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Decision Support System For Selecting Rental Houses Using The Simple Additive Weighting Method (Case Study: Bojong Indah Village)

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Simple Additive Weighting,
Rental House Selection,
Website.

ABSTRACT
The The development of housing is currently growing quite rapidly, one of which is rented houses, the increasing population growth in Bojong Indah Village has caused the need for housing to continue to increase. Families in Bojong Indah Village are not only native residents, but there are also newcomers. Newcomers and local families need a place to live, such as housing, apartments, and rented houses. However, limited costs are often one of the reasons for not buying a house or apartment. So that rented houses become an alternative choice for the community. In selecting this rented house, the author determines his own criteria in selecting it, namely price, space, distance to the market, security, and parking space. The use of the Simple Additive Weighting (SAW) method in a decision support system is a problem-solving path that can handle this problem, where tenants will feel relieved by the existence of this decision support system by providing suggestions for rented houses that match the criteria quickly by inputting the criteria desired by the user. So that at the end of the process, the user will get a list of recommendations for recommended rented houses based on their input criteria.

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INTRODUCTION

The development of housing is currently growing quite rapidly, one of which is rented houses, the increasing population growth in Bojong Indah Village has caused the need for housing to continue to increase. Families in Bojong Indah Village are not only native residents, but there are also newcomers. Newcomers and local families need a place to live, such as housing, apartments, and rented houses. However, limited costs are often one of the reasons for not buying a house or apartment. So that rented houses become an alternative choice for the community. Choosing the right rented house can be a time-consuming challenge for newcomers and families in Bojong Indah Village, especially if there are many choices of rented houses available, this can be even more difficult because there are many options for rented houses offered with various advantages and disadvantages each. Therefore, a Decision Support System is needed that can help users in selecting the most appropriate rental house option according to their preferences. The method used in this decision support system is the Simple Additive Weighting (SAW) method.

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The Simple Additive Weighting (SAW) method was chosen as one of the techniques in this decision support system because it is easy to understand and apply, and is flexible enough to accommodate various criteria to be assessed. The criteria used in this system can vary, such as price, space, distance to market, security, and parking. In addition, this system can help reduce the possibility of errors or inappropriate decisions in choosing a rental house.

Several previous studies have been conducted in the development of a Decision Support System for selecting a rental house. For example, a study conducted by Ainun Mardliyyah (2020) entitled "Development of a Decision Support System for Selecting a Rental House in Palembang City Using the TOPSIS Method" developed a web-based Decision Support System using the TOPSIS method to help users choose a rental house that suits their needs and preferences. In addition, a study conducted by Putra Aditya, Edy S and Tri Afirianto (2018) entitled "Selection of Boarding Houses Around Brawijaya University Using the Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW) Methods" also used the Simple Additive Weighting (SAW) method for calculating the weighting of the value criteria, and compared it with the Analytical Hierarchy Process (AHP) method in developing a Decision Support System for selecting a rental house so that it produces a system that can provide recommendations for rental houses that suit user preferences and provide high accuracy values.

It is expected that with this decision support system, prospective tenants can more easily and effectively choose a rental house that suits their needs and preferences, and can help rental house owners in marketing their properties. In addition, this research can also contribute to the development of information technology in the field of property and decision support systems.

METHODS

This research was conducted by collecting data by means of observation to several rental houses in Bojong Indah Village, conducting interviews with rental house owners, and literature studies that are useful for adding insight and references related to this research. Then, an analysis of the OOAD system, implementation and testing of the system was carried out.

Simple Additive Weighting (SAW)

Simple Additive Weighting (SAW) is a method that applies the concept of weighted summation to assess alternative performance based on certain criteria. In SAW, performance assessment is carried out by the process of normalizing the decision matrix (X) into a scale that can be compared with all existing alternatives[6]. In the SAW method, each criterion is given a relative weight that reflects its level of importance in the decision-making process. Furthermore, the criteria are assessed and normalized, meaning that the criterion values are converted into a uniform scale, usually ranging from 0 to 1. After that, for each alternative, the normalized criterion values are multiplied by the weight of each criterion, and the results are added together to produce a total preference score.

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The final output of the SAW method is a list of alternatives ranked by their preference scores, from highest to lowest. This approach allows decision makers to efficiently and systematically evaluate alternatives according to their personal preferences and the priority of the established criteria.

The SAW method is often used in various contexts, such as product selection, housing selection, investment decisions, and so on, especially in situations where multiple criteria need to be considered in decision making. Steps in the SAW Method Calculation as follows:

1. Determine each alternative, namely Ai
2. Determine what criteria will be used as a reference in making decisions Ci
3. Determine the weight of preference or level of importance (W) for each criterion. W=[W1 W2 W3 ... W4]
4. Create a rating table of suitability for each alternative on each criterion.
5. Create a decision matrix X formed from the rating table of suitability for each alternative (Ai) on each criterion (Cj) that has been determined where, I = 1,2,..., m and j = 1,2,..., n.
6. Normalize the decision matrix X by calculating the normalized performance rating value (rij) of the alternative (Ai) on the performance (Cj).
7. The results of the normalized performance rating value (rij) form a normalized matrix (R).

Simple Additive Weighting Analysis

1. Determining the types of criteria and alternatives, the author will use 16 rental house data as alternatives in the SAW method calculation example.

Table 1. Alternative

Alternative (A)	Alternative Name
A1	Sadeli Rented House
A2	Zakaria Rented House
A3	Amsar Rented House
A4	Melati Rented House
A5	Dadang Rented House
A6	Wira Rented House
A7	Umsiah Rented House
A8	Sadiah Rented House
A9	Khaeruman Rented House
A10	Lilis Rented House
A11	Nina Rented House
A12	Ma'mun Rented House
A13	Romli Rented House
A14	Agus Rented House
A15	Yasifa Rented House
A16	Belong Rented House

2. Determine what criteria will be used as a reference in decision making.

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Table 2. Criteria

Criteria (C_j)	Criteria Name	Benefit / Cost
C1	Price	Cost
C2	Room	Benefit
C3	Distance to Market	Cost
C4	Security	Benefit
C5	Parking Space	Benefit

3. Determine the weight of each criteria.

Table 3. Criteria Weight

Criteria (C_j)	Criteria Name	Weight
C1	Price	30% = 0.30
C2	Room	25% = 0.25
C3	Distance to Market	10% = 0.10
C4	Security	20% = 0.20
C5	Parking Space	15% = 0.15

4. Determining the room criteria value.

Table 4. Criteria Value

Alternative	Criteria	Sub-Criteria	Weight
Price	C1	0 – 500 Thousand	5
		>500 Thousand – 700 Thousand	4
		>700 Thousand – 900 Thousand	3
		>900 Thousand – 1,1 Million	2
		>1,1 Million	1
Room	C2	4 Bedrooms, Living Room, Bathroom, Kitchen	5
		3 Bedrooms, Living Room, Bathroom, Kitchen	4
		2 Bedrooms, Living Room, Bathroom, Kitchen	3
		1 Bedrooms, Living Room, Public Bathroom, Kitchen	2
		1 Bedrooms, Living Room, Public Bathroom	1
Distance to market	C3	>0 – 1KM	5
		>1KM – 2 KM	4
		>2KM – 3 KM	3
		>4 KM – 5 KM	2
		>5KM	1
Security	C4	Very Safe	5
		Safe	4
		Quite Safe	3
		Less Safe	2
		Prone to Theft	1
		Very Spacious	5
		Spacious	4

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Alternative	Criteria	Sub-Criteria	Weight
Parking Area	C5	Quite Spacious	3
		Not Spacious	2
		None	1

5. Create a rating matrix table for the suitability of each alternative to the criteria.

Table 5. Suitability Rating of each Alternative

Alternative (A)	C1	C2	C3	C4	C5
A1	5	4	3	4	4
A2	5	2	4	2	2
A3	3	3	5	1	3
A4	4	3	3	4	3
A5	2	2	2	2	3
A6	1	5	3	5	5
A7	4	2	5	1	3
A8	4	1	4	2	3
A9	3	3	1	4	3
A10	2	3	5	3	4
A11	2	2	4	4	4
A12	2	3	3	5	4
A13	3	3	5	3	3
A14	2	4	1	3	5
A15	3	3	3	2	3
A16	2	4	5	5	2

6. Normalize the decision matrix X by calculating the normalized performance value (Rij) of the alternative (Ai) on the criteria (Cj), with the equation.

$$r_{ij}\begin{cases}\dfrac{x_{ij}}{max(x_{ij})} & If\ j\ is\ the\ Benefit\ Criteria \\ \dfrac{min_i(x_{ij})}{x_{ij}} & If\ j\ is\ the\ Cost\ Criteria\end{cases}$$

Where :

r_{ij} : Normalized performance rating
max_i : Maximum value of each row and column
min_i : Minimum value of each row and column
x_{ij} : Rows and columns of the matrix

r_{ij} is the normalized performance rating of the alternatives on attributes i=1,2,....m and j=1,2,....n. Of all criteria, 3 are worth benefits and 2 are worth costs, the results obtained are as follows:

Column C1 (Cost)

$$R_{11} = \frac{1}{5} = 0.2 \qquad R_{21} = \frac{1}{5} = 0.2 \qquad R_{31} = \frac{1}{3} = 0.333$$

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$$R_{41} = \frac{1}{4} = 0.25 \quad R_{91} = \frac{1}{3} = 0.333 \quad R_{131} = \frac{1}{3} = 0.333$$
$$R_{51} = \frac{1}{2} = 0.5 \quad R_{101} = \frac{1}{2} = 0.5 \quad R_{141} = \frac{1}{2} = 0.5$$
$$R_{61} = \frac{1}{1} = 1 \quad R_{111} = \frac{1}{2} = 0.5 \quad R_{151} = \frac{1}{3} = 0.333$$
$$R_{71} = \frac{1}{4} = 0.25 \quad R_{121} = \frac{1}{2} = 0.5 \quad R_{161} = \frac{1}{2} = 05$$
$$R_{81} = \frac{1}{4} = 0.25$$

Column C2 (Benefit)

$$R_{12} = \frac{4}{5} = 0.8 \quad R_{72} = \frac{2}{5} = 0.4 \quad R_{132} = \frac{3}{5} = 0.6$$
$$R_{22} = \frac{2}{5} = 0.4 \quad R_{82} = \frac{1}{5} = 0.2 \quad R_{142} = \frac{4}{5} = 0.8$$
$$R_{32} = \frac{3}{5} = 0.6 \quad R_{92} = \frac{3}{5} = 0.6 \quad R_{152} = \frac{3}{5} = 0.6$$
$$R_{42} = \frac{3}{5} = 0.6 \quad R_{102} = \frac{3}{5} = 0.6 \quad R_{162} = \frac{4}{5} = 0.8$$
$$R_{52} = \frac{2}{5} = 0.4 \quad R_{112} = \frac{2}{5} = 0.4$$
$$R_{62} = \frac{5}{5} = 1 \quad R_{122} = \frac{3}{5} = 0.6$$

Column C3 (Cost)

$$R_{13} = \frac{1}{3} = 0.333 \quad R_{73} = \frac{1}{5} = 0.2 \quad R_{133} = \frac{1}{5} = 0.2$$
$$R_{23} = \frac{1}{4} = 0.25 \quad R_{83} = \frac{1}{4} = 0.25 \quad R_{143} = \frac{1}{1} = 1$$
$$R_{33} = \frac{1}{5} = 0.2 \quad R_{93} = \frac{1}{1} = 1 \quad R_{153} = \frac{1}{5} = 0.2$$
$$R_{43} = \frac{1}{3} = 0.333 \quad R_{103} = \frac{1}{5} = 0.2 \quad R_{163} = \frac{1}{3} = 0.333$$
$$R_{53} = \frac{1}{2} = 0.5 \quad R_{113} = \frac{1}{4} = 0.25$$
$$R_{63} = \frac{1}{3} = 0.333 \quad R_{123} = \frac{1}{3} = 0.333$$

Column C4 (Benefit)

$$R_{14} = \frac{4}{5} = 0.8 \quad R_{64} = \frac{5}{5} = 1 \quad R_{104} = \frac{3}{5} = 0.6$$
$$R_{24} = \frac{2}{5} = 0.4 \quad R_{74} = \frac{1}{5} = 0.2 \quad R_{114} = \frac{4}{5} = 0.8$$
$$R_{34} = \frac{1}{5} = 0.2 \quad R_{84} = \frac{2}{5} = 0.4 \quad R_{124} = \frac{5}{5} = 1$$
$$R_{44} = \frac{4}{5} = 0.8 \quad R_{94} = \frac{4}{5} = 0.8 \quad R_{134} = \frac{3}{5} = 0.6$$
$$R_{54} = \frac{2}{5} = 0.4$$

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$R_{144} = \frac{3}{5} = 0.6$ $R_{164} = \frac{5}{5} = 1$

$R_{154} = \frac{2}{5} = 0.4$

$R_{15} = \frac{4}{5} = 0.8$

Column C5 (Benefit)

$R_{25} = \frac{2}{5} = 0.4$ $R_{75} = \frac{3}{5} = 0.6$ $R_{125} = \frac{4}{5} = 0.8$

$R_{35} = \frac{3}{5} = 0.6$ $R_{85} = \frac{3}{5} = 0.6$ $R_{135} = \frac{3}{5} = 0.6$

$R_{45} = \frac{3}{5} = 0.6$ $R_{95} = \frac{3}{5} = 0.6$ $R_{145} = \frac{5}{5} = 1$

$R_{55} = \frac{3}{5} = 0.6$ $R_{105} = \frac{4}{5} = 0.8$ $R_{155} = \frac{3}{5} = 0.6$

$R_{65} = \frac{5}{5} = 1$ $R_{115} = \frac{4}{5} = 0.8$ $R_{165} = \frac{2}{5} = 0.4$

From the results of the equation calculation, a normalized matrix value is obtained, as follows:

Table 6. Normalized Matrix

Alternative (A)	C1	C2	C3	C4	C5
A1	0.2	0.8	0.333	0.8	0.8
A2	0.2	0.4	0.25	0.4	0.4
A3	0.333	0.6	0.2	0.2	0.6
A4	0.25	0.6	0.333	0.8	0.6
A5	0.5	0.4	0.5	0.4	0.6
A6	1	1	0.333	1	1
A7	0.25	0.4	0.2	0.2	0.6
A8	0.25	0.2	0.25	0.4	0.6
A9	0.333	0.6	1	0.8	0.6
A10	0.5	0.6	0.2	0.6	0.8
A11	0.5	0.4	0.25	0.8	0.8
A12	0.5	0.6	0.333	1	0.8
A13	0.333	0.6	0.2	0.6	0.6
A14	0.5	0.8	1	0.6	1
A15	0.333	0.6	0.2	0.4	0.6
A16	0.5	0.8	0.333	1	0.4

After getting a table like that, multiply each column in the table by the weight of the criteria that was declared previously.

$$V_i = \sum_{j=1}^{n} w_j r_{ij}$$

A Larger A_i Value Indicates That Alternative A_i Is More Preferred.

W : Criteria Weight [0.30 ; 0.25 ; 0.10 ; 0.20 ; 0.15]

R : Value of Each Rental House for Each Criteria

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$V_1 = (0.30)(0.2) + (0.25)(0.8) + (0.10)(0.333) + (0.20)(0.8) + (0.15)(0.8) = 0.5733$
$V_2 = (0.30)(0.2) + (0.25)(0.4) + (0.10)(0.25) + (0.20)(0.4) + (0.15)(0.4) = 0.325$
$V_3 = (0.30)(0.333) + (0.25)(0.6) + (0.10)(0.2) + (0.20)(0.2) + (0.15)(0.6) = 0.3999$
$V_4 = (0.30)(0.25) + (0.25)(0.6) + (0.10)(0.333) + (0.20)(0.8) + (0.15)(0.6) = 0.5083$
$V_5 = (0.30)(0.5) + (0.25)(0.4) + (0.10)(0.5) + (0.20)(0.4) + (0.15)(0.6) = 0.47$
$V_6 = (0.30)(0.1) + (0.25)(0.1) + (0.10)(0.333) + (0.20)(1) + (0.15)(1) = 0.9333$
$V_7 = (0.30)(0.25) + (0.25)(0.4) + (0.10)(0.2) + (0.20)(0.2) + (0.15)(0.6) = 0.325$
$V_8 = (0.30)(0.25) + (0.25)(0.2) + (0.10)(0.25) + (0.20)(0.4) + (0.15)(0.6) = 0.32$
$V_9 = (0.30)(0.333) + (0.25)(0.6) + (0.10)(1) + (0.20)(0.8) + (0.15)(0.6) = 0.5999$
$V_{10} = (0.30)(0.5) + (0.25)(0.6) + (0.10)(0.2) + (0.20)(0.6) + (0.15)(0.8) = 0.56$
$V_{11} = (0.30)(0.5) + (0.25)(0.4) + (0.10)(0.25) + (0.20)(0.8) + (0.15)(0.8) = 0.555$
$V_{12} = (0.30)(0.5) + (0.25)(0.6) + (0.10)(0.333) + (0.20)(1) + (0.15)(0.8) = 0.6533$
$V_{13} = (0.30)(0.333) + (0.25)(0.6) + (0.10)(0.2) + (0.20)(0.6) + (0.15)(0.6) = 0.4799$
$V_{14} = (0.30)(0.5) + (0.25)(0.8) + (0.10)(1) + (0.20)(0.6) + (0.15)(1) = 0.72$
$V_{15} = (0.30)(0.333) + (0.25)(0.6) + (0.10)(0.2) + (0.20)(0.4) + (0.15)(0.6) = 0.4399$
$V_{16} = (0.30)(0.5) + (0.25)(0.8) + (0.10)(0.333) + (0.20)(0.1) + (0.15)(0.4) = 0.6433$

So the 3 alternative values that have the highest value are alternative A6 with a value of 0.9333, the second value is alternative A12 with a value of 0.6533, and the third value is alternative A16 with a value of 0.6433.

RESULTS AND DESIGN

Use Case Design

A Use Case diagram is one of many types of UML (Unified Modeling Language) diagrams that show how a system interacts with the actors involved. A Use Case diagram can describe how system users interact with the system itself, explaining the types of interactions that occur. The following is a use case diagram in a rental house selection system.

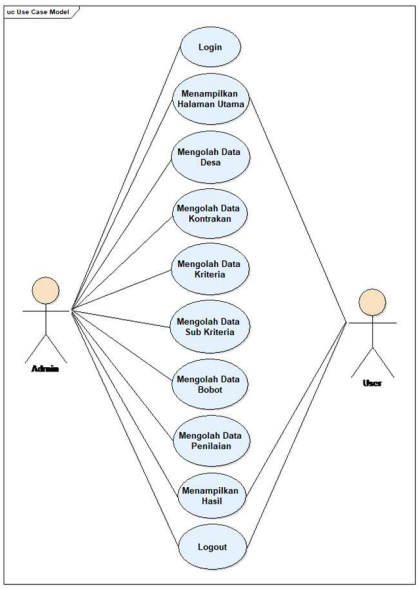

Figure 1. Use Case Diagram

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Interface Implementation

The design result is the stage where the system is ready to be operated at the actual stage. So it will be known whether the system that has been created is in accordance with what was planned.

1. Login Page Display

Figure 2. Login Page

2. Home Page Display

Figure 3. Home Page

3. Village Page Display

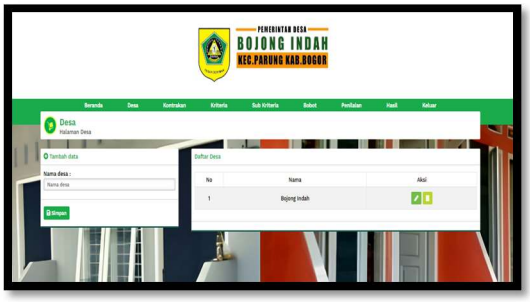

Figure 4. Village Page

4. Rental Page Display

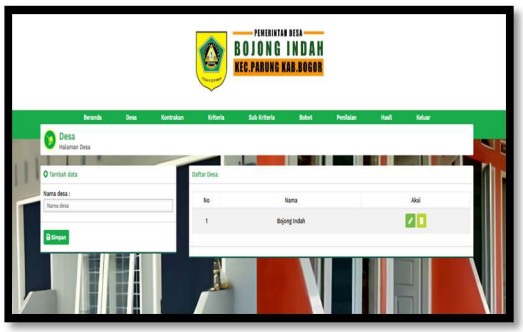

Figure 5. Rental Page

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5. Criteria Page Display\

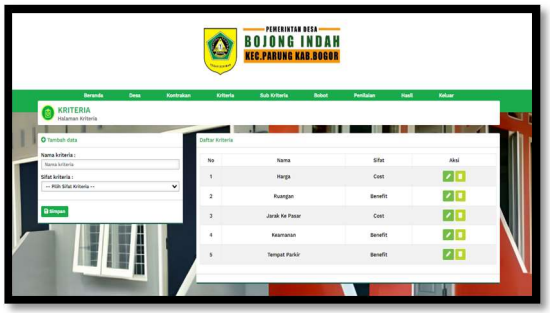

Figure 6. Criteria Page

6. Sub Criteria Page Display

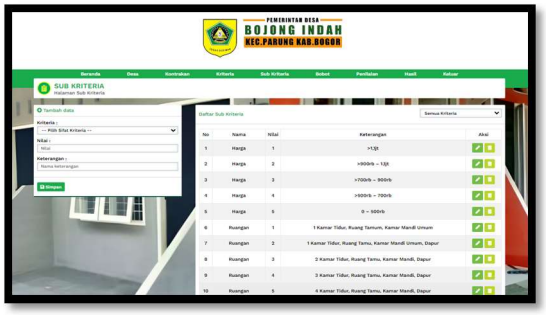

Figure 7. Sub Criteria Page

7. Weight Page Display

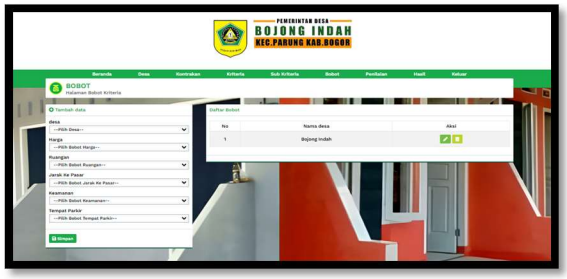

Figure 8. Weight Page

8. Assessment Page Display

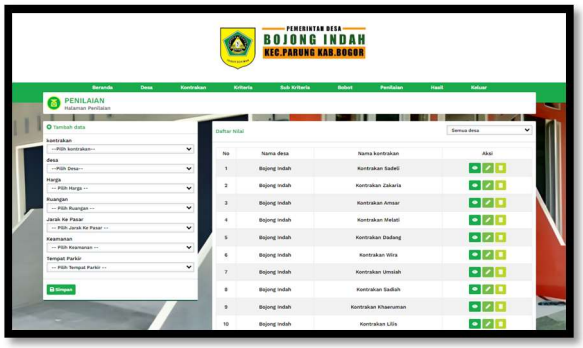

Figure 9. Assessment Page

9. Results Page Display

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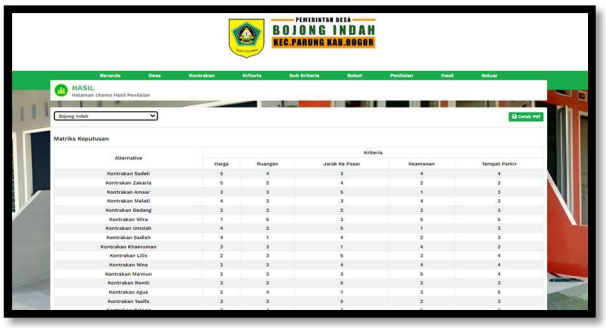

Figure 10. Results Page

CONCLUSION

The creation of a Decision Support System for Selecting a Rental House in Bojong Indah Village which has been carried out for calculating the assessment of the type of rental house with the ranking results has been successfully built. This system has been created to refer to the existing formula, namely the system can assess the selection of rental houses according to the provisions in the calculation based on a comparison of the Simple Additive Weighting (SAW) method. Some conclusions that can be described as follows: By using a website-based system, tenants can speed up and facilitate selection amidst the many choices available. DSS allows potential tenants to evaluate properties based on their personal criteria, such as location, price, facilities, and others, thus saving time and energy in the selection process. Information technology has brought significant changes to the property industry. In the context of DSS for selecting rental houses, information technology facilitates data collection, analysis, and presentation of relevant information to prospective tenants. This makes it easy to compare and select properties that suit individual needs. With DSS using the Simple Additive Weighting (SAW) method, it can help tenants in selecting rental houses by providing objective assessments of the various criteria given. In addition, SAW can also be used by rental homeowners to market their properties more effectively, by considering criteria that are important to tenants. 4. This Simple Additive Weighting (SAW) method can help in selecting rental homes that suit your needs and preferences. From the results of this calculation, the Wira rental home is the best choice because it has the highest value, namely V (0.933) and the Sadiah rental home is the lowest choice because it has the lowest value, namely V (0.32).

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