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Decision Support System for Choosing The Best Housing Location by The Satisficing Model and AHP Method

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A B S T R A C T

Residence is the most important means of life as a place to gather with family and build a peaceful and harmonious family. The realization of community welfare and quality human resources can be characterized by an improvement in the standard of living. This research took an alternative location to the villages located in Rumbai district, namely Sri Meranti, Umban Sari, Palas, Lembah Damai, Limbungan Baru, Meranti Pandak. The criteria used are at least 6 criteria with the AHP Method and Satisficing Model. The Analytical Hierarchy Process (AHP) method compares based on human perception, the AHP method can be strengthened by the Satisficing Models method because the Satisficing Models method in this case is a comparison method that calculates real financial or economic value with the human perception method. Thus, it can be concluded from this application and research that the Satisficing Models Method is a supporting method or method to strengthen the feasibility of the AHP method. The AHP method compares only six sides of the compared criteria in this DSS, while the Satisficing Models method compares all six financial aspects. In this case, the recommended alternative location to select is the one with the highest rating result in the AHP method - The Satisficing Model.

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1. Introduction

Residence is the most important means of life as a place to gather with family and build a peaceful and harmonious family. The realization of community welfare and quality human resources can be characterized by an improvement in the standard of living. A comparison will result in a decision that will affect the investment and outcomes of what we do, the correct decision will bring benefits to both the company and its users.

Several previous studies have proven that there are factors that influence the choice of home location. Housing demand will occur if an individual has the desire/criteria and the ability to purchase an item or service. The function of housing will be more real if the developer's facilities are more complex. Individual demand for a place to live is heavily influenced by the strategic location. Thus, in order to improve a company's progress, management must make decisions with accuracy and dexterity. Management requires complete information about the conditions and circumstances of a location, as well as the calculation of the budget based on market share, when assessing the location selection decision.

It is an important decision for PT. Inti Karya Bangun Persada as an attraction factor in housing marketing to choose a location. In deciding where to build a house, PT. Inti Karya Bangun Persada only

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considers the condition of the land and the costs that will be incurred, without considering other assessments and comparisons. As a result of making less observant decisions when selecting land for residential locations, the company frequently experiences slow sales, resulting in lower profits. As a result, a system that can aid in the selection of residential land on which to build housing is required.

A Decision Support System (DSS) is a collection of human capabilities combined with computer technology to perform data processing and decisions that can be used to help a manager make decisions when dealing with semi-structured problems. In this housing location selection decision-making system, a supporting method for a decision support system, namely the Analytical Hierarchy Process, is used to fulfill decision support (AHP). Analytical Hierarchy Process (AHP) technology has been widely used in a variety of applications including industry, electronics, and education. Furthermore, the Analytical Hierarchy Process (AHP) method can be used to determine which housing is appropriate and which housing should be avoided [1].

Furthermore, the problem of this research is to explain the process of designing, manufacturing, and implementing a decision system that can be precise and accurate in selecting housing locations in Rumbai District by combining the AHP method and The Satisficing Models Priority assessment indicators are divided into two parts: the criteria side and the financial side. The criteria, on the other hand, include the fundamental physical condition of the soil, electricity and water networks, transportation, flood potential, environmental conditions, and facilities. While financial indicators include land area, land prices, house prices, development taxes, and the allocation of funds require. While the company's area covers all urban villages in Rumbai District, it includes six urban villages as alternative variables: Meranti Pandak, Umban Sari, Limbungan Baru, Sri Meranti, Palas, and Lembah Damai Villages.

Based on an article written by [2] explained that the previous research has similarities with the current research, the similarities being in topics and objects, specifically the selection of housing locations, but the differences being in location and method, specifically using the Surabaya City location object and the AHP-WP method. The study "Implementation of the Analytic Hierarchy Process - Weighted Product Method for Ideal Housing Recommendations Case Study: Malang City" shares some similarities with the current study in that they both employ the AHP method. However, the study of [3] differs from current research in several ways. The distinction is found in the combination of methods and research objects. In terms of method combinations, previous studies used a combination of the AHP-WP method, whereas the current research uses a combination of the AHP-Satisficing Models method. DSS was used by the subject of previous research to select ideal housing. While the purpose of this research is to determine the location of a housing development.

2. Method

Analytical Hierarchy Methodology (AHP), Thomas L. Saaty created it in the 1970s [4]. This is a multi-criteria decision-making model that can aid the human frame of mind by optimizing logic, experience, knowledge, emotions, and feelings into a systematic process. AHP is essentially a method for solving complex and unstructured problems into groups, then entering numerical values as a substitute for human perception in making relative comparisons [5]. It will be possible to determine which element has the highest priority using a synthesis.

Determine which element is the most important. The Satisficing Models method is a decision-making process that involves choosing the first alternative solution that meets the bare minimum of decision criteria [6]. Managers will choose the first solution that comes up to solve the problem, even if a better solution is expected to exist later, because they will not try to pursue all alternatives to identify a single solution to maximize economic return. Decision makers cannot justify the time and effort expended in gathering complete information. Complex problems are simplified (only the core of the problem is taken into account / bounded rationality) to the point where decision makers are ready to solve them.

The Satisficing Model decision-making model has the following steps [7] [8] [9]: (1) Simplify the problem; (2) Setting goals (needs) for decision making is related to the existence of certain problems; (3) Determination of minimum standards from a series of decision criteria; (4) Identify a limited set of alternatives; (5) Analyze and compare each alternative to see if it meets the constraints better or worse than the minimum standard of a series of decisions; and (6) Are there alternatives that meet the decision requirement?, If yes, choose the alternative that is considered the best. If not, repeat step 5 and conduct another alternative search.

Utilization of combinations this method is used to determine the desired target or objective for determining housing locations, then select the appropriate criteria and create a pairwise comparison matrix to weight several criteria, This weighting is used to demonstrate the relationship between the sizes of the assessment parameters [10]. To obtain the weight of the criteria used in the calculation process to obtain alternative assessments for determining Rumbai District housing locations

The results of the AHP- and The Satisficing Model calculations are then used to develop web-based applications [11]. PHP is the programming language used, and the database is MySQL. The functions of designing this program are data input, data storage, data modification, data deletion, data processing, preparation of required reports and clear limits of authority or authorization to users of application programs.

This system is intended to be used as a model for determining housing locations in the Rumbai District by combining the AHP method and The Satisficing Models. SPK is typically created to aid in the resolution of a problem or the evaluation of an opportunity. DSS applications are used in data-driven decision making, have a simple user interface, and can combine decision makers' thoughts using one or more methods [12]. The combination of AHP and The Satisficing Model method was chosen for this study because it has many advantages in explaining the decision-making process. One of them is that it can be described graphically so that all parties involved in decision-making can easily understand it, and that it can be structured by developing a linkage model [13].

The phases of the research are depicted in the Figure 1 below.

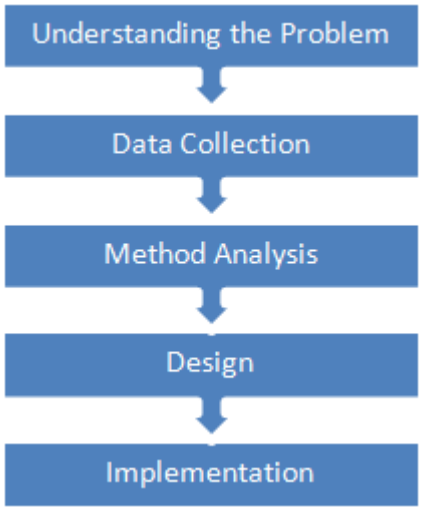


Figure 1. Structure of the Research Phases

The following is an explanation of Figure 1 [14]: (1) Understanding the Problem. Identify problems that occur and provide appropriate and accurate troubleshooting recommendations; (2) Data collection. After identifying the problem, the next step is to match the data and variable requirements, as well as the direction of the solution to be achieved. This procedure can be carried out using field studies and online data collection via published writings; (3) Method Analysis

The intent is to explain the need for methods as well as the methods used to produce appropriate outputs. The selected method repeats the identification of the required variables as data matching and data requirements; (4) Design. This process performs data processing by matching the variable values used with the method requirements and identifying the types and categories of variables based on the provisions of the method; and (5) Implementation. Implement a system that was designed with actual conditions in mind, and make improvements if there is insufficient data.

In addition to the aforementioned steps, the following are the stages of data collection for the application of the AHP method and the Satisfying Model in selecting the best housing location in Rumbai District: (1) Literature studies, is the first phase in the process of researching the literature for references and information on relevant research materials and topics; (2) Interview, direct discussions with competent sources and experts in the field of decision support systems, particularly the AHP and TSM methods, or to several housing developers in Rumbai sub-district and in general in Pekanbaru; (3) Identify the problem. At this stage, continuing the research by identifying the issues to be discussed, related to the application of the AHP (Analytic Hierarchy Process) Method and the Satisfaction Model Method in selecting the best housing location in Rumbai District; (4) Study literature is studying sources in the form of theoretical books on decision support systems, AHP research methods, The Satisfaction Model and journals used in research as other theoretical studies.

3. Results and Discussion

Systems analysis is a phase of system development that determines what the information system must do to solve existing problems by examining systems and work processes for strengths, weaknesses, and areas for improvement. The analysis phase occurs after the system design stage but before the system design stage.

Data analysis is defined as an effort to process data into information so that the characteristics of the data are easy to understand and useful for solving problems related to research activities. Data analysis techniques can thus be defined as a type of data analysis whose goal is to convert data into information so that the characteristics of the data are easy to understand and also useful for solving problems related to research activities such as data descriptions and induction or conclusions. Based on sample data, about the characteristics (parameters) of the population (statistics). Table 1 show compared financial data.

Table 1. Compared Financial Data

Alternative Locations	Land area / Ha	The land price / M2	House Selling Price / Unit	Area and Building Tax / Year	Average Income of Local Residents / Month	Allocation of Required Funds
Sri Meranti	6,5	Rp. 4.600.000	Rp. 72.000.000	Rp. 2.000.000	Rp. 2.600.000	Rp. 799.500.000
Umban Sari	6,5	Rp. 4.750.000	Rp. 71.750.000	Rp. 1.850.000	Rp. 2.300.000	Rp. 820.000.000
Palas	6,5	Rp. 4.550.000	Rp. 70.000.000	Rp. 1.775.000	Rp. 2.250.000	Rp. 850.000.000
Lembah Damai	6,5	Rp. 4.800.000	Rp. 75.500.000	Rp. 1.900.000	Rp. 2.750.000	Rp. 865.000.000
Limbungan Baru	6,5	Rp. 4.350.000	Rp. 77.000.000	Rp. 2.100.000	Rp. 3.000.000	Rp. 800.000.000
Meranti Pandak	6,5	Rp. 4.400.000	Rp. 72.500.000	Rp. 1.800.000	Rp. 2.550.000	Rp. 825.000.000

When the Consistency Ratio (RK) is less than or equal to 2.0% (CR = 0.0249 / 1.24 = 0.02009), the assessment is consistent. Appendix A contains detailed calculations for the process of calculating the consistency ratio. Only the final results of the calculation of the consistency ratio matrix of alternative pairwise comparisons on the criteria are shown in Table 2 below.

Table 2. Consistency Ratio of The Comparison Matrix on The Alternatives on The Criteria

No	Alternative Pairwise Comparison Matrix on Criteria	Consistency Ratio	Description
1	Basic Physical Soil	0,02041 (2,0%)	Consistent
2	Availability of Electricity and Water	0,06846 (6,8%)	Consistent
3	Support transportation	0,09693 (9,6%)	Consistent
4	Flood Potential	0,09698 (9,6%)	Consistent
5	Environmental Conditions	0,08919 (8,9%)	Consistent
6	Facility Requirements	0,08838 (8,8%)	Consistent

The TSM method is used to calculate the best investment from a financial standpoint in decision making. In this problem which compares the economic aspects of each alternative location, the economic value is compared and calculated as a value that has economic value or is supported by economic factors. The following cases and examples compare six economic aspects: land area, land price, house selling price, zoning and construction taxes, average resident income, and allocation of funds required. Table 3 below provides more information: (1) Land area. It is an important factor to consider in housing development plans because it will be the primary draw for potential buyers. Land that is not in accordance with government regulations will result in the loss of potential customers. It is hoped that housing developers will take note of this factor because it has a significant impact; (2) Land price. Because this cannot be separated, the price of land will be directly proportional to the price of the house sold by the developer. The higher the price of land, the higher the price of the house sold by the developer to prospective buyers; (3) House selling price. The size of the population's income influences the selling price of houses to potential buyers, which is directly proportional to the cost of land at housing construction sites; (4) Area and building tax. Before constructing a residential location, developers must consider the amount of land and building tax, as this will have a long-term impact on prospective customers. Then, consider the prospective buyers' level of ability to buy a house, as well as the type of house they are looking for; (5) Average income (UMR/UMK/UMP). The company must also consider the income of residents near the site where housing will be built because the economic quality of the population will affect the pace of the community's economy. If a region's population has an average income level that is lower than the national average or even lower, whether a consumer will buy a house around a community that has a low economic level, of course this is also taken into consideration by companies that want to build housing in that area; and (6) Allocation of required funds. The intent is an estimate of how much money will be allocated for the construction of one house in the area. The developer also considers employee salaries, the cost of renovating the workplace, and any other costs deemed necessary. The greater the variety, the lower the cost.

The AHP method's next stage is to determine the highest weight from the AHP method and financial weights. The outcomes are shown in the Table 3 below.

Table 3. Supporting Variables for Alternative Variables

No	Alternative Sub-distric	Land Area (Ha)	Land Price (Ha)	House Selling Price (Ha)	PBB / Year	Average Income of Local Residents / Month	Fund Allocation Required
1	Kel. Sri Meranti	6,5	4.600.000	72.000.000	2.000.000	2.600.000	799.500.000
2	Kel. Umban Sari	6,5	4.750.000	71.750.000	1.850.000	2.300.000	820.000.000
3	Kel. Palas	6,5	4.550.000	70.000.000	1.775.000	2.250.000	850.000.000
4	Kel. Lembah Damai	6,5	4.800.000	75.500.000	1.900.000	2.750.000	865.000.000
5	Kel. Limbungan Baru	6,5	4.350.000	77.000.000	2.100.000	3.000.000	800.000.000
6	Kel. Meranti Pandak	6,5	4.400.000	72.500.000	1.800.000	2.250.000	825.000.000

The following is the UML used in the design process of a web-based DSS system:

Figure 2 show use case diagram.

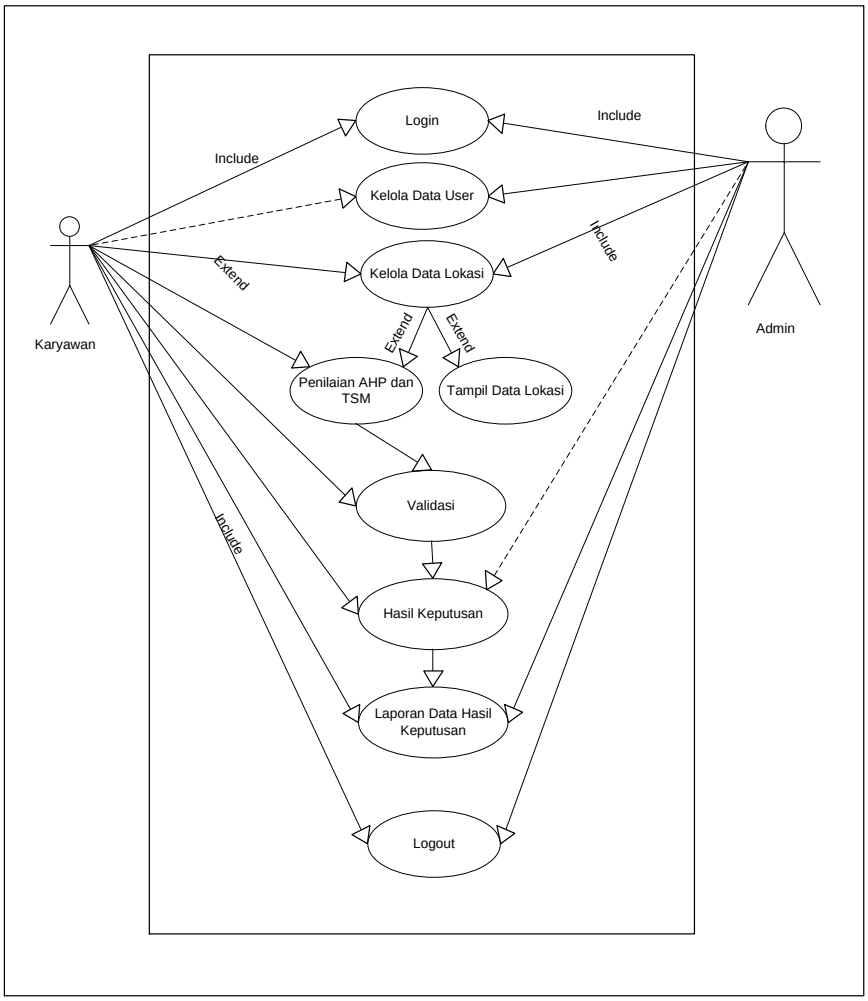


Figure 2. Use Case Diagram

Figure 3 and Figure 4 show squence diagram.

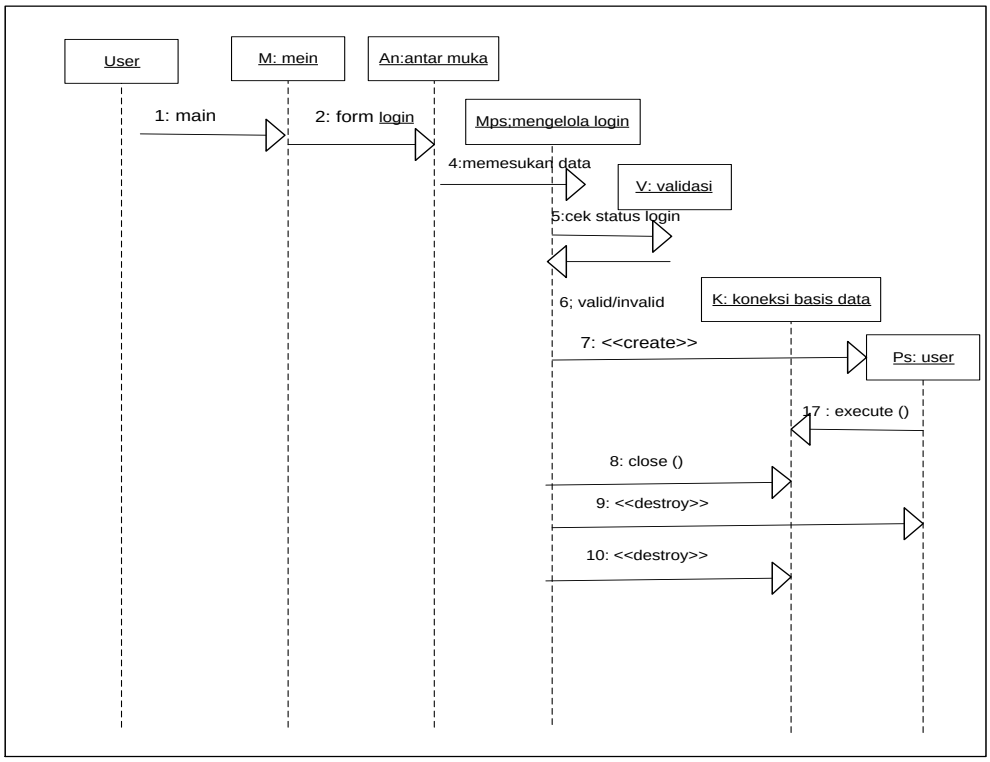


Figure 3. Sequence Diagram Login

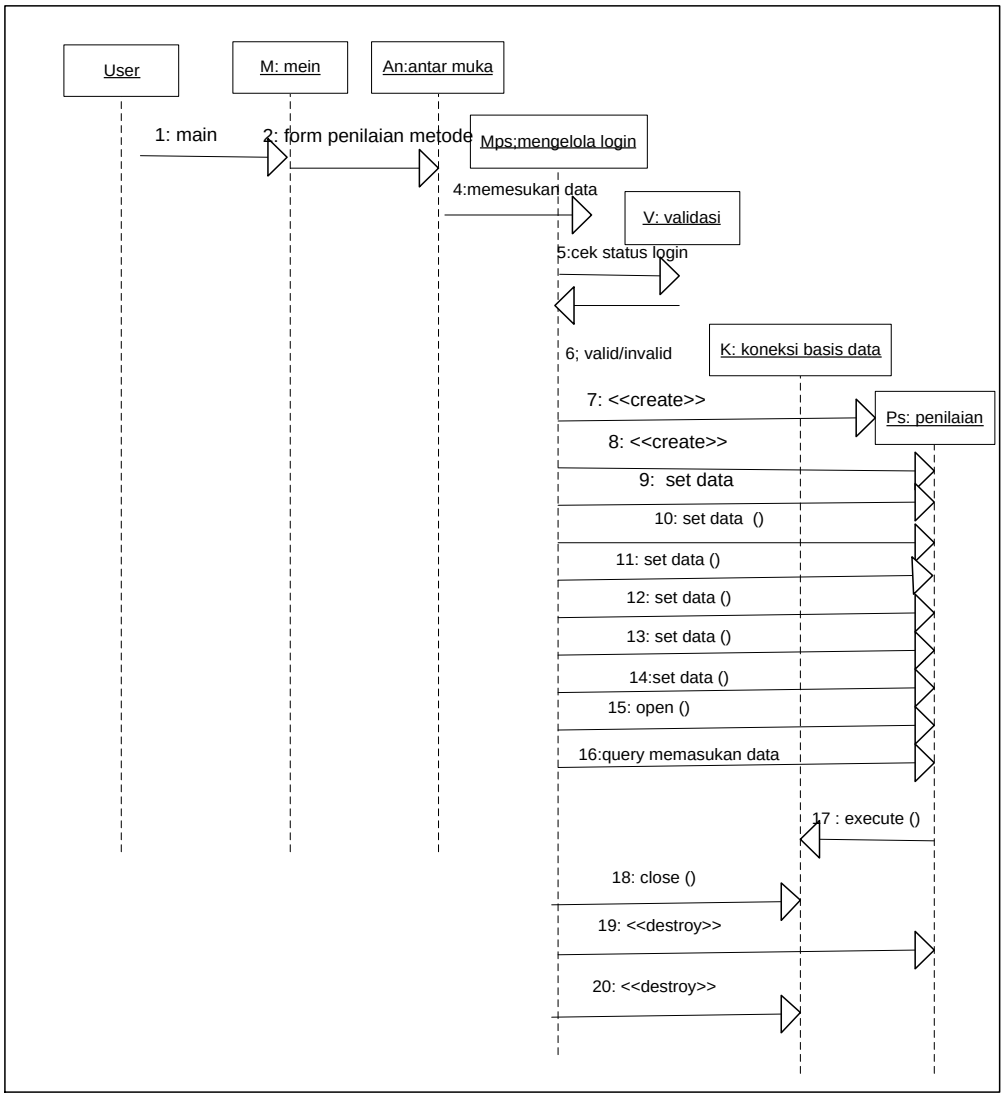


Figure 4. Sequence Diagram of AHP and TSM Assessment

Figure 5 show calss diagram.

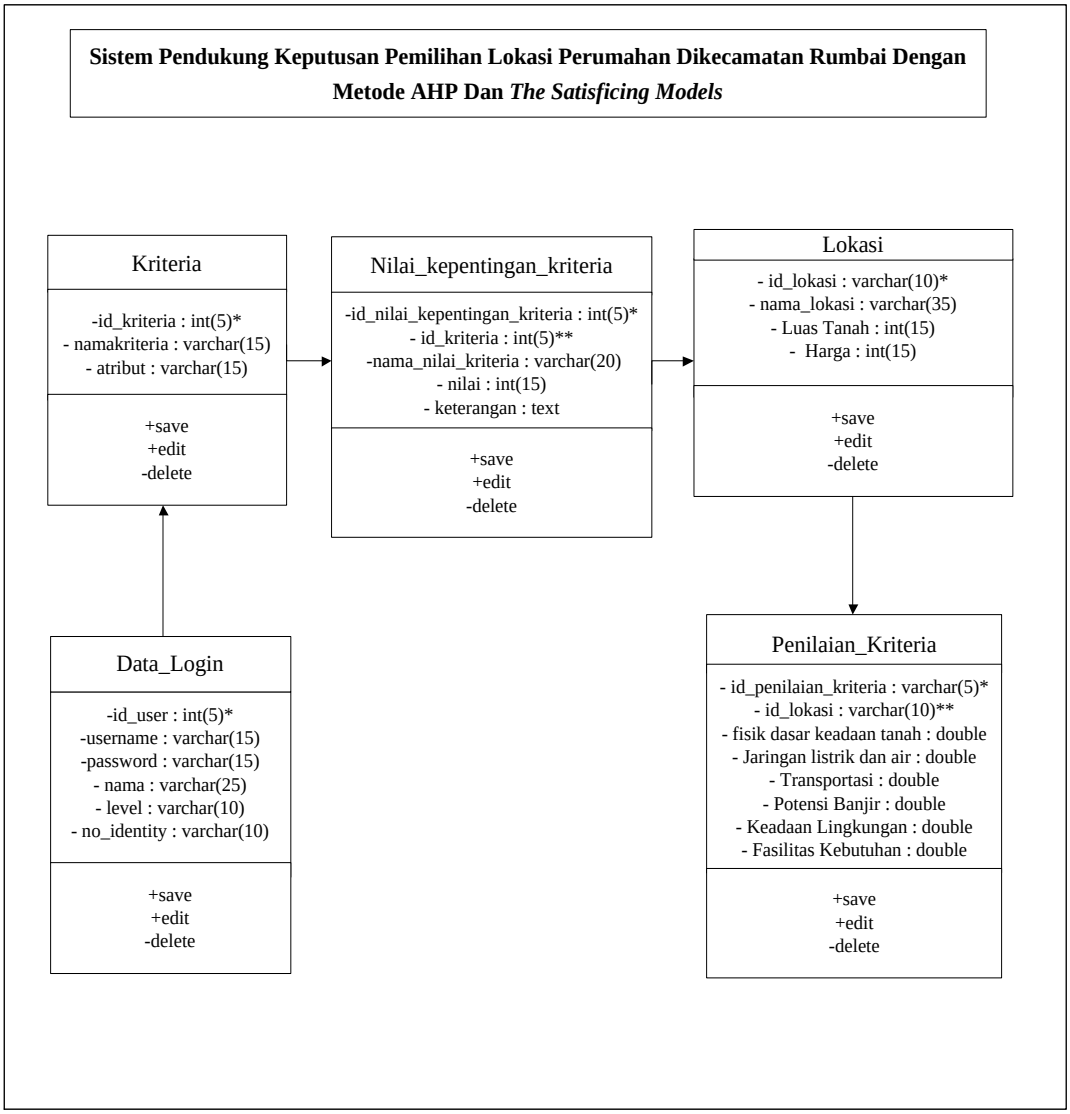


Figure 5. Class Diagram

After designing the system with UML, the DSS website is built as follows:

Figure 6 show login page. When the DSS process is completed, the login page appears; the user must login to the website to complete the DSS process.

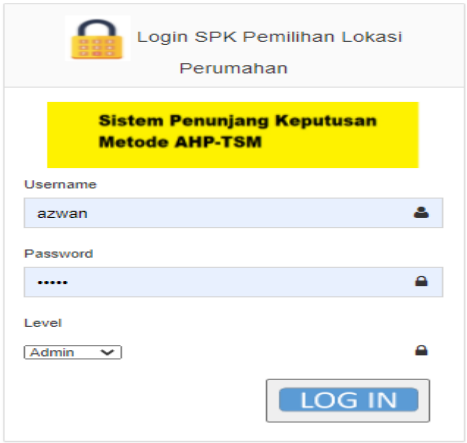


Figure 6. Form Login

Figure 7 show website home page. Is the main page of the website for the Decision Support System that was built, and it usually displays general information about the DSS process and methods, as well as the alternative variables and criteria that were used.

Figure 7. Main Menu Forms

Figure 8 show DSS location variable input page. On this page the admin / user can enter a location variable that is a recommendation for housing, in this case, the sub-district in the selected sub-district.

Figure 8. Location Data Input

Figure 9 and Figure 10 show the user settings. The goal of this page, which is only found in the superadmin module, is to manage users who can log in and process the website. Users can be added and removed as needed by the system.

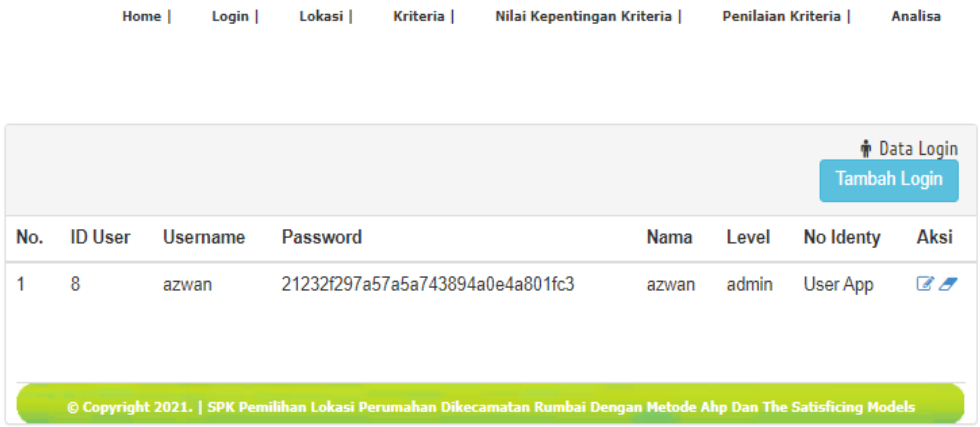


Figure 9. Form Data Login

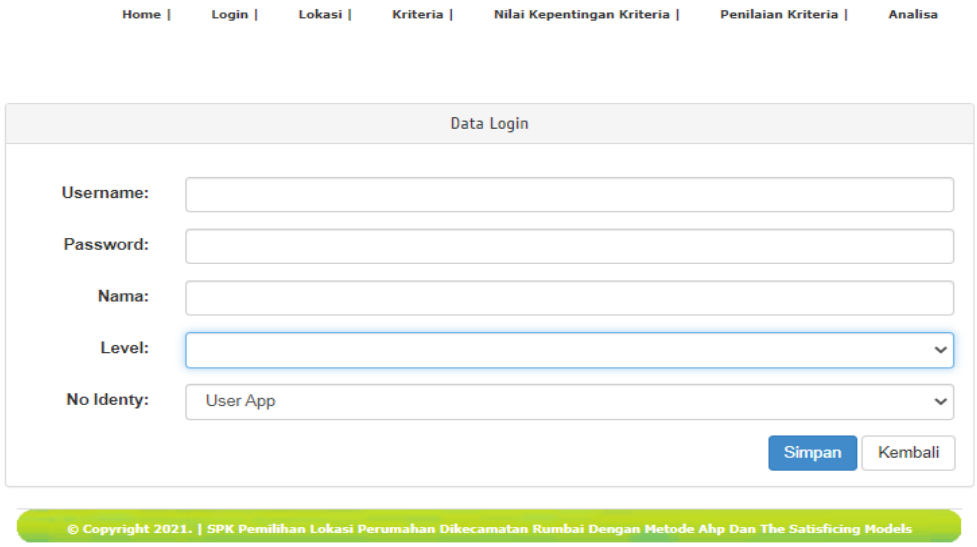


Figure 10. Input Data Login

Figure 11 show DSS Criteria Entry Page. The criteria data form display is used as a medium for displaying criteria data input when making decisions.

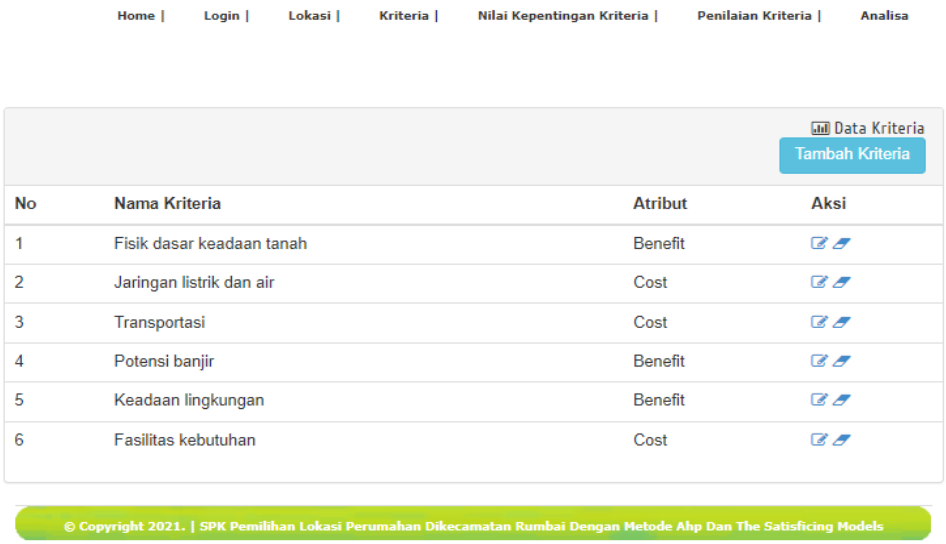


Figure 11. Criteria Data Input

Figure 12 show criteria importance value entry form. The display form of the importance value of the criteria is used as a medium for displaying data entry of the value of the importance of the criteria and processing it in the application.

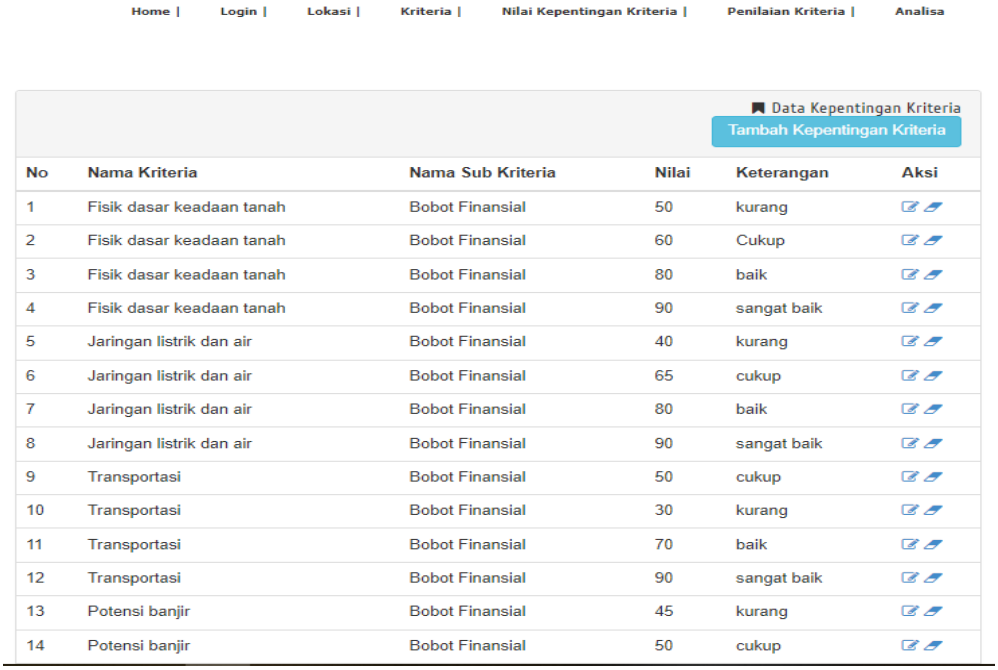
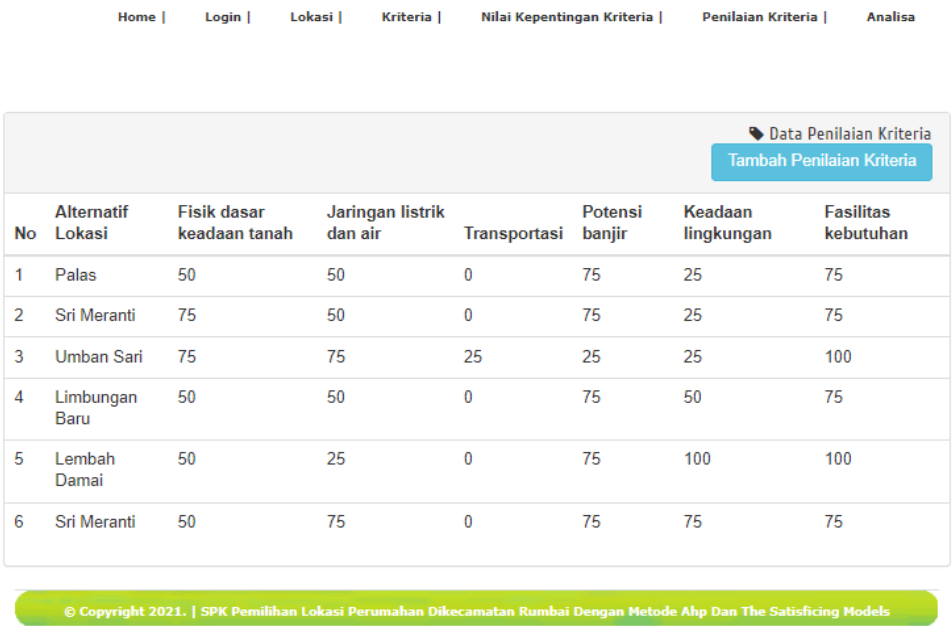


Figure 12. Data Input Value of Interest Criteria

Figure 13 and 14 show criteria assessment entry form. The display of the Criteria Assessment data form is used as a medium for displaying criterion value data entry and processing in the application.



No	Alternatif Lokasi	Fisik dasar keadaan tanah	Jaringan listrik dan air	Transportasi	Potensi banjir	Keadaan lingkungan	Fasilitas kebutuhan
1	Palas	50	50	0	75	25	75
2	Sri Meranti	75	50	0	75	25	75
3	Umban Sari	75	75	25	25	25	100
4	Limbungan Baru	50	50	0	75	50	75
5	Lembah Damai	50	25	0	75	100	100
6	Sri Meranti	50	75	0	75	75	75

Figure 13. Scoring Criteria

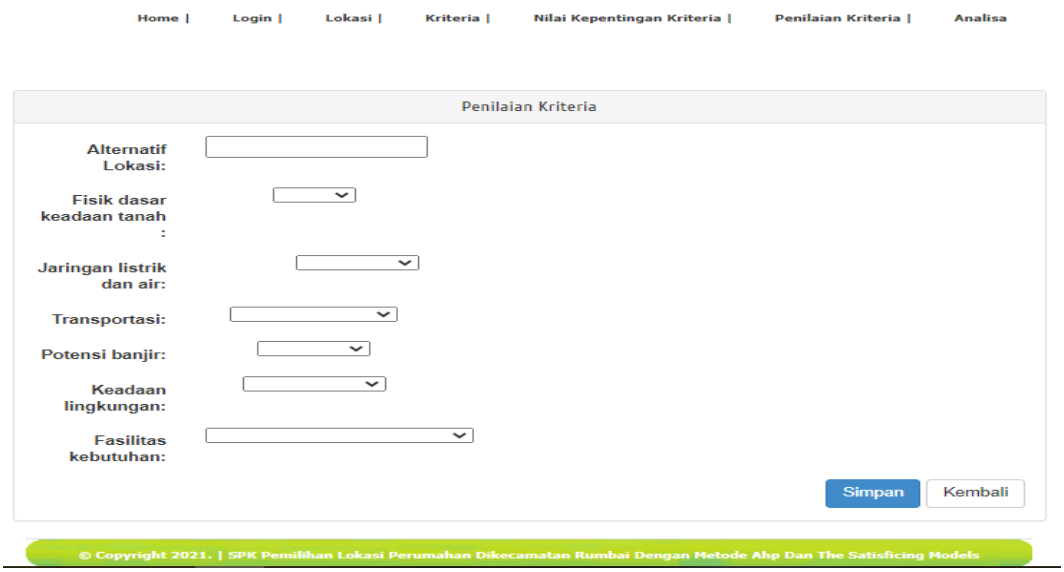


Figure 14. Entry Assessment Criteria

Figure 15 show calculation output form with the AHP method. Display form data Calculations with the AHP method are used as a medium to display calculation results and process them in applications.

Penilaian Menggunakan Metode AHP

Matrik Awal

No	Pemilihan Lokasi	C1	C2	C3	C4	C5	C6
1	Limbungan Baru	70	80	65	70	80	100
2	Lembah Damai	75	70	75	75	80	100
3	Palas	85	80	80	80	85	100
4	Umban Sari	80	75	73	75	85	100
5	Sri Meranti	80	80	70	65	85	100
6	Meranti Pandak	80	83	70	65	85	100

Matrik Normalisasi

No	Lokasi	C1	C2	C3	C4	C5	C6
1	Limbungan Baru	0.41957893	0.38682	0.47973	0.40252	0.45969	0.519474
2	Lembah Damai	0.156599703	0.20852	0.24378	0.2005	0.24959	0.240974
3	Palas	0.216977061	0.16078	0.10237	0.16312	0.15517	0.140496
4	Umban Sari	0.170954019	0.09421	0.11269	0.11846	0.09176	0.074316
5	Sri Meranti	0.092494061	0.14967	0.06144	0.1154	0.04379	0.02474
6	Meranti Pandak	0.092494061	0.14967	0.06144	0.1154	0.04379	0.02474

Rangking AHP	Nama	Nilai
1	Limbungan Baru	0.469925968
2	Lembah Damai	0.232261866
3	Palas	0.144744065
4	Umban Sari	0.09444188
5	Sri Meranti	0.060689047
5	Meranti Pandak	0.060689047

Figure 15. Calculations with The AHP Method

Figure 16 show calculation output form using the TSM method. Display form data calculations with the TSM method are used as a medium to display calculation results and process them in applications.

Hasil Penilaian AHP

HASIL PERHITUNGAN DENGAN METODE TSM

Hasil Penilaian Bobot Finansial : (240) (200) (200) (210) (300) (260)

No	Nama	FDT. Fisik dasar keadaan tanah (Benefit)	JLA. Jaringan listrik dan air(Cost)	TRN. Transportasi (Cost)	PBJ. Potensi banjir (Benefit)	KLG. Keadaan lingkungan (Benefit)	FKB. Fasilitas kebutuhan (Cost)
1	Palas	50	50	0	75	25	75
2	Sri Meranti	75	50	0	75	25	75
3	Umban Sari	75	75	25	25	25	100
4	Limbungan Baru	50	50	0	75	50	75
5	Lembah Damai	50	25	0	75	100	100
6	Sri Meranti	50	75	0	75	75	75

Normalisasi

No	Nama	FDT. Fisik dasar keadaan tanah (Benefit)	JLA. Jaringan listrik dan air(Cost)	TRN. Transportasi (Cost)	PBJ. Potensi banjir (Benefit)	KLG. Keadaan lingkungan (Benefit)	FKB. Fasilitas kebutuhan (Cost)
1	Limbungan Baru	1.21	1	1.23	1.14	1	1
2	Lembah Damai	1.13	1.14	1.06	1.06	1	1
3	Palas	1	1	1	1	0.94	1
4	Umban Sari	1.06	1.06	1.09	1.06	0.94	1
5	Sri Meranti	1.06	1	1.14	1.23	0.94	1
6	Meranti Pandak	1.06	1	1.14	1.23	0.94	1

Perangkingan Dengan Metode TSM

Print

No	Nama	Nilai
1	Limbungan Baru	110
2	Lembah Damai	106.5
3	Palas	103.7
4	Umban Sari	102.1
5	Sri Meranti	98.2
6	Meranti Pandak	98.2

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Figure 16. Calculations with The TSM Method

4. Conclusion

Based on the above explanation of the research material, the following conclusions can be drawn: (1) Based on the decision support process using the AHP and TSM methods, decision recommendations for selecting the best housing location based on the criteria used can be provided, particularly in the Rumbai District; (2) When compared to manual calculations, the building of the Decision Support System website can speed up decision recommendations; (3) Limbungan Baru sub-district is at the top of the ranking on The Satisficing Models method proposed by the Sri Meranti and Umban Sari sub-districts; and (4) Whereas in the AHP method the leader was the Limbungan Baru sub-district, followed by the Lembah Damai and Palas sub-districts.

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