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Implementation of the Fuzzy Method in the Selection of Activities Employees during the Pandemic

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***Abstract*: COVID-19 (Corona Virus Disease 2019) was first discovered in Wuhan, China in December 2019. This infectious virus has spread to almost all countries. In Indonesia, a large-scale social restriction policy was implemented that brings an impact on the economy, including the culinary sector. The Z Inc. also experienced the same thing, to survive during the pandemic; the company implemented a policy of paying wages based on working hours and a policy of laying off employees for 14 days for sick employees and employees traveling on off days. The impact for employees affects worker wages. The purpose of this study was to assist employees in making decisions in choosing activities and assist the company by increasing employee productivity. The fuzzy method application could help in selecting activities. The data analyzed were employee needs factors, namely economic, social, health, and safety factors. The method used was the Tsukamoto method which had four stages, namely 1. Fuzzification; 2. Implication Function using a minimum function; 3. Formation of rules using a minimum function; and 4. Defuzzification using a weighted average. Then the results obtained those 6 employees were recommended to rest, 3 employees were recommended to do online business and 1 person was recommended to exercise. These results were expected to be applied during off days to meet the employees' needs.**

***Keywords*: Activity selection, Fuzzy Inference System (FIS), Tsukamoto fuzzy, Employee.**

1. Introduction

At the end of December 2019, China reported to the World Health Organization's office about the presence of the new Covid-19 virus. The virus is known to first appear in the animal and seafood market in the city of Wuhan. It was later reported that many patients were suffering from this virus and it was found to be related to the animal and seafood market. The first infected were also known to be traders in the market. Wholesale animal and seafood markets sell wild animals such as snakes, bats and chickens. The virus spreads from animals to humans, and then from humans to humans. Until finally the transmission spread and so many people were infected that the Wuhan hospital was unable to accommodate patients [1]. The local government-imposed mass isolation to stop the spread of infection (lockdown) for more than two months and Wuhan is slowly returning to normal. This virus has spread rapidly throughout the world, including Indonesia [2].

Indonesia has implemented a large-scale social restriction from April 2020 and has an impact on the economy according to research from Moody's, the industries most affected are quite high, namely industries such as automotive, suppliers, consumers, tourism, airlines, and shipping. The decline that emerged was due to restrictions on all forms of activity outside the home in order to prevent the spread of Covid-19 which ultimately had an impact on economic activity and made the velocity of money slow down [3]. However, the government gives confidence that even though this virus is spreading, all forms of daily needs such as basic necessities will be maintained.

The health quarantine has begun to be relaxed so that the economy can recover. The industry can return to work but by following the health protocols set by the government, this slack can avoid or reduce the mass layoffs that occur [4].

One of the companies that experienced the same thing is the Z Inc., franchises in the culinary field felt the same impact during the pandemic, which resulted in a decrease in income and losses incurred. In order to survive during the Covid-19 pandemic, the company implemented a policy of laying off some employees. Employees return to work with fewer hours and days. Employees who work are employees who are in good health by always following health protocols, using gloves and masks when working. Due to the pandemic, there has been a decline in income. In addition, there are policies issued by the company including the company giving wages based on working hours, employees when they come to work in a state of illness will be laid off in self-isolation for 14 days. And if employees who are on holiday (Off Day) carry out traveling activities, they will also be laid off for 14 days. The policy is made so that employees are protected from disease and do not have the potential to infect other coworkers at work. The impact for employees who are affected by this policy is that there are fewer working hours which have an effect on work wages. Therefore, employees must be wise in making decisions by choosing the right activities and taking advantage of off days to meet employee needs. The application of the fuzzy method in the activity selection decision support system during the pandemic is expected to help employees in choosing activities.

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Based on the problems explained, hence the objectives of this study are as follows:

1. The study aims to help employees in making decisions to choose activities that are carried out on holidays (off day) by recommending activities according to employee needs.
2. The study goals to help the company in increasing employee productivity by working 6 days a week.

Based on the background of the research that has been described, it can be concluded that the formulation of the problem that forms the basis of the research is:

1. Company policy regarding working hours and self-isolation sanctions that affect employee wages.
2. The decrease in income that is influenced by one of them is the decrease in the level of employee productivity due to not full working days.

2. Methodology

A. Data Collection Method

The method is carried out to collect data by investigate the references from journals, books, theses, and conducting interviews to obtain data by way of question and answer directly to the company to find out the problems faced and discuss applications that are expected to solve these problems.

1) Fuzzification

This section aims to convert the firm input data into fuzzy input values [5]. The variables of health, safety, social and economic acted as the input variables and activity variables as outputs. The universe of conversation on the input variable is obtained by looking at the weights of the lowest and highest values of the questionnaire. The number of questions for each input variable is 5 questions with a weight value of 1 question is 10 and the highest value weight is 50, the activity variable is obtained from 2 things, namely less recommended value from 1 to 5 and recommended value from 5 to 10. To determine activity recommendations employees with Tsukamoto fuzzy use fuzzy variables namely health, safety, social and economic variables while the relationship between employees needs and employee activities is presented in the Table 1.

Table 1
Relation of employee needs and employee activities

No.	Activity	Factor
1.	Exercise	Health
		Social
2.	Online Shopping	Economy
		Social
3.	Rest	Health
		Safety

2) Fuzzy Rules

This rule is formed to express the relationship between input and output. The formation of rules resulting from the combination of each of these conditions is known as a decision rule [6]. The rule formation consists of 2 to 3 antecedents (elements) for 1 consequent, with the operator used for connecting is the "and" operator. While the map between input and output is "if then", the number of rules formed based on fuzzy sets for each recommended employee activity is as follows.

Table 2
Rules recommended exercise activities

Exercise	
[R1]	If health is low and social is low then exercise is low
[R2]	If health is low and social is high then exercise is low
[R3]	If health is high and social is low then exercise is high
[R4]	If health is high and social is high then exercise is high

3) Defuzzification

In the fuzzy inference system, the firm input values are converted by the fuzzification unit to the appropriate fuzzy values. The measurement results that have been fuzzy are then processed by the reasoning unit using a knowledge base unit which will produce a fuzzy set as its output. The last step done by the defuzzification unit will translate the output set into a definite value [5], [6]. This firm value is then realized in the form of an action carried out in the process.

B. System Building Method

The method is carried out to build a system by making a database design and a screen design that will be created in the system. After the design is complete, start creating the program that is used. The program platform used is desktop-based. After the program is completed, then conduct a trial of the program and evaluate the results of the program trial.

C. Analysis and Problem Solving

The process for determining the current activities of the company's employees is conducted by considering the need factors consisting of economic, health, social and safety. Therefore, this application can assist in providing appropriate recommendations to determine recommended employee activities by implementing the Tsukamoto Fuzzy method.

3. Result and Discussions

A. Solution using Tsukamoto Fuzzy Method

Table 3
Data on economic, health, social and safety variables

Need Factor	Score
Economy	40
Health	30
Social	10
Safety	20

Based on the questionnaire that has been filled out by the stakeholder, it will then be used as a reference for determining the input value.

Name: Innekeh Pratiwi
Gender: Female
Position: Waiter
μeconomy.low(40) = 0.25
μeconomy.high(40) = 0.75
μhealth.low(30) = 0.5
μhealth.height(30) = 0.5
μsafety.low(20) = 0.75

μsafety.height(20) = 0.25
μsocial.low(10) = 1
μsocial.height(10) = 0

After being reflected into the fuzzy set, two fuzzy rules are formed for sports activities, namely:

[R1] If health is low and social is low then exercise is low.
α1=min(μhealth.low, μsocial.low)
= min(0.5 , 1) = 0.5
μexercise = (10 – x) / 9 = 0.5
x = 5.5

[R3] If health is high and social is low then exercise is high
α3=min(μhealth.high, μsocial.low)
= min(0.5 , 1) = 0.5
μexercise = (x – 1) / 9 = 0.5
x = 5.5

The next step is blurring with a centralized mean.

$$Z = \frac{(0.5 * 5.5) + (0{,}5 * 5.5)}{0.5 + 0.5} = 5.5$$

The results are obtained using a weighted average, getting the results recommended for the following activities.

Table 4
Final results recommended employee activities

Need Factor	Score
Online Shopping	7.75
Exercise	5.5
Rest	4.75

Based on calculations using the Tsukamoto fuzzy method, the most recommended activity is the activity (Online Shopping) with a score of (7.75).

B. *Tsukamoto Fuzzy System Design*

1) System Design

a. Personal data page

On this page the user will fill in personal data such as name, gender, age, address, position and length of work which will be used as data to display results. The following is the design of the personal data page.

b. Questionnaire

The user will answer the questionnaire questions by choosing yes and no answers and the results of these answers will be a value that will be calculated and processed in the system to display the results. The following is the design page for filling out the questionnaire.

c. Results Page

This page displays personal data and the results of calculations from the answers to the questionnaire using the Tsukamoto fuzzy method by displaying the recommended order of activities with the largest value as a highly recommended activity.

2) System Implementation

In this system, we will discuss the steps used in the Tsukamoto fuzzy method. Here are the steps:

a. Fuzzification, changing the input value into the form of fuzzy input.
b. Inference, reasoning using Tsukamoto fuzzy is done by looking for the degree of membership of each variable, then checking each predetermined rule.
c. Defuzzification, changing the fuzzy output into a firm value based on a predetermined membership function.

3) System Test

In the testing process we enter a sample of employees and fill in the appropriate answers to the questionnaire and compare the results of the sum that has been done previously with the results of the system.

Fig. 1. Data page test

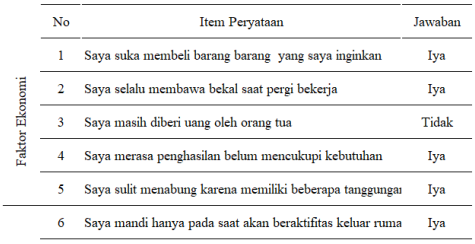

Fig. 2. Testing the questionnaire page

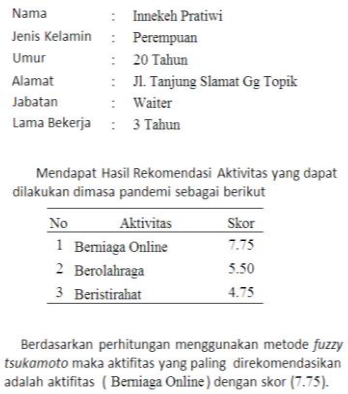

Fig. 3. Results page test

In the pictures above, it can be seen that the marked value is the highest value for each activity where 6 employees are recommended (Rest), 3 employees are recommended (Online Trading) and 1 employee is recommended (Exercise).

4. Conclusion

The following is a recap of employee activity scores with the highest score weight.

Based on the discussion to recommend employee activities during the pandemic by recommending activities based on economic factors, social health and safety, it can be concluded

that the results obtained are 6 recommended employees (resting), 3 recommended employees (Online Trading) and 1 recommended employee (Exercise).

Table 5
Employee activity recommendation recap

Employee	Recommended Activity
Innekeh	Online Shopping
Desi	Rest
Nur	Rest
Mende	Rest
Wira	Rest
Heru	Rest
Novri	Exercise
Febby	Rest
Rima	Online Shopping
Dwi	Online Shopping

It is hoped that these results can be applied when not working or during off days, in order to reduce the number of employees who are affected by the self-isolation policy due to illness and due to traveling during a pandemic, and it is hoped that the needs of employees in the economic field can be met and in the health sector they can stay healthy, in order to be able to return to work with full working hours.

Suggestions in this study are the selection of employee activities using the Tsukamoto fuzzy method consisting of four variables as inputs and four consequences as outputs, it is hoped that in future studies add the number of variables and the number of questions so that the value obtained is better.

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