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Development of a System for Determining Loan Eligibility in the Bukit Indah Cooperative, Batunya Village Using the Fuzzy Sugeno Method

I Gede Made Deny Surya Gunawan[1], Ni Ketut Kertiasih[2], Ni Wayan Marti[3], Agus Aan Jiwa Permana[4]
Universitas Pendidikan Ganesha, Indonesia
deny.surya@undiksha.ac.id; ketut.kertiasih@undiksha.ac.id

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Abstract

This study aims to develop a loan eligibility determination system at the Bukit Indah Cooperative in Batunya Village using the fuzzy sugeno method. The Bukit Indah Cooperative is a savings and business cooperative run independently by the Batunya Village community and carries out efforts for the welfare of the Batunya Village community. Fuzzy Sugeno is one of the fuzzy logic methods used for modeling, control and decision making. Fuzzy Sugeno was developed by Takagi, Sugeno, and Kang in 1985, this method aims to provide more efficient results in the control and decision making system. The research method used in this study is the waterfall method. This study has succeeded in developing and producing a system used to help the Bukit Indah Cooperative in Batunya Village to determine the eligibility of providing loans to customers. In testing the feasibility of the system with 20 sample data, it was found that out of 20 sample data, there were 18 correct data in the system, data comparison was carried out by comparing the data from the evaluation of calculations by cooperative officers with the data produced by the system which produced an accuracy level of 90.00%. Based on these results, it was found that the system developed can be said to work well and is considered sufficient to test the accuracy of the fuzzy Sugeno method.

Keywords: System development, Cooperative, Fuzzy Sugeno, Accuracy

INTRODUCTION

The calculation determination system is a mechanism or method used to calculate or determine the outcome of a calculation process based on specific data or parameters. This system is generally designed to simplify and expedite decision-making processes, minimize errors, and ensure consistency in the calculation results. The system can be implemented manually, using tables or mathematical formulas, or automatically with the help of software that processes data and provides calculation results according to predefined rules.

Cooperatives are based on a unique concept derived from the Latin word "coopere," which in English means "cooperation." "Co" means "together," and "Operation" means "work," so it essentially means "working together." Therefore, it can be interpreted as cooperating to achieve common goals and interests (Sattar, 2017: 28). A cooperative is a business and economic movement aimed at building a prosperous society based on Pancasila and the 1945 Constitution. Article 1, Paragraph 1 of the Indonesian Republic Law No. 25 of 1992 on Cooperatives defines a cooperative as "a business entity consisting of individuals or legal cooperative entities that base their activities on cooperative principles while functioning as a people's economic movement based on the principle of family." According to an article written by (Suryokumoro & Ula, 2020), it can be concluded that the elements of a cooperative definition are that it is an economic organization and not a mass organization. The founders/owners are individuals (private persons) or legal entities of cooperatives that operate based on cooperative principles. Kinship serves as an economic movement (Dewi et al., 2022).

Bukit Indah Cooperative is a savings and loan cooperative located in Batunya Village, Baturiti Subdistrict, Tabanan Regency. This cooperative is run independently by the people of Batunya Village to improve the welfare of its community. In practice, Bukit Indah Cooperative provides loans to its members. When offering loans, the cooperative operates cautiously to ensure that the transactions align with the cooperative's objectives.

The cooperative does not base loan approvals on personal relationships or family ties. Instead, it relies on relevant data, such as credit history, repayment ability, and collateral, to determine the appropriate loan amount.

By using this data, the cooperative ensures that the loans given do not exceed the member's ability to repay and reduces the risk of bad credit. Furthermore, the professional and transparent approach in providing loans increases members' trust in the cooperative and reduces the risk of conflicts of interest. The loan process at Bukit Indah Cooperative involves specific requirements or criteria that must be met by borrowing members. The assessment of loan eligibility often takes time and requires careful calculation to determine eligible borrowers. In addition, the manual assessment process carries the risk of errors or inaccuracies in decision-making.

Therefore, a decision-making system is needed that can provide accurate and efficient loan eligibility recommendations to members based on the existing problems. One method that can be used is the Sugeno fuzzy method.

According to Kusumadewi (in Fajar Rohman Hariri, 2016), Sugeno fuzzy is described as a calculation logic used to make a single or crisp decision during the defuzzification process. The use of this method depends on the problem at hand. The process flow of Sugeno fuzzy logic starts with fuzzification, inference, defuzzification, and output. Sugeno fuzzy was first introduced by Takagi-Sugeno Kang in 1985, which is why it is often referred to as the TSK (Takagi-Sugeno Kang) method. Sugeno fuzzy has a format similar to the Mamdani fuzzy method, except for the output.

By using Sugeno fuzzy, the cooperative can minimize the risk of bad credit and increase members' trust in the cooperative. Additionally, using this method can improve the cooperative's efficiency and productivity in providing financial services to its members. Therefore, the Sugeno fuzzy method can serve as an alternative solution to address cooperative loan issues.

This research discusses the loan eligibility determination system at Bukit Indah Cooperative in Batunya Village using the Sugeno fuzzy method. Sugeno fuzzy was chosen because it is deemed suitable for addressing the issues in this study. Therefore, the results of this research are expected to benefit the cooperative by improving efficiency and accuracy in assessing loan eligibility for its members.

METHODS

The research method employed in this study involved interviews, observations, and literature review. Interviews were conducted to identify the criteria required for obtaining a loan. Observations were carried out to observe the process of credit application. The literature review was conducted by seeking relevant sources related to this research as references. And the development method used in this research is the Waterfall Model. The Waterfall method is a sequential and systematic research approach. There are five stages in the Waterfall method: requirement gathering, followed by the design phase, implementation, verification, and maintenance.

RESULTS AND DISCUSSION

The research results explain the development of the Waterfall method, which was implemented in the decision support system for determining loan eligibility at the Bukit Indah Cooperative in Batunya Village using the Sugeno fuzzy method. The outcome of this research is a web-based system that can provide decision recommendations for determining loan eligibility at the Bukit Indah Cooperative in Batunya Village. The system can assess whether applicants are eligible or ineligible for loan applications.

System Design

In the system design phase, various aspects will be planned, including the creation of flowcharts, use case diagrams, Entity Relationship Diagrams (ERD), and database models. All these designs will be integrated into an interface that serves as a representation of the system's requirements and objectives. This phase involves the transformation of previously planned creative ideas and concepts into visual forms that can be interacted with.

Fuzzy Sugeno Calculation

At this stage, Fuzzy Sugeno calculations will be performed based on the data that has been collected.

1. Fuzzy Variables

   Based on the criteria data obtained, the fuzzy variables are determined as four input variables and one output variable. The input variables consist of Delay_History, Income, Dependents, and Collateral, while the output variable consists of Decision. For more details, refer to Table 1.

Table 1. Fuzzy variables

Function	Variable Name
Input	Delay_History
	Income
	Dependents
	Collateral
Output	Decision

2. Linguistic Values

After the Fuzzy variables are determined, the next step is to assign linguistic values to each variable. These linguistic values are determined based on the sub-criteria data obtained from the initial data. For more details, refer to Table 2.

Table 2. Linguistic Values

Function	Variable	Sub criteria	Linguistic Value
Input	Delay_History	Never late & new loan	Never
		1 – 3 times late	Rarely
		≥ 4 times late	Often
	Income	< Rp.2.824.613	Low
		Rp. 2.824.613 – Rp. 5.649.226	Moderate
		> Rp. 5.649.226	High
	Dependents	0 people / No. dependents	Few
		1 - 2 people	Moderate
		≥ 3 people	Many
	Collateral	< Rp. 5.000.000	Insufficient
		Rp. 5.000.000 – Rp. 20.000.000	Adequate
		> Rp. 20.000.000	Good
Output		1	Approved
		0	Rejected

3. Universe of Discourse

After the linguistic values are determined, the next step is defining the universe of discourse. The universe of discourse represents the entire set of values that can be manipulated by fuzzy variables. It is a set of real numbers that always increases from left to right. The values in the universe of discourse can be positive or negative. In some cases, the universe of discourse is not limited by its upper bound (Sri Kusumadewi, 2022). For further details, refer to Table 3.

Table 3. Universe of Discourse

Function	Variable Name	Universe of Discourse
Input	Delay_History	[0 – 12]
	Income	[0 – 8.000.000]
	Dependents	[0 – 5]
	Collateral	[0 – 100.000.000]
Output	Decision	[0 – 1]

4. Domain Values

The fuzzy domain represents the range of values that a fuzzy variable can take. Domain values are assigned to each linguistic value of the sub-criteria variables previously determined. The assignment of domain values is based on the sub-criteria data, ensuring that the range of domain values does not exceed the universe of discourse. For further clarity on the assignment of domain values, refer to Table 4.

Table 4. Domain Values

Function	Variable	Linguistic Value	Domain
Input	Delay_History	Never	[0 – 1]
		Rarely	[0 – 4]
		Often	[3 – 12]
	Income	Low	[0 – 3.000.000]
		Moderate	[2.824.613 – 6.000.000]
		High	[5.649.226 – 8.000.000]
	Dependents	Few	[0 – 1]

Function	Variable	Linguistic Value	Domain
		Moderate	[0 – 3]
		Many	[2 – 10]
	Collateral	Insufficient	[0 – 6.000.000]
		Adequate	[5.000.000 – 21.000.000]
		Good	[20.000.000 – 100.000.000]
Output		Approved	[0]
		Rejected	[1]

5. Fuzzification

The membership degrees in this decision support system are divided into four input variables: Delay_History, Income, Dependents, and Collateral. The output variable is Decision.

a. Variable Delay_History (*Riwayat_Keterlambatan*)

The Delay_History variable has a universe of discourse ranging from 0 to 12. Based on Table 4, the Delay_History variable is divided into three linguistic values: Never, Rarely, and Often. To represent Never, a downward linear curve is used, for Rarely, a trapezoidal curve is applied, and for Often, an upward linear curve is employed. The fuzzy set representation for the Delay_History variable is shown in Figure 1.

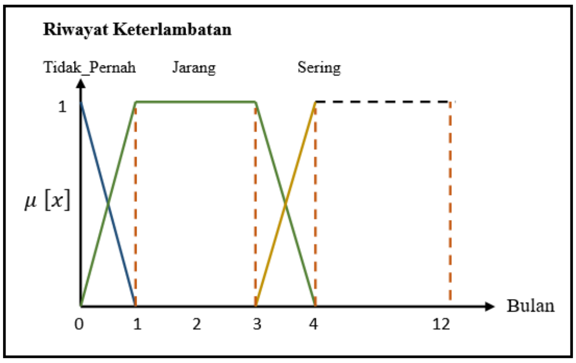

Figure 1. Fuzzy Set Curve for Delay_History

Based on Figure 1, the membership functions for the Delay_History variable are as follows.

$$\mu \text{ Never } (Tidak\_pernah)\ [x] = \begin{cases} 1\ ; x \le 0 \\ \frac{1-x}{1-0};\ 0 \le x \le 1 \\ 0\ ;\ x \ge 1 \end{cases} \quad (1)$$

$$\mu \text{ Rarely } (Jarang)\ \ [x] = \begin{cases} 0\ ; x \le 0\ or\ \ge 1 \\ \frac{x-0}{1-0};\ 0 \le x \le 1 \\ 1;\ 1 \le x \le 3 \\ \frac{4-x}{4-2};\ x \ge 4 \end{cases} \quad (2)$$

$$\mu \text{ Often (Sering) } [x] = \begin{cases} 0\ ; x \le 2 \\ \frac{x-2}{4-2};\ 2 \le x \le 4 \\ 1\ ;\ x \ge 4 \end{cases} \quad (3)$$

b. Variable Income (*Penghasilan*)

The Income variable has a universe of discourse ranging from 0 to 8,000,000. Based on Table 4, the Income variable is divided into three linguistic values: Low, Moderate, and High. To represent Low, a downward linear curve is used, for Moderate, a triangular curve is applied, and for High, an upward linear curve is employed. The fuzzy set representation for the Income variable is shown in Figure 2.

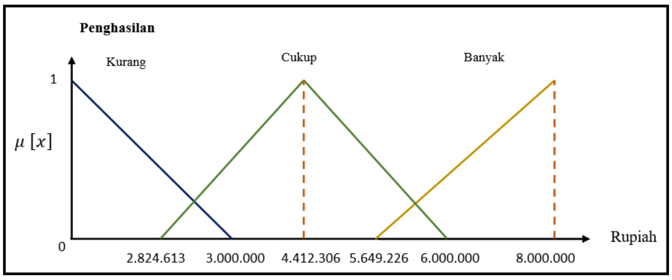

Figure 2. Fuzzy Set Curve for Income

Based on Figure 2, the membership functions for the Income variable are as follows.

$$\mu \text{ Low } (kurang)\ [x] = \begin{cases} 1\ ; x \le 3.000.000 \\ \frac{3.000.000-x}{3.000.000-0};\ 0 \le x \le 3.000.000 \\ 0\ ;\ x \ge 3.000.000 \end{cases} \quad (4)$$

$$\mu \text{ Moderate } (Cukup)\ [x] = \begin{cases} 0\ ; x \le 2.824.613\ or\ \ge 6.000.000 \\ \frac{x-2.824.613}{4.000.000-2.824.613};\ 2.824.613 \le x \le 4.412.306 \\ \frac{6.000.000-x}{6.000.000-4.412.306};\ 4.412.306 \le x \le 6.000.000 \end{cases} \quad (5)$$

$$\mu \text{ High } (baik)\ [x] = \begin{cases} 0\ ; x\ \leq 5.649.226 \\ \frac{x - 5.649.226}{8.000.000 - 5.649.226};\ 5.649.226 \leq x\ \leq 8.000.000 \\ 1\ ;\ x\ \geq 8.000.000 \end{cases} \quad (6)$$

c. Variable Dipendents (*Tanggungan*)

The Dependents variable has a universe of discourse ranging from 0 to 10. Based on Table 4, the Dependents variable is divided into three linguistic values: Few, Moderate, and Many. To represent Few, a downward linear curve is used, for Moderate, a trapezoidal curve is applied, and for Many, an upward linear curve is employed. The fuzzy set representation for the *Dependents* variable is shown in Figure 3.

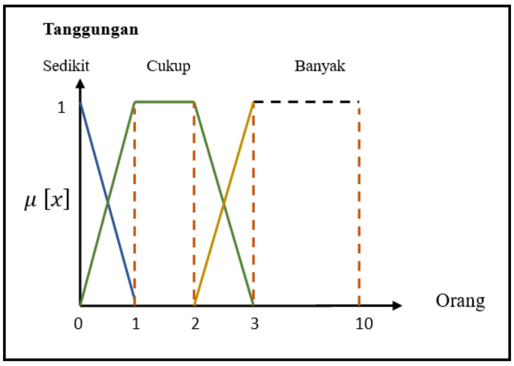

Figure 3. Fuzzy Set Curve for Dependents

Based on Figure 3, the membership functions for the Dependents variable are as follows.

$$\mu \text{ Few } (Sedikit)\ [x] = \begin{cases} 1\ ; x\ \leq 0 \\ \frac{1-x}{1-0};\ 0 \leq x\ \leq 1 \\ 0\ ;\ x\ \geq 1 \end{cases} \quad (7)$$

$$\mu \text{ Moderate } (Cukup)\ \ [x] = \begin{cases} 0\ ; x\ \leq 0\ or\ \geq 1 \\ \frac{x-0}{1-0};\ 0 \leq x\ \leq 1 \\ 1;\ 1 \leq x\ \leq 2 \\ \frac{3-x}{3-2};\ x\ \geq 3 \end{cases} \quad (8)$$

$$\mu \text{ Many } (\ Banyak\ )\ [x] = \begin{cases} 0\ ; x\ \leq 2 \\ \frac{x-2}{3-2};\ 2 \leq x\ \leq 3 \\ 1\ ;\ x\ \geq 3 \end{cases} \quad (9)$$

d. Variable Collateral (*Jaminan*)

The Collateral variable has a universe of discourse ranging from 0 to 100,000,000. Based on Table 4, the Collateral variable is divided into three linguistic values: Insufficient, Adequate, and Good. To represent Insufficient, a downward linear curve is used, for Adequate, a triangular curve is applied, and for Good, an upward linear curve is employed. The fuzzy set representation for the Collateral variable is shown in Figure 4.

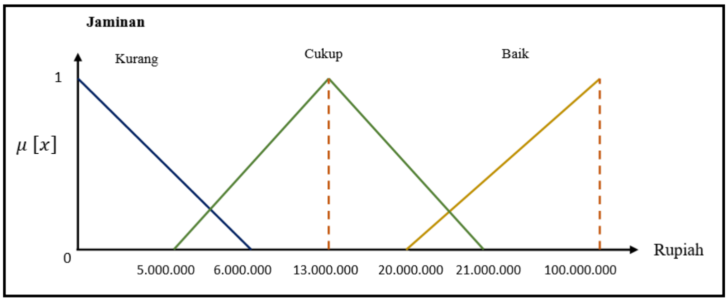

Figure 4. Fuzzy Set Curve for Collateral

Based on Figure 4, the membership functions for the *Collateral* variable are as follows:

$$\mu \text{ Insufficient } (Kurang)\ [x] = \begin{cases} 1\ ; x\ \leq 6.000.000 \\ \frac{6.000.000 - x}{6.000.000 - 0};\ 0 \leq x\ \leq 6.000.000 \\ 0\ ;\ x\ \geq 6.000.000 \end{cases} \quad (10)$$

$$\mu\ Adequate(Cukup)\ \ [x] = \begin{cases} 0\ ; x\ \leq 5.000.000\ atau\ \geq 21.000.000 \\ \frac{x - 5.000.000}{13.000.000 - 5.000.000};\ 5.000.000 \leq x\ \leq 13.000.000 \\ \frac{21.000.000 - x}{21.000.000 - 13.000.000};\ 13.000.000\ \leq x\ \geq 21.000.000 \end{cases} \quad (11)$$

$$\mu\ Good\ (Baik)\ [x] = \begin{cases} 0\ ; x\ \leq 20.000.000 \\ \frac{x - 20.000.000}{100.000.000 - 20.000.000};\ 20.000.000 \leq x\ \leq 100.000.000 \\ 1\ ;\ x\ \geq 100.000.000 \end{cases} \quad (12)$$

6. Fuzzy Rules

The design of the fuzzy rules in this study is derived from mapping the input variables, which include four input variables, each with three sub-variables. The determination of these fuzzy rules is based on interviews conducted by the researcher with experts. The implication function used in the Sugeno fuzzy calculations is the AND function (MIN function). Based on expert input and the implication function used, a total of 81 fuzzy rules are generated.

The Rule Base System can also be described using IF/THEN rules, which establish the relationship between inputs and outputs as follows:

R1. **IF** Delay_History = Never **AND** Income= Low **AND** Dependents = Few **AND** Collateral = Insufficient **THEN** Decision = Rejected.

R2. **IF** Delay_History = Never **AND** Income = Low **AND** Dependents = Few **AND** Collateral = Adequate **THEN** Decision = Rejected.

R3. **IF** Delay_History = Never **AND** Income = Low **AND** Dependents = Few **AND** Collateral = Good **THEN** Decision = Rejected.

R4. **IF** Delay_History = Never **AND** Income = Low **AND** Dependents = Moderate **AND** Collateral = Insufficient **THEN** Decision = Rejected.

R5. **IF** Delay_History = Never **AND** Income = Low **AND** Dependents = Moderate **AND** Collateral = Adequate **THEN** Decision = Rejected.

...

R81. **IF** Delay_History = Never **AND** Income = Low **AND** Dependents = Moderate **AND** Collateral = Adequate **THEN** Decision = Rejected.

7. Inference

After establishing the fuzzy rules, the next step is the inference process. In this study, inference is performed using the MIN implication function to obtain the α-predicate values for each rule (α1, α2, α3, …, αn). Each α-predicate value is then used to compute the crisp output of the inference for each rule (z1, z2, z3, …, zn).

8. Defuzzification

Defuzzification is the process in fuzzy logic systems that converts fuzzy results into a crisp value. It is the final step in fuzzy control systems or decision-making, where the information processed in fuzzy form must be translated into a value that can be used in decision systems.After the inference, the next step is Defuzzification. In this process, the output is expressed as a crisp number. Defuzzification is performed by calculating the weighted average, which is as follows:

$$z = \frac{\sum_{r=1}^{R} a_r z_r}{\sum_{r=1}^{R} a_r} \qquad (13)$$

With:

z = demand quantity variable

a_r = α-predicate (fire strength) of the r-th rule

Z_r = output of the r-th rule antecedent

Sample Calculation for Sugeno Fuzzy

In the credit application dataset, there are 20 samples that need to be evaluated to determine whether a credit application is eligible for approval or not. The Sugeno fuzzy calculations for a sample are performed in three stages: fuzzification, inference, and defuzzification.

Below is the calculation for sample data number 1. The details for sample data number 1 are as follows:

- Name: I Made Dharma
- Delay_History: 0 times delayed
- Income: Rp.10,000,000
- Dependents: 2 persons
- Collateral: Rp.150,000,000

1. Fuzzification

a. Fuzzification of Delay_History

To perform fuzzification for the Delay_History variable with an input value of 0:

- μ Delay_History Never [0] = 1, Delay_History < 1.
- μ Delay_History Rarely [0] = 0, Delay_History ≤ 0 or Delay_History ≥ 4.
- μ Delay_History Often [0] = 0, Delay_History ≤ 4.

From the above calculations, the membership degrees for each linguistic value are:

- μ Never [0] = 1.
- μ Rarely [0] = 0.

- μ Often [0] = 0.

b. Fuzzification of income

To perform fuzzification for the Income variable with an input value of 10.000.000:

- μ Income Low [10.000.000] = 0, Income ≥ 3.000.000.
- μ Income Moderate [10.000.000] = 0, Income ≤ 2.824.613 atau Income ≥ 6.000.000.
- μ Income High [10.000.000] = 1, Income ≥ 5.649.226

From the above calculations, the membership degrees for each linguistic value are:

- μ Low [10.000.000] = 0.
- μ Moderate [10.000.000] = 0.
- μ High [10.000.000] = 1.

c. Fuzzification of Dependents

To perform fuzzification for the Dependents variable with an input value of 2:

- μ Dependents Few[2] = 0, Dependents ≥ 1.
- μ Dependents Moderate [2] = 1, Dependents ≤ 0 atau Dependents ≥ 3.
- μ Dependents Many [2] = 0, Dependents ≤ 2.

From the above calculations, the membership degrees for each linguistic value are:

- μ Few [2] = 0.
- μ Moderate [2] = 1.
- μ Many [2] = 0.

d. Fuzzification of Collateral

To perform fuzzification for the Collateral variable with an input value of 150.000.000:

- μ Collateral Insufficient [150.000.000] = 0, Collateral ≥ 6.000.000
- μ Collateral Adequate [150.000.000] = 0, Collateral ≤ 5.000.000 atau Collateral ≥ 21.000.000

- μ Collateral Good [150.000.000] = 1, Collateral ≥ 100.000.000

From the above calculations, the membership degrees for each linguistic value are:

- μ Insufficient [150.000.000] = 0.
- μ Adequate [150.000.000] = 0.
- μ Good [150.000.000] = 1.

2. Inference

In this stage, we compare the results of fuzzification for each variable according to the predefined fuzzy rules. The implication function used is the AND function, which involves finding the minimum value.

For the given data sample, we determine which rule applies based on the fuzzification results. The rule that satisfies the fuzzification results is rule number 24 [R24]. The implication is calculated by finding the minimum value, as follows:

R24. **IF** Delay_History (1) = Never **AND** Income = High (1) **AND** Dependents = Moderate (1) **AND** Collateral = Good (1).

= MIN (1 , 1 , 1 , 1)

= **1**

3. Defuzzification

In the defuzzification process, the goal is to determine the final decision. In this case, a decision of "Rejected" is assigned a value of 0, and a decision of "Approved" is assigned a value of 1. To compute the defuzzified value, we use the weighted average formula. The general formula for defuzzification using the weighted average is:

Decision

(0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (1 x 0) + (1 x 0) + (0 x 0) + (1 x 0) + (1 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (1 x 0) + (1 x 0) + (0 x 0) + (1 x 0) + (1 x 1) + (0 x 0) + (0 x 0) + (1 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (1 x 0) + (1 x 0) + (0 x 0) + (1 x 0) + (1 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (1 x 0) + (1 x 0) + (0 x 0) + (1 x 0) + (1 x 0) + (0 x 0) + (0 x 0) + (1 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x 0) + (0 x

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= **1**

So, if the computed value is indeed 1, the final decision for the credit application would be Approved.

Implementation

In the context of software development, implementation refers to the stage where the software design is transformed into executable source code. This is the phase where the concepts and plans developed during the analysis and design stages are realized into a functional program. Implementation involves coding, testing, and deploying the software. The implementation for the system can be observed in Figures 5, 6, 7, and 8.

1. Admin Dashboard

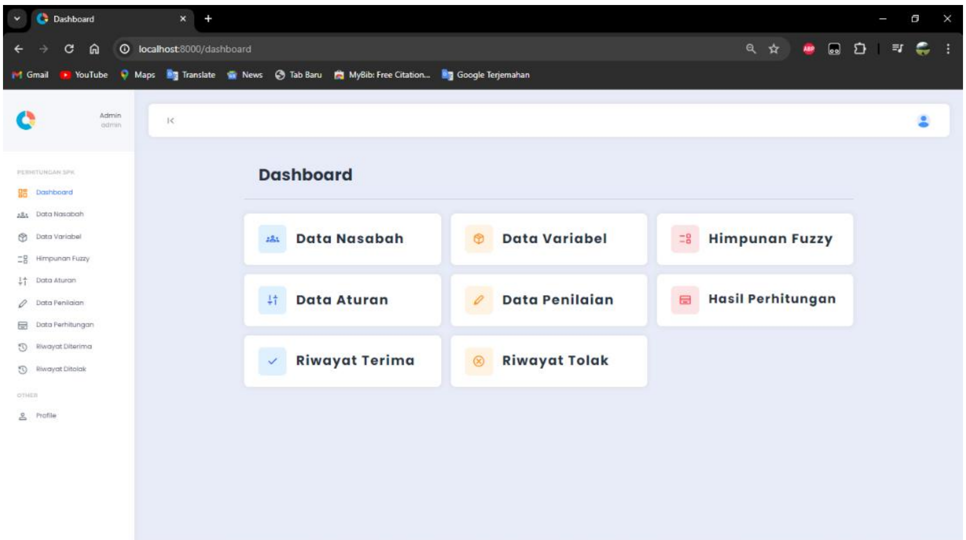

Figure 5. Admin Dashboard

2. Officer Dashboard

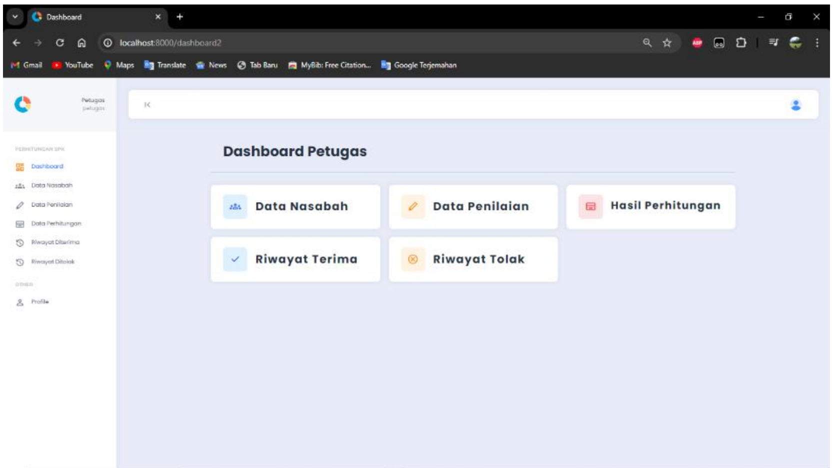

Figure 6. Officer Dashboard

3. Admin Calculation Results

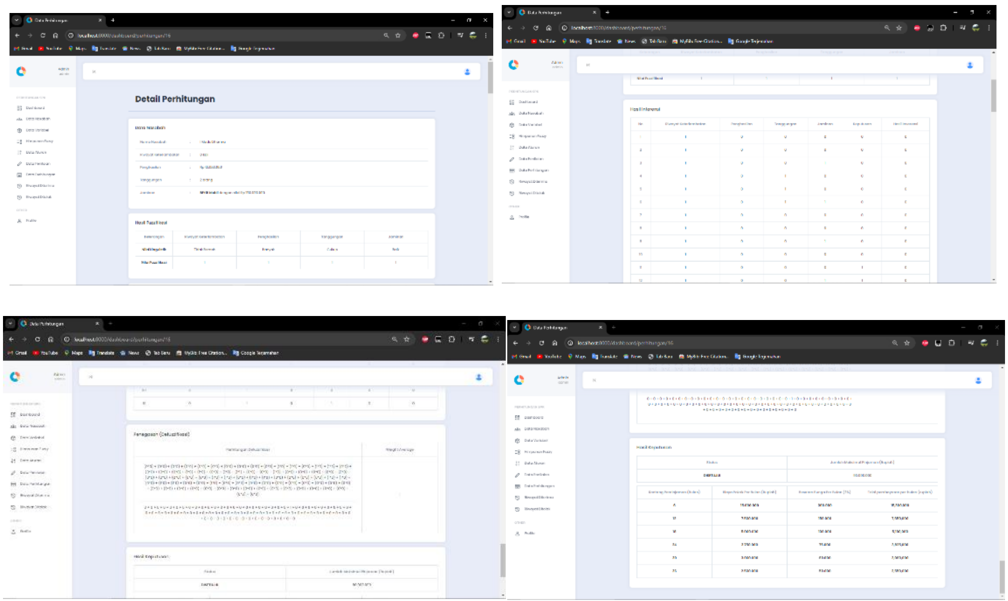

Figure 7. Admin Calculation Detail Results

4. Officer Calculation Detail Results

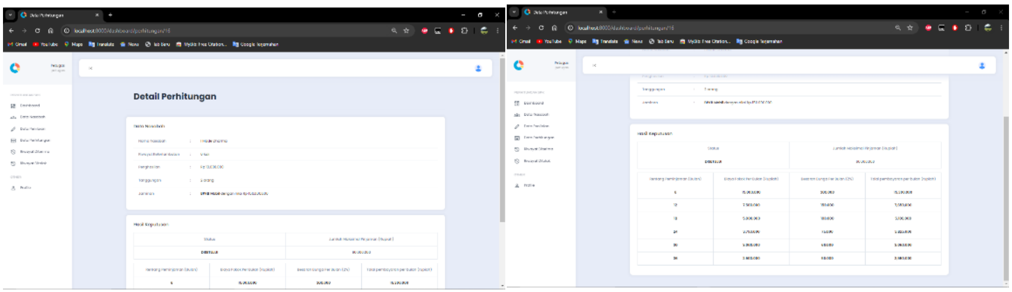

Figure 8. Officer Calculation Detail Results

Testing

From the accuracy testing results, it was observed that the evaluation of calculations by the cooperative staff matched the system calculations in 18 out of 20 data samples. To verify these results, the accuracy was calculated using the following formula.

$$Accuracy = \frac{18}{20} * 100\% = 90.00\% \quad (14)$$

Out of the total 20 data samples used, there were 2 discrepancies between the calculations performed by the cooperative staff and those by the system. The accuracy result of 90.00% indicates that the developed system operates effectively and the accuracy testing results are satisfactory.

CONCLUSION

Based on the results of the research that has been done, it can be concluded that in the implementation of the fuzzy sugeno method calculation, it was found that the calculation using the fuzzy sugeno method was successfully used to calculate the eligibility provisions for customer loans at the Bukit Indah cooperative. The fuzzy sugeno method is effectively used to help determine the decision-making process of whether or not customers are eligible to borrow at the Bukit Indah cooperative by obtaining accurate calculations from the input criteria values entered through the fuzzification stage to determine the crips value in the fuzzy set so that the set value is obtained that corresponds to the linguistic value and the fuzzy set value, through inference where the fuzzification result value is compared with the rules that have been determined and the minimum value is determined with the AND implication to find the MIN value in the fuzzy set value, then when the comparison with the rules has been obtained, it is continued with deffuzification to obtain a weighted average value of the inference value so that the output results are 0 (rejected) and 1 (accepted). Based on testing carried out on 20 sample data obtained from 18 sample data, there was no difference in the evaluation of the calculation by the cooperative officer with the calculation on the system. These 18 precise data are then measured by dividing them by the total amount of data available and multiplied by the percentage of 100.00% and the result is 90.00%. The result of the percentage of 90.00% reflects that the system that has been developed is quite precise and can function well and is considered adequate.

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