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# DECISION SUPPORT SYSTEM TO DETERMINE THE PRICE OF USED COMPUTER BASED ON SPECIFICATION AND USAGE DURATION USING FUZZY LOGIC

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**Abstract**

Using computers at work or others has many positive impacts, including a special program that simplifies data and media processing. Certain software applications will, for some time, require high computer specifications. Many people have computers and want to fulfill the application requirements by selling computers to upgrade the specifications. However, some people are not very knowledgeable about calculating the cost of a used computer. One of the things that are done to make it easier for users to determine the price of a used computer is to create a decision support system that will assist in determining the price of a used computer based on specifications and usage duration. The Fuzzy Logic method was used in this study by comparing the accuracy results of the Fuzzy Mamdani and Sugeno methods. The parameters are based on the purchase price of all computer components, including Processor, Motherboard, RAM, SSD, HDD, VGA, PSU, and Case and usage duration. Fuzzy Mamdani is proven to have a higher accuracy with a value of 71% when compared to Fuzzy Sugeno. Based on measurement findings and a comparison of the methods used. Therefore, Fuzzy Mamdani is recommended for future studies using the same parameters. The benefits of this research include a recommendation system that will make it simpler for the general public to determine the selling price of used computers based on their specifications and usage duration. Another advantage is that it makes it easier for the general population to become a reference when buying or selling used computers, mainly assembled computers.

**Kata Kunci**: Decision Support Systems, Recommendation Systems, Fuzzy Logic, Fuzzy Mamdani, Fuzzy Sugeno.

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## PENDAHULUAN

The development of technology, especially computers, has progressed rapidly in recent years. A computer is an electronic system for fast and precise data processing, designed to automatically receive, store, and handle input data to create output that is stored in memory [1]. All aspects of people's lives are inseparable from the support of information technology and computers [2]. The increasing number of computers globally has a considerable impact on society. The use of computers in society is very diverse. With their various uses, computers are very important tools that help people work in various fields [3].

Ensuring that the computer components you buy suit your needs and usage duration is important with so many different uses. Buying and selling always occur in everyday life, especially in selling electronic devices, namely computers. Often in buying and selling computers, especially sales, it is rare for the seller to know the used price of computer components. Pricing errors can be fatal. If the price is too high, buyers may be reluctant to buy and may switch to other sellers. If the price is too

low, it will cause losses. The development of the computer era experienced significant innovation from generation to generation. Sometimes many people have a computer. A desire arises to upgrade the specifications of an old computer or sell their computer to meet the minimum specifications of a new application that is used or sold because the computer is not used.

Previous research [4] used the Fuzzy Mamdani method to determine the price simulation of an assembled computer using four computer components as parameters and has given results with input Hardisk (enough = 50), Processor (enough = 50), RAM (enough = 50), VGA (enough = 50 ). Price output (cheap = 0 – 20, decent = 15 – 15, expensive = 35 -100), then produces value (expensive = 55) [4]. Subsequent research [3] uses the Fuzzy database method to determine computer specifications based on user needs and prices using five computer components as parameters with Processor input (low = 2), RAM (low = 2), Hard drive (low = 320), PSU (low = 500), Monitor (small = 16). Output needs and prices (games = 9,000 – 12,000, internet = 3,000 – 4,000, multimedia = 20,000 – 25,000), then generate value (Internet needs and low prices = 0.566) [3]. Based on these two studies, in determining the price of computers, only use one method and the parameters used as computer specifications are too few. Changes and additions to the parameters and methods must be needed to give different results.

The purpose of discussing this paper is to make recommendations for a system based on a decision support system for determining the price of used computers. The system built can also determine the selling price of one or all computer components from parameters based on their respective usage duration. The parameters used in this study are based on the computer components Processor, Motherboard, RAM, SSD, HDD, VGA, PSU, Case, and parameters for 1 to 3 years of use. The Fuzzy logic method was used in this study by comparing the best accuracy results on the Fuzzy Mamdani and Fuzzy Sugeno methods based on the ability to determine the reason.

## LITERATURE REVIEW

A. Decision Support System

A Decision Support System or Decision Support System can offer problem-solving and communication skills for semi-structured problems, generally defined as systems capable of providing problem-solving and communication skills for semi-structured difficulties [5]. The decision is the end of thinking about the problem [6]. Choosing one solution is considered a change from what was planned. Decision-making is a way to deal with problems in a planned manner [6]. The decision-making process has three stages, namely [7]:

1. Understanding. When investigating environmental conditions that require decisions, raw data is collected, processed, investigated, and used as clues to identify problems.
2. Design, discover, develop, and analyze action options. This involves understanding the problem, finding a solution, and testing whether the solution can be implemented.
3. Selection, select a particular action from all available actions. Decisions are made and carried out.

B. Fuzzy Logic

Fuzzy logic studies the systematic rules of effective thinking [8]. The logic commonly used in everyday and objective thinking is binary logic, in which each statement has two possible points, true or false.

1. Fuzzy Sets
   A set is a group or collection of objects with specific matching properties [8]. Fuzzy sets are a further development of the mathematical concept of sets. The fuzzy set is a range of values with a membership degree of 0 to 1.
2. Membership Functions
   The membership function is a curve that shows the relationship between data entry points and their membership values or degrees of membership with a distance of 0 to 1 [9].
3. Fuzzy Inference System (FIS)
   FIS is a way to determine what to think based on unclear clues and known facts [10]. In FIS, the input variables are used to process the application of implication function and rule composition.
4. Fuzzy Set Operations
   The membership value resulting from two sets of operations is commonly referred to as fire strength or *α-cut*. There are three basic operators created by Zadeh, namely: AND, OR, and NOT [11].
5. Defuzzification Unit
   The defuzzification process is a fuzzy set consisting of fuzzy rules, where the output is generated from strict numbers in the fuzzy domain [12].
   a. Mamdani Fuzzy Logic

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Fuzzy Mamdani with the MIN function and composition between rules with the MAX function. Defuzzification using centroid according to Equation (9).

b. Sugeno's Fuzzy Logic
Sugeno defuzzification has been done by finding the average value [13].

C. Confusion Matrix
The Confusion Matrix is a tool that measures the performance of prediction methods by calculating the accuracy of the classification process [14]. Given the amount of predictive data from the system and the amount of predictive data from experts as input variables to the Confusion Matrix, the system assigns fuzzy values for accuracy, precision, recall, and F-1 scores for each method.

## DATASETS

There are data requirements needed to build this application. The required data requirements are based on internet user postings on social media and forums which include computer components Processor, motherboard, random-access memory (RAM), Solid State Drive (SSD), Hard Disk Drive (HDD), Video Graphics Adapter (VGA), Power Supply (PSU), Computer-Aided Software Engineering (case), and usage duration. The parameters in the research case study are determined based on the average price of computer components owned by users on social media posts or forums. Then the component price limit is set at Rp. 100,000 to Rp. 10,000,000 based on Table 1.

Table 1. Data Parameters and Criteria

| Parameters | Criteria | Categories |
|---|---|---|
| *Processor*, *Motherboard*, RAM, SSD, | 100.000–5.000.000 | Cheap |
| HDD, VGA, PSU, and Case | 5.000.000–10.000.000 | Expensive |
| Usage duration | 0.1-1 | 1 year |
| | 0.1-1,2 | 2 years |
| | 1-2.7 | 3 years |
| Output | 100.000–3.500.000 | Cheap |
| | 3.500.000–7.000.000 | Expensive |

## METHOD

The DSS application that will be made in this study is web-based. This application generates prices for used computers based on the components and usage entered by the user. The initial step that the user prepares is data on the brand or series of computer components, the price of the components, and the length of time the components have been used. The calculation process is done by selecting a brand or series of computer components, the price of each computer component, and the usage time of these components. If the user does not find the brand name or component series provided, the user can input the item master according to the brand or series owned. Users can also calculate the used price of only one computer component, not necessarily a computer set. Furthermore, the value of the input price of computer components and the time they are used is calculated using fuzzy logic, as shown in Figure 1.

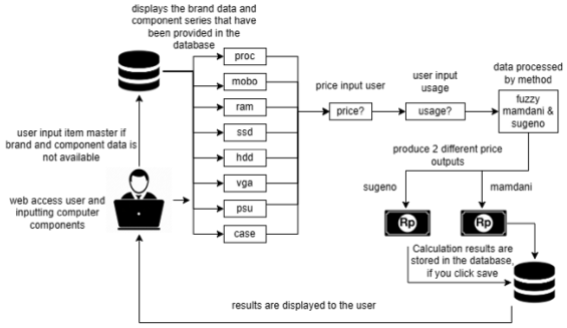


Figure 1. Decision Support System Architecture Determining Used Computer Prices Based on Specifications and Usage Duration

The stages of data processing to determine the price of used computers based on specifications and usage duration use the fuzzy Mamdani and Sugeno logic shown in Figure 1. Parameter-based input data is processed by forming fuzzy sets and degrees of membership, followed by a fuzzy inference process. The next stage is to compose fuzzy rules, then the defuzzification process with two types of fuzzy Mamdani and Sugeno methods. The final result will be a comparison of the calculation results of the two methods.

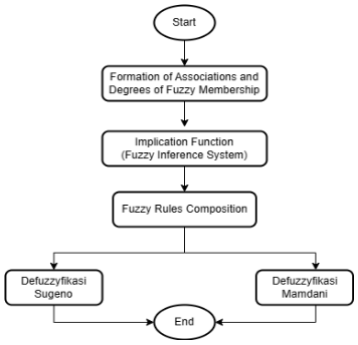


Figure 2. Fuzzy Method Flow

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A. Formation of the Association and Degrees of Membership. The function or degree of membership is a curve that shows the relationship between data entry points and the value or degree of membership with a distance of 0 to 1 [14]. In this study, the input prices for Processor, Motherboard, RAM, SSD, HDD, VGA, PSU, and Case have the same values and fuzzy sets, so the degree of membership is also the same. The initial stage determines the interval member function with the formula in Equation (1).

μÃ: U → [0,1].
(1)

Where the fuzzy set *Ã* in the universe of conversation U is represented by the membership function *μÃ* whose values are in the interval [0,1], after determining the interval, the next step is to determine the degree of membership defined using Equation (2).

Ã = {(u, μÃ (u) | u ∈ U}.
(2)

Where the fuzzy set is declared *Ã* in the universe of speech U as a companion element to u, where u is a member of U. Figure 3 the formation of cheap sets using Equation (3). Expensive ones using Equation (4) as well as the degree of membership with parameters of the Processor, motherboard, RAM, SSD, HDD, VGA, PSU, and Case.

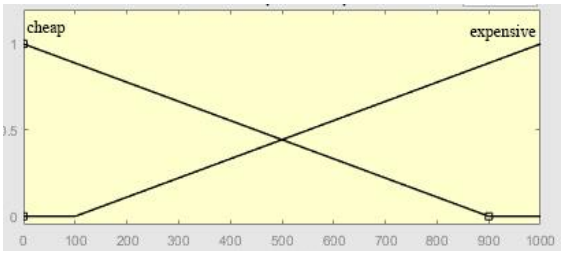


Figure 3. Member Functions of Input Parameters

$$\mu_{cheap}|x| = \begin{cases} \frac{(b\,(900)-x)}{(b\,(900)-a\,(100))}, & a\,(100) \le x \le b\,(900) \\ 0, & x \ge b\,(900) \end{cases}$$
(3)

$$\mu_{expensive}|x| = \begin{cases} 0, & x \le 100 \\ \frac{(x-100)}{(900-100)}, & 100 \le x \le 900 \end{cases}$$
(4)

Where the *a* variable is the smallest domain value when the membership degree is the smallest, the *b* variable is the largest degree of membership in the domain, and the *x* variable is the input value.

In Figure 4, there are three sets of 1 year based on Equation (5), 2 years based on Equation (6), and 3 years based on Equation (7) and the degree of membership of the usage duration parameter.

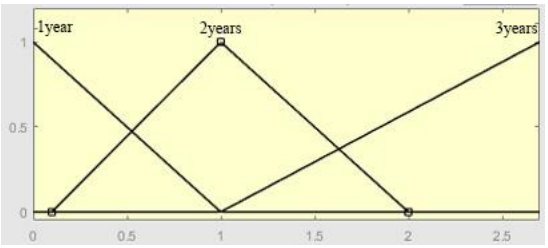


Figure 4. Member Function of Usage Duration Parameter

$$\mu_{1year}|x| = \begin{cases} \frac{(1-x)}{(1-0,1)}, & 0,1 \le x \le 1 \\ 0, & x \ge 1 \end{cases}$$
(5)

$$\mu_{2years}|x| = \begin{cases} 0, & x \le a(0)\ dan\ x \ge c(2) \\ \frac{x-a\,(0,1)}{b\,(1)-a(0,1)}, & a(0,1) \le x \le b(1) \\ \frac{c\,(2)-x}{c(2)-b(1)}, & b(1) \le x \le c(2) \end{cases}$$
(6)

$$\mu_{3years}|x| = \begin{cases} 0, & x \le 1 \\ \frac{(x-1)}{(2,7-1)}, & 1 \le x \le 2,7 \end{cases}$$
(7)

Where, the *a* variable is the smallest domain value when the membership degree is smallest, the *b* variable is the largest degree of membership in the domain, the *c* variable is the largest domain value when the membership degree is smallest, and the *x* variable is the input value.

Figure 5 shows the sets cheap and expensive, as well as the degree of membership of the output processor, motherboard, RAM, SSD, HDD, VGA, PSU, and Case that is:

$$\mu_{cheaph}|x| = \begin{cases} \frac{(600-x)}{(600-100)}, & 100 \le x \le 600 \\ 0, & x \ge 600 \end{cases}$$

$$\mu_{expensive}|x| = \begin{cases} 0, & x \le 100 \\ \frac{(x-100)}{(600-100)}, & 100 \le x \le 600 \end{cases}$$

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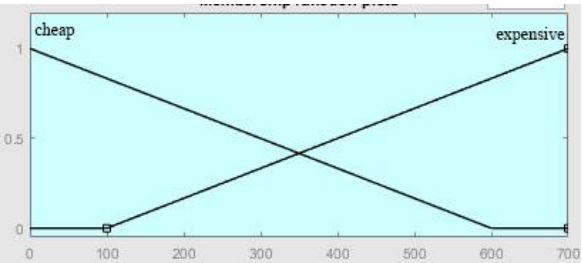


Figure 5. Member Function of Output Parameter

B. Fuzzy Inference System

A fuzzy inference system is a way to determine what to think based on clear instructions and known facts [10]. In this research inference system, there are six established rules. This rule applies to all parameters based on Table 2.

Table 2. Rules

| Rules | Price (inputs) | Usage Duration | Output |
|---|---|---|---|
| 1 | Cheap | 1 year | Cheap |
| 2 | Cheap | 2 years | Cheap |
| 3 | Cheap | 3 years | Cheap |
| 4 | Expensive | 1 year | Expensive |
| 5 | Expensive | 2 years | Expensive |
| 6 | Expensive | 3 years | Expensive |

C. Composition of Fuzzy Rules

The AND operation (intersection) is related to the slice set's operation. The intersection of the two sets is the minimum value for each pair of elements in the two sets using Equation (8) [11].

$$\mu A \cap B = \min(\mu_A[x], \mu_B[y]) \quad (8)$$

D. Defuzzification

In this research, there are two defuzzification processes: Mamdani and Sugeno. In the Mamdani defuzzification process, the decision-making method takes the center point of the fuzzy area using Equation (9).

$$Z_0 = \frac{\int_a^b z\,\mu_2 dz}{\int_a^b \mu_2\, dz} \quad (9)$$

Where the variable *Z* represents the value of the defuzzification results or the center point of the fuzzy region, the variable $\mu$(z) represents the membership value and the variable $\int_z \mu(z) z\, dz\rangle\!\rangle$ represents the moment for the region resulting from the composition rules. Sugeno defuzzification is done by finding the average value based on Equation (10).

$$Z = \frac{w_1 t_1 + w_2 t_2 + .. + w_n t_n}{w_1 + w_2 + .. + w_n} \quad (10)$$

Where variable *Z* is the average value, variable $w_n$ is the predicate value of the n-th rule, and variable $t_n$ is the index value of the n-th constant output.

E. Method Evaluation

This study uses the Confusion matrix to evaluate the method used by calculating the value of accuracy, precision, and recall using Equations (11), (12), and (13), respectively [15]. This is done to see how well the logic is based on Table 3 [15].

Table 3. Confusion Matrix

| | True Condition | |
|---|---|---|
| **Predicted Condition** | **Positive** | **Negative** |
| ***Positive (P)*** | *True Positive (TP)* | *False Positive (FP)* |
| ***Negative (N)*** | *False Negative (FN)* | *True Negative (TN)* |

$$Accuracy = \frac{TP+TN}{TP+FP+TN+FN} \times 100 \quad (11)$$

$$Precision = \frac{TP}{TP+FP} \times 100 \quad (12)$$

$$Recall = \frac{TP}{TP+FN} \times 100 \quad (13)$$

## RESULTS AND DISCUSSION

In discussing the calculation method, take the example of a case study of calculating a processor component with an input price of 450,000 and 2.5 years of usage duration.

Association Formation and Degree of Membership. Input price processor parameters = 450.

$$\mu_{expensive}|450| = \begin{cases} 0, & x \le 100 \\ \frac{(450-100)}{(900-100)}, & 100 \le x \le 900 \end{cases} = 0{,}4375$$

$$\mu_{cheap}|450| = \begin{cases} \frac{(900-450)}{(900-100)}, & 100 \le x \le 900 \\ 0, & x \ge 900 \end{cases} = 0{,}5625$$

Input usage duration parameters = 2,5.

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$\mu_{1year}|2{,}5| = 0$

$\mu_{2years}|2{,}5| = 0$

$$\mu_{3years}|2{,}5| = \begin{cases} 0, & x \leq 1 \\ \frac{(2{,}5-1)}{(2{,}7-1)}, & 1 \leq x \leq 2{,}7 \end{cases} = 0{,}882$$

After getting the set and membership degree results, the next step is to determine the fuzzy rules based on Table 2.

- [R1], if the price (Processor) is cheap and the usage duration is 1 year then it is cheap
- [R2], If the price (Processor) is cheap and the usage duration is 2 years, then it is cheap
- [R3], If the price (Processor) is cheap and the usage duration is 3 years, then it is cheap
- [R4], If the price (Processor) is expensive and the usage duration is 1 year, then it is expensive
- [R5], If the price (Processor) is expensive and the usage duration is 2 years, then it is expensive
- [R6], if the price (Processor) is expensive and the usage duration is 3 years, then it is expensive

In the composition of fuzzy rules, the results of the degree of the set are adjusted to the rules that have been made using Equation (8).

- $[R1]\ \alpha\ predicate_1 = \min(\mu\ cheap\ [450]\ ;\ \mu\ 1year[2{,}5]) = \min(0{,}562\ ;\ 0) = 0$
- $[R2]\ \alpha\ predicate_2 = \min(\mu\ cheap\ [450]\ ;\ \mu\ 2years[2{,}5]) = \min(0{,}562\ ;\ 0) = 0$
- $[R3]\ \alpha\ predicate_3 = \min(\mu\ cheap\ [450]\ ;\ \mu\ 3\ years\ [2{,}5]) = \min(0{,}562\ ;\ 0{,}882) = 0{,}562$
- $[R4]\ \alpha\ predicate_4 = \min(\mu\ expensive\ [450]\ ;\ \mu\ 1\ year[2{,}5]) = \min(0{,}437\ ;\ 0) = 0$
- $[R5]\alpha\ predicate_5 = \min(\mu\ expensive\ [450];\ \mu\ 2\ years[2{,}5]) = \min(0{,}437\ ;\ 0) = 0$
- $[R6]\ \alpha\ predikat_6 = \min(\mu\ expensive\ [450]\ ;\ \mu\ 3years[2{,}5]) = \min(0{,}437\ ;\ 0{,}882) = 0{,}437$

After getting the set results, the degree of membership, and the composition of the fuzzy rules, the next step is to calculate the defuzzification value with fuzzy Mamdani and Sugeno using equations (9) and (10). The results of the Mamdani fuzzy defuzzification are:

$$Z = \frac{(100+200+300)\ x\ 0{,}562+(400+500+600)\ x\ 0{,}437}{0{,}562+0{,}562+0{,}562+0{,}437+0{,}437+0{,}437}$$

$$Z = \frac{337{,}2+655{,}5}{2{,}997}$$

$$Z = 331{,}231 \approx Rp.331.250{,}00$$

The results of the Sugeno fuzzy defuzzification are:

$$Z = \frac{(0{,}562\ x\ 100)+(0{,}437\ x\ 600)}{0{,}562+0{,}437}$$

$$Z = 318{,}718 \approx Rp.318.750{,}00$$

After the defuzzification process was carried out, the final result was produced where the processor price was 450,000 with 2.5 years of use, resulting in fuzzy Mamdani 331.231 and fuzzy Sugeno 318.718, according to the results in the program in Figure 6.

| Harga Beli | Pemakaian | Harga Jual (M) | Harga Jual (S) |
|---|---|---|---|
| Rp 450.000,00 | 2.5 Tahun | Rp 331.250,00 | Rp 318.750,00 |

Figure 1. Hasil Program Fuzzy

This process applies to calculations of other computer parameters besides the Processor because it has the same set, member functions, and rules.

In calculating accuracy, the program results data are compared with the actual data obtained in social media group posts, according to Table 4.

Table 4. User Actual Data

| Name of goods | Name of goods | Name of goods (years) | Name of goods | Name of goods |
|---|---|---|---|---|
| i3 10100F | 1,500,000 | 1,3 | 1,100,000 | Expensive |
| Gigabyte Z490 | 7,300,000 | 1,3 | 6,500,000 | Cheap |
| Adata XPG 16GB | 1,500,000 | 1,3 | 1,100,000 | Expensive |
| Adata XPG 512GB | 1,100,000 | 1,3 | 850,000 | Cheap |
| RTX 3050 | 7,600,000 | 1,3 | 4,450,000 | Cheap |
| MSI 750W | 2,000,000 | 1,3 | 1,500,000 | Cheap |
| Xigmatek | 1,700,000 | 1,3 | 1,000,000 | Cheap |
| **Total** | **22,700,000** | | **16,500,000** | |

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Where the duration of use is from 18th May 2021 to 30th December 2022, the status is based on 2022 prices. Based on actual data and program data, a confusion matrix table is generated based on data from the Mamdani method on programs with real data, as shown in Table 5 and Table 6.

Table 5. Confusion Matrix Results of the Mamdani Fuzzy Method

| | | Prediction Data | |
|---|---|---|---|
| | | Cheap | Expensive |
| **Actual Data** | Cheap | 5 | 0 |
| | Expensive | 2 | 0 |

Then the calculation of accuracy, precision, and recall uses equations (11), (12), and (13) as follows:

$$Accuracy = \frac{5+0}{5+0+0+2} \text{x } 100 = 71{,}42\%$$

$$Precision = \frac{5}{5+0} \text{ x } 100 = 100\%$$

$$Recall = \frac{5}{5+2} \text{x } 100 = 71{,}42\%$$

Table 6. Confusion Matrix Results of the Sugeno Fuzzy Method

| | | Prediction Data | |
|---|---|---|---|
| | | Cheap | Expensive |
| **Actual Data** | Cheap | 4 | 1 |
| | Expensive | 2 | 0 |

$$Recall = \frac{4}{4+2} \text{x } 100 = 66{,}67\ \%$$

$$Precision = \frac{4}{4+1} \text{x } 100 = 80\%$$

$$Accuracy = \frac{4+0}{4+1+0+2} \text{x } 100 = 57{,}14\%$$

Based on the results of the two fuzzy Mamdani and Sugeno accuracy calculations, the resulting fuzzy Mamdani can provide an accurate value of 71%, 100% precision, and 71% recall. In comparison, the Sugeno Fuzzy gives an accuracy value of 57%, 80% precision, and 66% recall. The difference in the results between the two methods lies in defuzzification. The selling price results from the actual user data in Table 4 are compared with the program selling price results in Figure 9 using a confusion matrix. The best accuracy is produced using the Mamdani fuzzy method with the same input value and a different defuzzification process.

This implementation phase describes the results of the application's design and manufacture, which aims to show the functions and how to operate the application. Figure 7 displays the item master for inputting computer component data if it is not listed in the list on the main page of the web application.

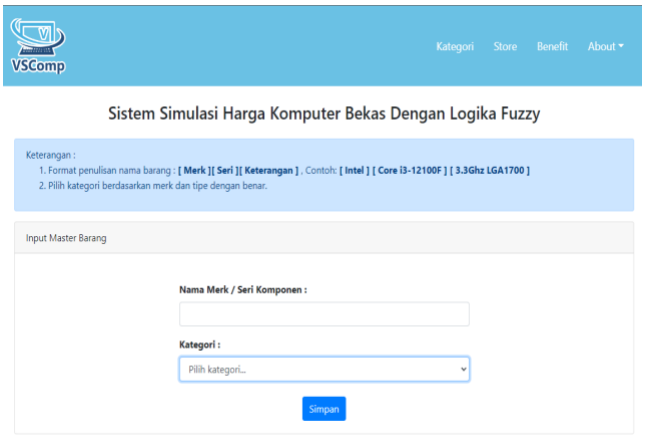


Figure 2. Item Master Page

Figure 8 shows the application's main page for calculating used prices based on computer components that have been input based on component categories, purchase prices, and usage to produce fuzzy calculations.

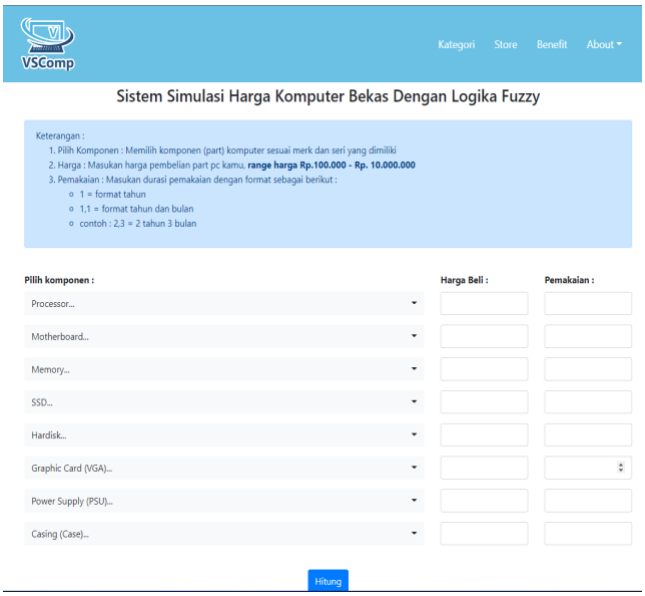


Figure 3. Main Page Display

Figure 9 displays the calculation results carried out on the main page based on computer components, purchase prices, and usage that have been inputted and produce differences in Fuzzy Mamdani and Sugeno.

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Detail Harga Penjualan Bekas

| No. | Nama Barang | Harga Beli | Pemakaian | Harga Jual (M) | Harga Jual (S) |
|---|---|---|---|---|---|
| 1 | Intel Core i3 10100F 3.6Ghz (1200) | Rp 1.500.000,00 | 1.3 Tahun | Rp 1.176.000,00 | Rp 1.409.836,00 |
| 2 | Gigabyte Z490 Gaming (1200) | Rp 7.300.000,00 | 1.3 Tahun | Rp 4.225.664,00 | Rp 4.835.616,00 |
| 3 | ADATA DDR4 XPG Gammix D30 PC24000 3000MHz 16GB (2X8GB) | Rp 1.500.000,00 | 1.3 Tahun | Rp 1.176.000,00 | Rp 1.409.836,00 |
| 4 | Adata XPG 512GB M.2 NVME | Rp 1.100.000,00 | 1.3 Tahun | Rp 674.000,00 | Rp 1.087.719,00 |
| 5 | Colorful Geforce RTX 3050 NB 8G -V | Rp 7.600.000,00 | 1.3 Tahun | Rp 4.279.279,00 | Rp 5.000.000,00 |
| 6 | MSI MAG 750W 80+ Gold | Rp 2.000.000,00 | 1.3 Tahun | Rp 1.802.000,00 | Rp 1.757.576,00 |
| 7 | Casing Xigmatek ATX | Rp 1.700.000,00 | 1.3 Tahun | Rp 1.427.000,00 | Rp 1.555.556,00 |

Figure 4. Program Output Results

The program results above are based on actual data obtained and matched to the program. The results of the program and actual data can produce accurate data based on the Results and Discussion chapter.

## CONCLUSIONS

The DSS application for determining the price of used computers based on specifications and usage duration can produce prices based on specifications and usage in one or all computer components based on specified parameters. The calculation results of the two fuzzy Mamdani and Sugeno methods produce and display the difference or recommended selling price range based on the specifications that have been input into the application. The results of the accuracy of the fuzzy Mamdani and Sugeno methods, between program results and actual data on fuzzy Mamdani, can provide an accurate value of 71%, 100% precision, and 71% recall. The Sugeno Fuzzy gives an accuracy value of 57%, 80% precision, and 66% recall. The final results obtained are more accurate using fuzzy Mamdani because the results of program prices, such as Figure 9, are close to or cheaper in actual data, such as Table 4, namely the actual data for a total selling price of Rp. 16,500,000, based on mamdani's results, the total selling price was Rp. 14,759,000.

The future research that can be developed is to make an SPK application to determine the price of used computers based on specifications and usage that does not include other computer components such as monitors, coolers, accessories, or other computer components. It is necessary to add parameters in the future along with the times. There needs to be a trial with research using different methods to support the parameters and the addition of parameters in the test.

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