Decision Support System Recommendation Housing Using AHP And Saw Method Palangka Raya City

Gatot Tri Pranoto*[1], Ismasari Nawangsih[2]
*[1,2]Informatics Engineering Study Program, Faculty of Engineering, Pelita University nation
email: gatot.pranoto@pelitabangsa.ac.id*[1], ismasari.n@pelitabangsa.ac.id[2]*

Edy Widodo[3]
*[3]Informatics Engineering Study Program, Faculty of Engineering, Pelita University nation
email: ewidodo@pelitabangsa.ac.id[3]*

*Corresponding author

Abstract - *Palangka Raya City, as one of the provincial capitals in Indonesia, which has an area of around 2,400,000 km^2, is a strategic city as a service and distribution hub for the industrial, trade, government and education sectors. Regional Policy of the city government with the existence of a development plan in the City of Palangka Raya as an implementation of the city space with all the disadvantages of its designation resulting in a distribution pattern of urban land types which in fact is not evenly distributed throughout the city. This research was conducted based on the results of observations made in several Marketing Agents in the Palangkaraya Region, which included 5 districts where the survey results obtained several marketing agents for KPR housing with the aim of facilitating the purchase of KPR housing. The purpose of this study is to design a decision support system that is used to support the decision to purchase housing loans in the Palangkaraya area. Based on the research that has been done, it is expected that the results of the purchase decision support system for the KPR recommendation with the best value can be a recommendation for the purchase. This system is designed with the AHP and SAW methods to help prospective residents to determine the house based on the desired criteria.*

Keywords: Real estate agent, KPR, AHP, SAW, SPK.

1. INTRODUCTION

Palangka Raya City as one of the provincial capitals in Indonesia which has an area of about 2,400,000 km^2 is a strategic city as a service and distribution node for the industrial, trade sectors as well as a city for government and education. The policy of the city government is marked by the existence of a regional development plan in the city of Palangka Raya as an implementation of urban space with all the consequences of its designation resulting in a pattern of distribution of types of urban land use which in fact is relatively uneven throughout the city area. This can be seen from the pattern of population distribution and sector and sub-sector activities which are still largely concentrated in the southern part of Palangka Raya City. Over the last few years, information technology has been able to help basic human needs to solve various kinds of problems, one of which is in the economic and business fields (Yulianto and Wibowo, 2017).

Based on the 1945 Constitution (UUD) in Article H of the 1945 Amendment to the 1945 Constitution, housing is one of the basic rights of every Indonesian person, so every citizen has

the right to live and have a good and healthy living environment. This is then confirmed by Law Number 1 of 2011, concerning Housing and Settlements, that the house is a building that functions as a place to live or dwell and a means of fostering a family. The house is a basic need for every human being in increasing the dignity, quality of life and livelihood, as well as a personal reflection in an effort to improve the standard of living, as well as the formation of the character, character and personality of the nation (Abbas, 2015).

A house or a place to live is one of the basic (primary) human needs in addition to clothing and food. Many factors influence everyone to choose a house, including the price of the house, land area, building area, house model, distance from house to road, distance from house to work, distance from house to children's school, environmental security facilities, distance from house to house. shopping and so on. These factors sometimes contradict each other, for example a house close to the center of the crowd is expensive or a house that is suitable in terms of price, size and location but there are no places of worship close to the complex or neighborhood. So, sometimes, if one factor is met, the other factors are not met. The best possible solution is to try to get the optimal solution point by considering all the factors that exist, even though it is not the most satisfying one factor (Supriyono, 2015).

The development of housing for the lower middle class is also influenced by the perpetrators, namely developers and residents of the housing itself. Residents of housing certainly have factors that influence their preferences in choosing the location of housing to live in (Endyan, Hidayati and Kukuh, 2019).

People's Housing Loans are loans used to buy houses or for other consumptive needs with collateral/collateral in the form of houses. The collateral required for a KPR is the house that will be purchased itself for a KPR Purchase. As for the Multipurpose Mortgage or Refinancing Mortgage, the collateral is the house that is already owned. Because it is included in the Consumptive Credit category, the allotment of KPR must be for consumptive activities such as buying houses, furniture, motor vehicles and not allowed for productive activities such as purchasing stock of merchandise, working capital and so on. (Azhar and Handayani, 2018)

Frequently, the need for housing increases, especially in the city of Palangka Raya. This need makes many housing agents take part in the housing market in Palangkaraya.

In Central Kalimantan, especially the City of Palangka Raya, the construction of KPR-BTN is mushrooming like in the rainy season. The type and model of KPR-BTN housing varies according to the model that has been determined by the developer/contractor who built the housing (Waluyo Nuswantoro, 2007).

Housing marketing reaches all over the city of Palangka Raya with many agents causing a wide variety of mortgage housing options ranging from subsidized to unsubsidized from houses that are ready to be occupied to houses whose status is still being built.

This creates a large number of home choices in Palangkaraya which creates new problems for buyers to make decisions, so that it often takes one or two houses to take half a year to find buyers through mortgage credit lines or through direct purchases. Subsidized mortgages also seem sluggish. The sluggishness of mortgages is due to the exhaustion of the FLPP (Housing Financing Liquidity Facility) quota made by the government. (Editorial Team, 2019).

In determining which house to buy, there are many criteria that are usually considered by the community in making home buying decisions. Usually someone will face problems when they have several options that both meet the desired criteria. In connection with this, a decision support system is needed that can help the community to get the most optimal decision based on predetermined criteria. With the help of this decision support system, it will be able to reduce the risk of errors in making decisions to determine which house to buy. One of the models that

can be used in building a decision support system in buying this house is Simple Additive Weighting (SAW).

The SAW method is a method for decision making and this method can simultaneously solve cost and benefit data. The SAW method is used in the process of ranking data by utilizing the preference value. The SAW method can be added by searching for weighted data from the performance of each alternative. SAW has a simple concept, is not difficult, easy to understand, and has the ability to measure the relative performance of existing alternatives (Sunarti, 2020).

In Sunarti's research, the criteria used in building a decision support system using SAW are Price, Location, Mortgage, Type of House, Facilities, and Initial Payment (Sunarti, 2020).

Meanwhile, H. Supriyono uses eleven criteria as a consideration in choosing housing, namely Location, Price, Land Area, Building Area, Number of Bedrooms, Number of Bathrooms, security system, number of floors, environment, facilities, and distance to school (Supriyono, 2015).

Then in Azhar's research there are six criteria, namely Licensing, Location, House Prices, Facilities, Building Quality and Down Payment (Azhar and Handayani, 2018).

2. RESEARCH METHOD

2.1. *Research Instruments Research*

Instruments are research facilities in the form of tools used to conduct research. As for this research will use instruments that include software equipment and hardware equipment.
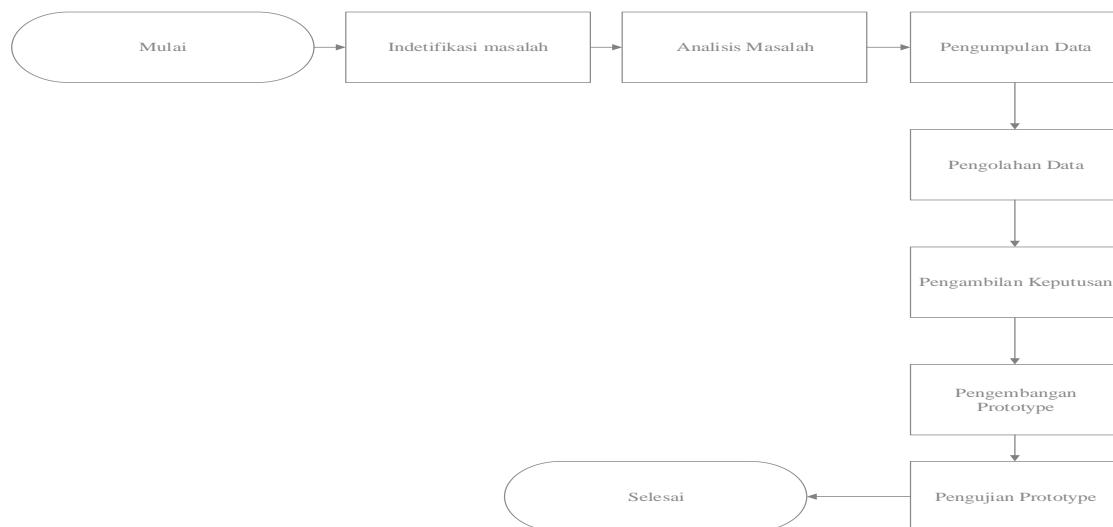

Figure 1 Research Method

1. Software (software)

Software is needed to run the research model that is built. The software requirements in this study are:
a. Windows 10 Operating System

To support research, you can use a minimum Windows 10 operating system with a 64-bit version.
b. XAMPP SERVERS

To support research, XAMPP server supports local server with PHP Server Language.

2. Hardware

   Apart from requiring software, there is also hardware required for implementation. The hardware specifications needed are:

   Laptops with minimum specifications :
   1. CoreTM i5
   2. CPU RAM with a size of 6 GB
   3. Hard drive with a size of 500 GB
   4. Screen monitors

2.2. *Data Collection*

   At this stage, the author collects data through several stages:
   a. Literature Study, at this stage the author explores the concept of research through a literature study based on previous studies to be used as a supporting study in the research topic that the author is doing.
   b. Observation, at this stage data collection is carried out through direct observation of housing in the city of Palangka Raya, then processing the observation data, to be analyzed using the AHP Method for Criteria and SAW for Mortgage Recommendations.
   c. Secondary data comes from collecting and identifying and processing written data in the form of books and journals related to the problem.

2.3. *Processing Data*

   Analysis of data in research is very important in the methodology of this research, because by doing analysis, the data can be processed, processed and given meaning and meaning to solve problems that occur.

2.4. *Decision Making Stage*

   According to Herbert A. Simon (Karsasah, 2002:15-16), the stages that must be passed in the decision-making process are as follows:
   1. Understanding Phase (Intelligence Phase)

      At this stage identify and find out what system users only the criteria used and how much weight is given to each criterion which will later apply the Simple Additive Weighting (SAW) method.
   2. Design Phase

      At this stage the House Mortgage Recommendation Decision Support System model uses the Simple Additive Weighting (SAW) method using the following criteria:
      a. house criteria
         1) House Type
         2) Total Price
         3) Land areas
         4) Facilities
         5) Letter Types
         6) Development status indent / already exists
         7) Activity Distance
   3. Implementation Phase

      The Simple Additive Weighting (SAW) method has several stages, namely:
      1) Determine the criteria that will be used as a reference in decision making.

Table 1 Criteria for Taking KP

Criteria	Information
C1	HouseType
C2	Total Price
C3	land areas
C4	Facilities
C5	Activity distance
C6	Types of Letters
C7	Development Status

2) Using the AHP method to determine the weight of each existing criterion.

3) Conversion based on alternatives and criteria that have been recorded.

4) After the alternative weights have been adjusted to the suitability value, it enters the normalization stage.

5) After getting the results from normalization, then a matrix multiplication (preference) will be made to get a ranking of all alternatives.

2.5. *Prototype Development*

At this stage the prototype development includes:

a) Designing system interactions with actors using Use Case Diagrams and Scenario Use Case Diagrams.

b) Designing the system interface (User Interface).

c) Designing applications using the PHP programming language.

2.6. *Prototype*

Testing Testing in terms of prototypes in research uses TAM (Technology Acceptance Method) testing.

3. RESULTS AND DISCUSSION

3.1. Data Collections

For initial data acquisition, what is done is *crawling* data from local websites offering mortgages in the city of Palangka Raya according to research needs, as shown in Table 2.

Table 2 Preliminary Data Research

type	of land area	condition	Certificate	Price	Location	Facility
100	176	READY TO OCCURE	SHM Certification (Certificate of Ownership)	400 million	Jl. Princess uphold Foam 1	2 Bedrooms 1 Bathroom Electric 2200 Fence Kitchen Front Yard Cast Cement
80	205	READY TO OCCURE	SHM Certification (Ownership Certificate)	375 million	Jl. Rhino III	2 Bedrooms 1 Bathroom (Closet Sitting) Kitchen Front Yard Cast Cement Mini garden in front of the house
45	266	READY TO OCCURE	SHM Certification (Ownership Certificate)	275 million	Jl. Tingang 20 (Near SMA PLUS) Palangkaraya	2 Bedrooms 1 Bathroom Water Tank
50	150	READY TO OCCURE	SHM Certification	280 million	Jl. Gurame (Tange)	2 Bedrooms 2 Bathroom

type	of land area	condition	Certificate	Price	Location	Facility
			(Ownership Certificate)			Fence Kitchen Front Yard Cast Cement
45	200	PIVOT	SHM Certification (Ownership Certificate)	330 million	Jl. Keminting Hill XV	2 Bedrooms 1 Bathroom IMB
45	200	READY TO	HGB	250 million	Jl. G. obos 16 Block E	Foundation : Tread Foundation / Chicken Claw Sloof : Cast Iron Reinforced Frame : Benuas Wood Wall : Plaster Roof Frame : Wood Roof : Metal Tile Ceiling : Nusa Board Front Door : Benuas Wood WC Door : Aluminum / Zinc Glass : Riben 5mm Painting : Paint inside and out Floor : Full ceramic WC Bathroom : Closet Sitting
60	266	READY TO OCCURE	SHM Certification (Ownership Certificate)	485 million	Jl. Tenggaring V (Seth Adji)	2 Bedrooms 2 Bathrooms (Closet Sitting) Fence Kitchen Front Yard Cast Cement Mini garden in front of the House

3.2. Determination of Criteria

Based on the results of interviews with marketing agents in the Palangka Raya area as well as from the existing literature, the following are the criteria used by marketing agents for prospective mortgage buyers.

Table 3 Table of Criteria

Criteria	Name Criterion
C1	Type House
C2	Land Area
C3	Condition
C4	Certificate
C5	Price
C6	Location
C7	Facility

1. Type contains information on building area in general, the larger the number, the larger the building area. This criterion includes the benefit variable.
2. Land area contains information on land area in general, the larger the number, the wider the land area. This criterion includes variable benefits.
3. Conditions containing information on existing mortgages are generally divided into two, namely Indent (not yet built), (ready to live in) and Used, therefore it is changed to a number where the largest number is 3 being ready for habitation, 2 being not being built, and 1 be an old house. This criterion includes the variable Cost.
4. The certificate contains information on the legality status where the data found has 2 statuses, namely HGB and SHM. The two statuses are converted into numbers where number 2 means SHM and number 1 means HGB. This criterion is included in the Benefit Variable.
5. The price contains information on the total price of the building, where at the time of the interview, the cheaper price, the number of buyers attracts with such conditions, the price becomes part of the cost variable.
6. The location contains information from the location of the housing being built, mapped into two places, namely the inner ring area and the outer city ring area where the inner city ring area is worth 2 and the inner city ring area is 1. This criterion is part of the benefit variable.

7. Facilities contain information about the specifications of the house, facilities have values in the form of complete and incomplete. Complete here, I reduce the segment by having a minimum of a room, kitchen, bathroom and living room, while incomplete here has less than that where complete is worth 2 and incomplete is worth 1. This criterion is included in the Benefit Variable.

3.3. Data

Processing Data processing converts raw data into data that can be used in DSS weighting so that it can be used to process data that is processed.

Table 4 Data Processing

Types	of Land	Conditions	Certificates	Price	Locations	Facilities
100	176	2	2	400	1	3
80	205	2	2	375	2	3
45	266	2	2	275	3	1
50	150	2	2	280	3	3
45	200	1	2	330	2	1
45	200	1	1	250	3	4
60	266	2	2	485	3	4

3.4. The Design Stage

Criteria for weight determination is based on the results of the study of the literature as well as taking the experience of observation. Where the Criteria data refers to the preparation of the Comparison Matrix between each of the two Criteria.

Table 5 Determination of Criteria Data

	for Type of House	Land Area	Condition	of Certificate	Price	Location	Facilities
Type of House	1.00	0.50	3.00	0.33	3.00	0.50	2.00
Land Area	2.00	1.00	3.00	0.50	4.00	1.00	1.00
Condition	0.33	0.33	1.00	1.00	1.00	1.00	1.00
Certificate	3.00	2.00	1.00	1.00	1.00	1.00	1.00
Price	0.33	0.25	1.00	1.00	1.00	1.00	1.00
Location	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Facilities	0.50	1.00	1.00	1.00	1.00	1.00	1.00
TOTAL	9.17	6.08	11.00	5.83	12.00	6.50	8.00

From the converted data, the next step is to normalize each row and column. Normalization is done by dividing the data for each criterion by the total number of columns. Done with the following equation:

With the following calculations:

a. for house type parameter (C1)

   C1 = 1 / 9.17 = 0.11
   C2 = 2 / 9.17 = 0.22
   C3 = 0.33 / 9.17 = 0.04
   C4 = 3 / 9.17 = 0.33
   C5 = 0.33 / 9.17 = 0.04
   C6 = 2 / 9.17 = 0.22
   C7 = 0.5 / 9.17 = 0.05

b. for land area parameter (C2)

   C1 = 0.5 / 6.08 = 0.08
   C2 = 1 / 6.08 = 0.16
   C3 = 0.33 / 6.08 = 0.05
   C4 = 1 / 6.08 = 0.33
   C5 = 1 / 6.08 = 0.04

C6 = 1 / 6.08 = 0.16
C7 = 1 / 6.08 = 0.16

c. for Condition parameter (C3)

C1 = 3 / 11 = 0.27
C2 = 3 / 11 = 0.27
C3 = 1 / 11 = 0.09
C4 = 1 / 11 = 0.09
C5 = 1 / 11 = 0.09
C6 = 1 / 11 = 0.09
C7 = 1 / 11 = 0.09

d. for Certificate parameter (C4)

C1 = 0.33 / 5.83 = 0.08
C2 = 0.50 / 5.83 = 0.16
C3 = 1 / 5.83 = 0.09
C4 = 1 / 5.83 = 0.17
C5 = 1 / 5.83 = 0.17
C6 = 1 / 5.83 = 0.17
C7 = 1 / 5.83 = 0.17

e. for the Condition parameter (C5)

C1 = 3 / 12 = 0.25
C2 = 4 / 12 = 0.33
C3 = 1 / 12 = 0.08
C4 = 1 / 12 = 0.08
C5 = 1 / 12 = 0.08
C6 = 1 / 12 = 0.08
C7 = 1 / 12 = 0.08

f. for Condition parameter (C6)

C1 = 0.5 / 6.50 = 0.25
C2 = 1 / 6.50 = 0.15
C3 = 1 / 6.50 = 0.15
C4 = 1 / 6.50 = 0.15
C5 = 1 / 6.50 = 0.15
C6 = 1 / 6.50 = 0.15
C7 = 1 / 6.50 = 0.15

g. for the Condition parameter (C7)

C1 = 2 / 8 = 0.25
C2 = 1 / 8 = 0.13
C3 = 1 / 8 = 0.13
C4 = 1 / 8 = 0.13
C5 = 1 / 8 = 0.13
C6 = 1 / 8 = 0.13
C7 = 1 / 12 = 0.13

Table 6 Normalization of AHP

	Type of House	Land Area	Condition	of Certificate	Price	Location	Facilities
Type of House	0.11	0.08	0.27	0.06	0.25	0.08	0.25
Land Area	0.22	0.16	0.27	0.09	0.33	0.15	0.13
Condition	0.04	0.05	0.09	0.17	0.08	0.15	0.13
Certificate	0.33	0.33	0.09	0.17	0.08	0.15	0.13
Price	0.04	0.04	0.09	0.17	0.08	0.15	0.13

Location	0.22	0.16	0.09	0.17	0.08	0.15	0.13
Facilities	0.04	0.16	0.09	0.17	0.08	0.15	0.13
TOTAL	1	1	1	1	1	1	1

Eigen vector or priority weight is obtained by adding up each row of criteria and dividing by the total criteria.

Table 7 Eign Vector/Result of weighting

Type of House	0.16
Land Area	0.19
Condition	0.10
Certificate	0.18
Price	0.10
Location	0.14
Facilities	0.12

Table 8 Calculations Consistency

Criteria	Multiplication Matrix	/weight
Type of House	1225	7.66
Land Area	1.56	8.21
Condition	0.75666666666667	7.57
Certificate	1.5	8.33
Price	0.7408333333333	7.41
Location	1.15	8.21
Facilities	0.91	7.58

How to Calculate Consistency
t = 1 / 7 * 54.97 = 7.8528571428571
CI = (7.8528571428571 - 7) / 7 = 0.12183673469388
CR = 0.12183673469388 / 1.32 = 0.092300556586271

3.5. Implementation

Implementation The following is the data that has been modified based on the determination of criteria. Where the data is entered into the table then normalization is carried out after that will get ranking results that provide the best house recommendations based on the AHP criteria that have been done previously.

Table 9

Alternatives	Type of House (Benefits)	Land Area (Benefits)	Condition (Cost)	Certificate (Benefits)	Price (Cost)	Location (Benefits)	Facilities (Benefits)
A1	100	176	2	2	400	1	3
A2	80	205	2	2	375	2	3
A3	45	266	2	2	275	3	1
A4	50	150	2	2	280	3	3
A5	45	200	1	2	330	2	1
A6	45	200	1	1	250	3	4
A7	60	266	2	2	485	3	4
A8	60	266	2	2	485	0	4

3.5.1. Normalization

A11 = max {100, 80, 45, 50, 45, 45, 60, 60} / 150 = 1

The above is an example of a calculation to get the results of Normalization in Column A1, the first row, it will be repeated until all data is normalized if the benefits will be normalized

using the existing Max numbers. If it is cost then it will be normalized based on the Nim of the existing set.

Table 10

Alternatives	House Types (0.16)	Land Areas (0.19)	Conditions (0.1)	Certificates (0.18)	Prices (0.1)	Locations (0.14)	Facilities (0.12)
A1	1	0.66	0.5	1	0.625	0.33	0.75
A2	0.8	0.78	0.5	1	0.67	0.67	0.75
A3	0.45	1	0.5	1	0.91	1	0.25
A4	0.5	0.56	0.5	1	0.90	1	0.75
A5	0.45	0.75	1	1	0.76	0.67	0.25
A6	0.45	0.75	1	0.5	1	1	1
A7	0.6	1	0.5	1	0.51	1	1
A8	0.6	1	0.5	1	0.51	0	1

A11 = (1*0.16) + (0.66*0.19) + (0.5*0.1) + (1*0.18) + (0.625*0.1) + (0.33*0.14) + (0.75*0.12)
= 0.71488095238095

Above is an example calculation to get the result then multiplication will be carried out based on the criteria and added up to provide recommendations.

3.5.2. Results

Table 11

Ranking	Alternatives	Value
1	A7	0.82754639175258
2	A6	0.76485714285714
3	A2	0.75442857142857
4	A3	0.75290909090909
5	A4	0.73642857142857
6	A1	0.71488095238095
7	A5	0.69394805194805
8	A8	0.68754639175258

4. CONCLUSION

The problem in this research departs from How to Design a Decision Support System for Home Mortgage Using AHP and SAW Methods Case Study of Palangka Raya City. The problem is based on the city's vast land area, minimal transportation and the many developers who complain about declining sales. So there is the availability of many home mortgage products with minimal interest. This can make some companies close with no income from selling mortgages.

By using the AHP and SAW methods, it is hoped that it can help provide recommendations for home choices that match what home buyers want. The use of this system is expected to increase sales in the city of Palangka Raya.

The use of the criteria that have been published as a basis for providing recommendations for the house desired by the purchaser seems to be known. Ask for exploratory, this interest describes the behavior of someone who is always looking for information about the product he is interested in and looking for information to support the positive characteristics of the product.

So that by using the AHP and SAW methods can provide relevant information so that buying interest increases.

REFERENCES

[1] Alayed, W., Mackenzie, L. and Pezaros, D. (2018) 'Analytical hierarchy process multi-metric objective function for RPL', NCA 2018 - 2018 IEEE 17th International Symposium on Network Computing and Applications. IEEE, pp. 1–5. doi:10.1109/NCA.2018.8548054.

[2] Central Bureau of Statistics (2019) Portrait of Indonesian Education 2019.

[3] Burhanudin, M., Ferdinandus, F. and Bayu, M. (2019) 'Decision Support System Recommendation for Poor Student Aid Recipients Using the Simple Additive Weighting (Saw) Method', Journal of Informatics, Information Systems, and Computer Science, Cahaya Tech, 8(2).

[4] Chayanie. T., Lestari, SD and Hermawan, H. (2019) 'Decision Support System for Poor Student Aid Recipients (BSM) Using the Simple Additive Weighting (SAW) Method at SMA Negeri 1 Raren Batuah, East Barito Regency', 3(2), pp. 114–118.

[5] Canellas, MC et al. (2015) 'Accuracy and Effort of Decision-Making Strategies With Incomplete Information: Implications for Decision Support System Design', pp. 1–16.

[6] The House of Representatives of the Republic of Indonesia (2018) Draft Law on the Implementation of Donations. Indonesia.

[7] Djaoui, C. et al. (2018) 'A graph transformation approach to generate analysable maude specifications from UML interaction overview diagrams', Proceedings - 2018 IEEE 19th International Conference on Information Reuse and Integration for Data Science, IRI 2018. IEEE, pp. 511–517. doi:10.109/IRI.2018.00081.

[8] Fernando, Y. and Fernanda, S. (2017) 'Implementation of a Decision Support System for Receiving School Operational Assistance Funds for Students of SMA N 1 Sidomulyo Using the Web-Based Topsis Method', Journal Techno Compact, 11(1), p. 29. doi:10.33365/jtk.v11i1.181.

[9] Ge, Z. and Liu, Y. (2019) 'Analytic Hierarchy Process Based Fuzzy Decision Fusion System for Model Prioritization and Process Monitoring Application', IEEE Transactions on Industrial Informatics, 15(1), pp. 357–365. doi : 10.1109/TII.2018.2836153.

[10] Hamza, ZA and Hammad, M. (2019) 'Web and mobile applications' testing using black and white box approaches', IET Conference Publications, 2019(CP758), pp. 20–23. doi : 10.1049/cp.2019.0210.

[11] Harb, Y. and Alhayajneh, S. (2019) 'Intention to use BI tools: Integrating technology acceptance model (TAM) and personality trait model', 2019 IEEE Jordan International Joint Conference on Electrical Engineering and Information Technology, JEE 2019 - Proceedings. IEEE, pp. 494–497. doi : 10.1109/JEEIT.2019.8717407.

[12] Hasugian, AH and Cipta, H. (2018) 'Analysis and Design of a Decision Support System for the Selection of Life Spouses According to Karo Culture Using the Analytical Hierarchy Process (AHP) Method', Journal of Computer Science and Informatics, 02(april), pp. 14–30.

[13] Hidayah, NA et al. (2020) 'Analysis Using the Technology Acceptance Model (TAM) and DeLone & McLean Information System (D & M IS) Success Model of AIS Mobile User Acceptance', IEEE Access.

[14] Hidayat, R. (2017) 'Simple Additive Weighting Method as a Decision Support System for Outstanding Student Scholarship Recipients', Syncron (Journal & Research on Informatics Engineering), 2(2), pp. 13–17. Available at: https://stmikglobal.ac.id/journal/index.php/sisfotek/article/view/147/151.

[15] Inayatulloh (2020) 'Technology acceptance model (TAM) for the implementation of knowledge acquired model for SME', Proceedings of 2020 International Conference on

Information Management and Technology, ICIMTech 2020, (August), pp. 767–770. doi:10.1109/ICIMTech50083.2020.9211279.

[16] Jaya, TS (2018) 'Application Testing with the Black Box Testing Boundary Value Analysis Method (Case Study: Lampung State Polytechnic Digital Office)', Journal of Information Technology Development (JPIT), 3(2), pp. 45–46. doi:10.30591/flop. v3i1.647.

[17] Kaprocki, Z., Pekovic, V. and Velikic, G. (2017) 'Combined testing approach: Increased efficiency of black box testing', 2015 IEEE 1st International Workshop on Consumer Electronics - Novi Sad, CE WS 2015, pp. 76–78. doi:10.1109/CEWS.2015.7867160.

[18] Kusrini (2007) Database: Strategy, Design, and Management. Yogyakarta: Andi.

[19] Kusuma, UW (2018) 'Use of Analytical Hierarchy Process for Decision Support Systems for Poor Students', Generation Journal, 2(2), pp. 43–52.

[20] Moreira, MWL et al. (2019) 'A Comprehensive Review on Smart Decision Support Systems for Health Care', IEEE Systems Journal. IEEE, 13(3), pp. 3536–3545. doi:10.109/JSYST.2018.2890121.

[21] Murad, DF et al. (2020) 'Application engineer selection using simple additive weighting method approach', Proceedings of 2020 International Conference on Information Management and Technology, ICIMTech 2020, (August), pp. 660–663. doi : 10.1109/ICIMTech50083.2020.9210945.

[22] Nasuha, AH, Winata, H. and Marsono (2018) 'Decision Support System to Determine Eligibility of Poor Student Assistance (BSM) at SD Negeri 8 Bintang Using the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) Method', Journal of Science and Computers (SAINTIKOM), 17(2), pp. 198–205.

[23] Nofriansyah, D. (2014) The Concept of Data Mining Vs Decision Support Systems. Yogyakarta.

[24] Nurdiawan, O. (2018) 'Selection of Social Aid Recipients Based on a Decision Support System in an Effort to Reduce Students' Prone to Drop Out', XIII, pp. 32–40.

[25] Pahu, GYKSS (2018) 'Decision Support System To Select Recipients of Poor Student Aid Funds Using the Simple Additive Weighting (SAW) Method', Expert – Journal of Management Information Systems and Technology, 08(02).

[26] Pressman, RS (2015) Software Engineering: A Practitioner's Approach 8e. 8th edn . New York: McGraw-Hill.

[27] Rubiati, N., Kurniawan, R. and Septiana, L. (2019) 'Decision Support System for Poor Student Assistance (BSM) at Sdn 005 Bukit Timah Using the AHP Method', Journal of Informatics, Management and Computers, 11(2), pp. 37–43.

[28] Saaty, RW (1987) 'The analytic hierarchy process-what it is and how it is used', Mathematical Modeling, 9(3–5), pp. 161–176. doi:10.1016/0270-0255(87)90473-8.

[29] Safitri, K. and Tinus Waruwu, F. (2017) 'Decision Support System for Selection of Outstanding Employees Using the Analytical Hierarchy Process Method (Case Study: PT. Capella Dinamik Nusantara Takengon)', 1(1), pp. 12–16.

[30] Sam'An, M. et al. (2018) 'A modified algorithm for full fuzzy transportation problems with simple additive weighting', 2018 International Conference on Information and Communications Technology, ICOICT 2018, 2018-January, pp. 684–688. doi:10.1109/ICOIACT.2018.8350745.

[31] State Secretariat of the Republic of Indonesia (2003) Law 20 of 2003 concerning the National Education System. Indonesia.

[32] Shaikh, A. and Will, UK (2018) 'Overview of Slicing and Feedback Techniques for Efficient Verification of UML/OCL Class Diagrams', IEEE Access, 6(c), pp. 23864–23882. doi:10.1109/ACCESS.2018.2797695.

[33] Shi, X. et al. (2010) 'Construction of an online crisis decision support system', Proceedings - 2010 IEEE 2nd Symposium on Web Society, SWS 2010, pp. 383–387. doi:10.109/SWS.2010.5607422.

[34] Sianturi, M. and Telaumbanua, F. (2019) 'The Best Employee Selection Decision Support System with AHP and WASPAS Methods', National Seminar on Information Science & Technology (SENSASI), 3(2), p. 119. doi : 10.14421/jiska.2018.32-06.

[35] Suryani, E. et al. (2018) 'Decision Support System for Poor Student Aid Recipients Applying the WASPAS and MOORA Methods', National Seminar on Information Science & Technology, pp. 719–727.

[36] Susanto, A. et al. (2017) 'Decision support systems design on sharia financing using Yager's fuzzy decision model', 2017 5th International Conference on Cyber and IT Service Management, CITSM 2017. doi:10.1109/CITSM.2017.8089263.

[37] Thongkoo, K., Daungcharone, K. and Thanya Phongphat, J. (2020) 'Students' Acceptance of Digital Learning Tools in Programming Education Course using Technology Acceptance Model', 2020 Joint International Conference on Digital Arts, Media and Technology with ECTI Northern Section Conference on Electrical, Electronics, Computer and Telecommunications Engineering, ECTI DAMT and NCON 2020, pp. 377–380. doi:10.1109/ECTIDAMTNCON48261.2020.9090771.

[38] Votyakova, E., Gnatyuk, A. and Staroverov, B. (2016) 'Direct analytic hierarchy process for choosing power substation equipment', 2016 57th International Scientific Conference on Power and Electrical Engineering of Riga Technical University, RTUCON 2016, pp. 0–4. doi:10.1109/RTUCON.2016.7763146.

[39] Widowati, Y. (2020) Criteria for Recipients of GNOTA Foundation Education Assistance. Jakarta.

[40] Abbas, I. (2015) 'Evaluation of Policies on the Development of Decent Housing for the Poor in Samarinda City, East Kalimantan Province', Paradigm Journal, 4(2), pp. 80–91. Available at: http://e-journals.unmul.ac.id/index.php/JParadigma/article/view/409/369.

[41] Arzian, R. et al. (2020) 'Application of Fuzzy SAW for Recommendations on Determining Recipients of Development Assistance The House is Not Livable', Journal of Information Technology and Multimedia, 2(1), pp . 36–42.

[42] Azhar, Z. and Handayani, M. (2018) 'Analysis of Priority Factors in the Selection of Mortgage Housing Using the Ahp Method', Journal of Management Informatics and Information Systems, 1(2), p. 19. doi:10.36595/misi.v1i2.38.

[43] Badruddin, MA et al. (2020) 'DECISION SUPPORT SYSTEM FOR THE DETERMINATION OF NEW STUDENT'S DEPARTMENT USING SIMPLE ADDITIVE WEIGHTING (SAW) METHOD', Journal of Technology, Health and Social Sciences, 2(1), pp. 1–7.

[44] Endyan, RD, Hidayati, SR and Kukuh, DKN (2019) 'Housing Location Preferences by the Middle and Lower Community of Jambi City', National Proceedings of XIV Year 2019 Industrial and Information Technology Engineering (ReTII), 2019 (November), pp . 7–17.

[45] Kurniawan, D. (2020) 'Combination of Fuzzy Logic and Simple Additive Weighted (SAW) Method to Help Recommend Majors in Higher Education', Journal of Informatics Engineering Unis, 7(2), pp. 115–121. doi:10.33592/justis.v7i2.392.

[46] Nursaka Putra, Dedi Rahman Habibie, IFH (2020) 'SUPPLIER SELECTION DECISION SUPPORT SYSTEM IN TB. NAMEENE WITH SIMPLE ADDITIVE WEIGHTING (SAW) METHOD', Journal of Information and Management Systems, 8(1).

[47] Priyono, SS et al. (2020) 'Information System to Determine Student Potential Using the Fuzzy Multiple Attribute Decision Making Method with Simple Additive Weighting Case Study: STIKES DUTA GAMA KLATEN', Journal of Information Technology, XV, pp. 97–103.

[48] Riyansuni, I. and Devitra, J. (2020) 'Analysis and Design of a Decision Support System for Recipients of Non-Cash Food Assistance (BPNT) With Simple Additive Weighting (SAW) at the Jambi City Social Service', Journal of Information System Management, 5(1), pp. 151–163.

[49] Sunarti (2018) 'Comparison of TOPSIS and SAW Methods for Selection of Residential Houses', Journal of Information Systems, 3(1), pp. 69–79. Available at: https://publikasi.dinus.ac.id/index.php/joins/article/view/1883/1289.

[50] Sunarti, S. (2020) 'Decision Support System for Culinary Tourism Selection in the Depok City Area Using the Simple Additive Weighting (SAW) Method', Journal of Informatics Explora -, 9(2), pp. 105–110. doi:10.30864/eksplora.v9i2.323.

[51] Supriyono, H. (2015) 'Selection of Residential Houses Using the Weighted Product Method', Khazanah Informatics: Journal of Computer Science and Informatics, 1(1), p. 23. doi:10.23917/khif.v1i1.1178.

[52] Editorial Team (2019) 'KPR Natural Lethargy', tabengan.com.

[53] Waluyo Nuswantoro, DS and EP (2007) 'A study of consumer satisfaction of housing kpr-btn Public Corporation Perumnas in Palangka Raya City', Journal of ENGINEERING DESIGN, pp. 90–98.

[54] Yulianto, A. and Wibowo, K. (2017) 'The influence of the outer ring road on regional development in Palangka Raya City in terms of land use', Proceedings of the National Seminar on Innovation in Smart City Development, 1(1) , pp. 94–107