



Decision Support System Rental Housing Investment In Singingi District Area

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ABSTRACT

Construction and the need for houses in each region must be different based on the need, the number of jobs, access roads, and the condition of the location where the house will be built, whether or not it has fulfilled the requirements for a comfortable and safe house so that it can attract residents to occupy and rent the house. With the current problems, where in building a rental house, it can not immediately build a house, but it needs careful planning so that the price of rental homes in accordance with the desired.

The decision making system using fuzzy logic can help the community to determine the appropriate area to be used as a lakasi for the construction of rental homes as a long-term investment.

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1. Introduction

The rapid development of technology at this time requires us to participate in its development so that the application of existing technology has included all aspects of the environment of human life without exception, even in terms of education, it has also used information technology.

In the current uncertain conditions, business competition in the property sector is getting tougher, which requires an investor's creativity in choosing so it is necessary to look for a more effective strategy in investing.

Investment planning is a very specific plan because it is long term. A good investment plan must also clearly describe the characteristics of the business that is being or will be carried out. For this reason, developers who want to invest in property must be able to make the decision to choose a strategic, safe and comfortable location.

This decision making system can be used as an alternative in the selection of locations in order to produce the best decision based on the results of consideration, with the aim of:

1. Help make decisions to solve semi-structured problems
2. Supporting assessment in decision making rather than replacing it.
3. Increase the effectiveness of decision making.

The ability of decision support systems helps voters in determining alternative investment locations in making rental homes. Decision support system assistance can be felt more quickly and accurately if the decision support system uses a computer.

During this time, in making a rental house as an investment in the singing area does not yet exist so that when the capital owner wants to build a rental house, prioritizing land or land to build it is in the area around the existing house and land, even though with such conditions, the construction of a rental house less effective because it will be difficult to find people who will rent the house because of the location and access roads in the area, and will affect the rental price of the house.

The purpose and objectives of this study can be explained as follows:

- 1) Building a rental decision-making investment system.
- 2) Evaluate the old system so that it looks more effective.





2. Research methods

In collecting data and information, at this stage is carried out to find out about the system under study. From the data and information collected, data will be obtained to support the research. The method used by the author for data collection with various methods as follows:

a. Observation

Make direct observations at the research site to find out clearly and in detail the existing problems. Observation was immediately carried out by the island island village and the village of golden water singingi district.

b. Interview

Conducted to obtain the information or data needed by conducting direct interviews with migrant communities in the island of Padang and golden water villages where they rent houses to live.

c. Study of literature

In this method information is collected by reading journals and books relating to this research to support the analysis of data and information. Among books relating to fuzzy sets and journals related to research.

3. Results and Discussion

3.1. Analysis of problem variables

To find out the problems faced, the problem analysis must first be done as an initial process that must be carried out to determine the problem as an object of research. This process is very important because the inaccurate analysis process will cause the results of the system's construction will not be as expected.

Fuzzy Inference System in determining investment rental housing has 13 input variables and 1 output variable. Input variables consist of Location (N), Security (P), Convenience (K), water condition (pH), output variables, namely Investment Home Rentals.

Location (N) which is variable with N value is an assessment factor in determining a comfortable place to live and can make it easy to find a place of work. Location variable value is very low <0.10, low 0.10 to 0.20, medium 0.21 to 0.50, height 0.51 to 0.75, very high 0.75 to 1.0.

Safety (P) which varies with the P value is an assessment factor in determining where to live, because life is not only inside the house but also outside the home and also the family becomes awake, the value of the Safety variable, very low <10, low 10 to 15, moderate 16 to 25, high 26 to 35, very high 36 to 50.

Convenience (K) which is variable with the value of K is comfort in living in the area of the area where the rented house is, the value of the variable Convenience, very low <0.1, low 0.1 to 0.2, moderate 0.3 to 0.5, height of 0.6 to 1.0, very high of 1.0 to 1.0.

The condition of the water (pH) of the land which is variable with pH is an important factor in the household, where for our daily needs use water, the variable value of pH is very acidic <4.5, acidic 4.5 to 5.5, somewhat acidic 5.5 to 6.5, neutral 6.5 to 7.5, slightly alkaline 7.5 to 8.5, alkaline 8.5 to 14.

3.2. Data Input Design

After defining the problem, an analysis is carried out on the problem of how to apply the problem that has been defined into the fuzzy rules by applying the Tsukamoto method to get the crisp output value. The output is the investment of rental homes as can be seen in the picture below:

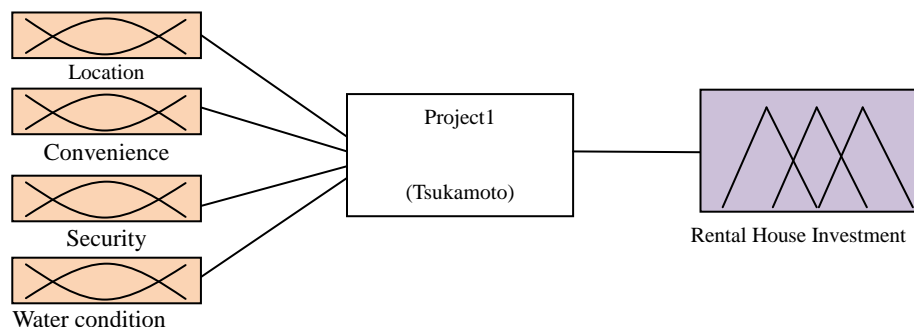


Fig 1. Variable Inputs And Output Variables With Fuzzy





Table 1.
Talk Universe

Fungsi	Variabel	Notasi	Semesta pembicaraan	Keterangan
Input	Location	N	[0 - 5]	Location
	Convenienc	P	[0 - 50]	Convenienc
	Security	K	[0 - 5]	Security
	Water condition	pH	[0 - 14]	Water condition
Output	Rental House Investment	f	[0 - 50]	Rental House Investment

A. Fuzzification

The fuzzy set that is made for each input variable is shown in Table 4.2, for the fuzzy input set and for the fuzzy output set table 4.3. The degree of membership (μ) for each fuzzy set has intervals from 0 to 1. A value of 1 indicates absolute membership (100%) while a value of 0 indicates no membership (0%) in the fuzzy set.

Table 2.
Fuzzy Input Set

Variabel		Fuzzy Input Set		Domain
Name	notation	Name	notation	
Location	A	Very low	sr	[0 , 0,10]
		Low	r	[0,08 , [0,20]
		Medium	s	[0,18 , 0,50]
		high	t	[0,48 , 0,75]
		Very High	st	[0,73 , 5]
Convenienc	B	Very low	sr	[0 , 10]
		Low	r	[8 , 15]
		Medium	s	[13 , 25]
		high	t	[23 , 35]
		Very High	st	[33 , 50]
Security	C	Very low	sr	[0 , 0,10]
		Low	r	[0,08 , 0,20]
		Medium	s	[0,18 , 0,50]
		high	t	[0,48 , 1]
		Very High	st	[0,58 , 5]
Water condition	D	Sour	m	[0 , 5,5]
		rather sour	am	[5,4 , 6,5]
		Netral	n	[6,4 , 7,5]
		somewhat alkaline	aa	[7,4 , 8,5]
		Alkaline	a	[8,4 , 14]

Tabel 3.
Fuzzy Output Set

Variabel		Fuzzy Input Set		Domain
Name	Notation	Neame	Notatoin	
Rumah Sewa	F	very bad	sr	[0 , 4]
		bad	r	[3,6 , 5]
		very good	s	[4,6 , 8]
		good	t	[7,6 , 10]
		Not good	st	[9,6 , 20]

Location variable membership degree function

The linear descending membership function is used to represent a good fuzzy set and the ascending linear membership function for a dangerous fuzzy set. The triangular membership degree function is used to represent very low, low, low, high, very high fuzzy sets.





$$\mu_{sr}(a) = \begin{cases} 0 & ; a < 0 \text{ or } a > 0,10 \\ (a - 0)/0,05 & ; 0 \leq a \leq 0,05 \\ (0,10 - a)/0,05 & ; 0,05 \leq a \leq 0,10 \end{cases}$$

$$\mu_r(a) = \begin{cases} 0 & ; a < 0,08 \text{ or } a > 0,20 \\ (a - 0,08)/(0,14 - 0,08) & ; 0,08 \leq a \leq 0,14 \\ (0,20 - a)/(0,20 - 0,14) & ; 0,14 \leq a \leq 0,20 \end{cases}$$

$$\mu_s(a) = \begin{cases} 0 & ; a < 0,18 \text{ or } a > 0,50 \\ (a - 0,18)/(0,34 - 0,18) & ; 0,18 \leq a < 0,34 \\ (0,50 - a)/(0,50 - 0,34) & ; 0,34 \leq a \leq 0,50 \end{cases}$$

$$\mu_t(a) = \begin{cases} 0 & ; a < 0,48 \text{ or } a > 0,75 \\ (a - 0,48)/(0,61 - 0,48) & ; 0,48 \leq a \leq 0,61 \\ (0,75 - a)/(0,75 - 0,61) & ; 0,61 \leq a \leq 0,75 \end{cases}$$

$$\mu_{st}(a) = \begin{cases} 0 & ; a < 0,73 \\ (a - 0,73)/(5 - 0,73) & ; 0,73 \leq a \leq 5 \\ 1 & ; a > 5 \end{cases}$$

Function of the degree of membership of the Security variable

The linear descending membership function is used to represent a good fuzzy set and the ascending linear membership function for a dangerous fuzzy set. The triangular membership degree function is used to represent very low, low, low, high, very high fuzzy sets.

$$\mu_{sr}(b) = \begin{cases} 0 & ; a < 0 \text{ or } a > 10 \\ (a - 0)/5 & ; 0 \leq a \leq 5 \\ (10 - a)/5 & ; 5 \leq a \leq 10 \end{cases}$$

$$\mu_r(b) = \begin{cases} 0 & ; a < 8 \text{ or } a > 15 \\ (a - 8)/(11 - 8) & ; 8 \leq a \leq 11 \\ (15 - a)/(15 - 11) & ; 11 \leq a \leq 15 \end{cases}$$

$$\mu_s(b) = \begin{cases} 0 & ; a < 13 \text{ or } a > 25 \\ (a - 13)/(19 - 13) & ; 13 \leq a < 19 \\ (25 - a)/(25 - 19) & ; 19 \leq a \leq 25 \end{cases}$$

$$\mu_t(b) = \begin{cases} 0 & ; a < 23 \text{ or } a > 35 \\ (a - 23)/(29 - 23) & ; 23 \leq a \leq 29 \\ (35 - a)/(35 - 29) & ; 29 \leq a \leq 35 \end{cases}$$

$$\mu_{st}(b) = \begin{cases} 0 & ; a < 33 \\ (a - 33)/(50 - 33) & ; 33 \leq a \leq 50 \\ 1 & ; a > 50 \end{cases}$$

Data Processing with Tsukamoto's Fuzzy Inference System (FIS).

In processing data using the Tsukamoto inference engine there are several steps that are carried out, the data sourced from the average number of two soil test samples:

The stages of Tsukamoto's method:

a. Fuzzification

This stage is a step to determine the value of the degree of membership for each input based on a predetermined membership function.

1. Air Emas Village

$$(N) \mu_{aSangatRendah}[0,09] = [0,09 - 0,08] / 0,06 \quad (P) \mu_{bSangatRendah}[4,21] = [4,21 - 0] / 5 \\ = 0,166 \quad = 0,842$$

$$(K) \mu_{cRendah}[0,13] = [0,13 - 0,08] / 0,06 \quad (pH) \mu_{dAsam}[4,20] = [5,5 - 4,20] / 3 \\ = 0,833 \quad = 0,52$$

2. Pulau Padang Village





$$(N) \mu_{aRendah}[0,14] = [0,20 - 0,14] / 0,06 = 1$$

$$(P) \mu_{bSangatRendah}[4,82] = [4,82 - 0] / 5 = 0,964$$

$$(K) \mu_{cRendah}[0,12] = [0,20-0,12]/0,06 = 0,666$$

$$(pH) \mu_{dAgakAsam}[5,81] = [6,5 - 5,81]/5,95 = 0,81$$

The rule used is Rule 1 based on the fuzzy domain membership variable.

- Rule 126 If N is Very Low AND P is Very Low AND K is Very Low AND pH is a Little Acidful Then the Investment Conditions for Rent a House are Low
- Rule 27 If N is Low AND P is Very Low AND K is Low AND pH is Acid Then Investment Conditions for Rented Houses are Very Low

Inference Engine

At this stage is a process of reasoning (inference), this process serves to find an inference engine value applied to the min function for each rule in the application of the fuzzy implant function output of fuzzy input.

1. Air Emas Village

$$\alpha_{prediket} = \mu_{aSedang} \cap \mu_{bSangatRTinggi} \cap \mu_{cSangatRendah} \cap \mu_{dNetral}$$

$$= \text{Min}(\mu_{aSedang}(0,09), \mu_{bSangatTinggi}(4,21), \mu_{cSangatRendah}(0,13), \mu_{dNetral}(4,20))$$

$$= \text{Min}(0,1;0,574;0,35;0,23)$$

$$= 0,166$$

To find the value of z based on a set of conditions of Investment Not Good.
 $(0.2 - z) / 0,06 = 0,166 \rightarrow z_I = 0.21$

2. Pulau Padang Village

$$\alpha_{prediket} = \mu_{aRendah} \cap \mu_{bSangatRendah} \cap \mu_{cRendah} \cap \mu_{dAgakMasam}$$

$$= \text{Min}(\mu_{aRendah}(0,14), \mu_{bSangatRendah}(4,82), \mu_{cRendah}(0,12), \mu_{dAgakMasam}(5,81))$$

$$= \text{Min}(0,4;0,518;0,57;0,11)$$

$$= 0,666$$

To find the value of z based on a set of conditions Investment is not good.
 $(z - 0.10) / 0.05 = 0,666 \rightarrow z_I = 0,133$

Defuzzifikasi

To determine the value firmly used the average method with the function implication value min. The result of the inference engine above is because there are two rules in use, then the value is taken to produce a firm value with the value of the function implication min, to determine the value of z based on the rules used.

$$z = \frac{0.166 * 0.21 + 0.666 * 0.133}{0.166 + 0.666} = \frac{0,123}{0,832} = 0,148$$

The results obtained from the z value are used as a reference to determine Rental House Investment based on the reference in table 4.3, so it can be concluded that the condition of Rental House Investment in Singingi District for August - December 2019 has very low investment opportunities for rental housing.

4. Conclusion

After conducting research and testing to determine the investment of rental homes in the Singingi District area by applying fuzzy logic using the Tsukamoto method, it can be concluded:

- In determining investment rental homes with fuzzy logic using the Tsukamoto method can be applied based on the type of conditions and circumstances of the location where the rental house will be built.
- In setting and analyzing investment in rental homes using fuzzy logic rules and parameters are needed, and more rules are needed to get better results.





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