4   Results

This study used data for April 2023 as shown in Table 2. It displays parameter data, namely NA = Number of Activities, MA = Minutes of Activities, A = Attendance for April 2023.

Table 2: Civil Servants Parameters

Name and EIN	Parameter		
	NA	*MA*	*A*
196812251998031004 H. IWAN FITRIADY, SH, MH	228	7322	100
198207022000121002 SATRIAWAN RAMADHANA, M. Eng	76	7446	91
196405251989032009 Dra. Hj. FATIMAH, M. Pd	117	10396	100
196404151985031008 MUHAMMAD RIDUAN, S.Pd	45	7019	100
196803181993031011 Drs. ZULFAISAL PUTERA	32	8908	100

Table 3 presents the fuzzification results from the previous data obtained with the parameters in Table 2 are shown in. Meanwhile, the inference stage for calculating the Fuzzy Tsukamoto method is shown in Table 4-5. In Table 4 its displays inference results, written as:

- FFF = Few Few Few,
- FFM = Few Few Many,
- FMF = Few Many Few,
- FMM = Few Many Many,
- MFF = Many Few Few,

- MFM = Many Few Many,

- MMF = Many Many Few,

- MMM = Many Many Many.

Table 3: Fuzzification Results

Name and EIN	Fuzzification					
	NA Few	*NA Many*	*MA Few*	*MA Many*	*A Few*	*A Many*
196812251998031004 H. IWAN FITRIADY, SH, MH	0	1	0.55933	0.440667	0	1
198207022000121002 SATRIAWAN RAMADHANA, M. Eng	0.4667	0.5333	0.518	0.482	0	1
196405251989032009 Dra. Hj. FATIMAH, M. Pd	0	1	0	1	0	1
196404151985031008 MUHAMMAD RIDUAN, S.Pd	1	0	0.66033	0.339667	0	1
196803181993031011 Drs. ZULFAISAL PUTERA	1	0	0.03067	0.969333	0	1

Table 4: Tsukamoto Fuzzy Results (part1)

Inference							
FFF	*FFM*	*FMF*	*FMM*	*MFF*	*MFM*	*MMF*	*MMM*
0	0	0	0	0	0.5593	0	0.4407
0	0.4667	0	0.4667	0	0.518	0	0.482
0	0	0	0	0	0	0	1
0	0.6603	0	0.3397	0	0	0	0
0	0.0307	0	0.9693	0	0	0	0

Table 5: Tsukamoto Fuzzy (part2)

Inference							
Rule1	*Rule2*	*Rule3*	*Rule4*	*Rule5*	*Rule6*	*Rule7*	*Rule8*
70	70	70	70	70	65.6	70	64.41
70	64.67	70	64.67	70	65.18	70	64.82
70	70	70	70	70	70	70	70
70	66.60	70	63.4	70	70	70	70
70	60.31	70	69.7	70	70	70	70

The 3rd stage of calculating the Tsukamoto Fuzzy method is defuzzification. This is the final stage of calculating the Tsukamoto Fuzzy method. From the final value a decision can be made from the results of the calculation according to the rules determined by the Banjarmasin City Regional Civil Service Agency. The results are shown in Table 6.

Table 6: Defuzzification Results

Name and EIN	Defuzzification	Conclusion
196812251998031004 H. IWAN FITRIADY, SH, MH	65.0704	Not Diligent
198207022000121002 SATRIAWAN RAMADHANA, M. Eng	64.8424	Not Diligent
196405251989032009 Dra. Hj. FATIMAH, M. Pd	70	Diligent
196404151985031008 MUHAMMAD RIDUAN, S.Pd	65.5141	Not Diligent
196803181993031011 Drs. ZULFAISAL PUTERA	69.4054	Not Diligent

5   Conclusions

In this research, a fuzzy-based method was carried out, namely Tsukamoto Fuzzy using data from the Banjarmasin City Government. The data is used to evaluate the performance of civil servants. From the results of defuzzification, it can be seen that the performance of civil servants is still a lot of civil servants who are not diligent. This data can be used to provide warnings and improve civil servant performance. Based on the results, the Government can reward those who are diligent.

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