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Decision Support System for Property Investment Selection in Makassar City

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Abstract: In the selection of property investment for various purposes it is very important for prospective homeowners to know the nature and characteristics of the property. This research has made an application as a tool for decision support systems that can assist in decision making with the analytical ability to assess property compatibility with prospective investor using the Analytic Hierarchy Process (AHP) Model, each of which is based on the attributes of the property. The completion process using AHP modeling is make a pairwise comparison matrix, calculate the priority value for each criterion, make a paired matrix sub-criteria of each criterion and d) calculate the priority value of the subcriteria of each criterion and form of calculation using AHP. With the combination of criterion, sub-criterion intensity and weights values entered with official property data in the city of Makassar, the application will be able to produce a sequence of global compatibility values for each alternative property to prospective investor. The result of this process is a compatibility ranking. This ranking is the basis of recommendations for decision makers to choose suitable property. This web-based software is created with the open source tools and software.

Key words: Decision support system, property investment, Makassar city, global, AHP, web-based software

INTRODUCTION

In recent years, the need for housing which is one of the elements of primary needs for human beings has increased rapidly along with population growth and a growing level of the domestic economy, this opportunity was followed by the availability of various offers banking credit with low interest rates which attract public interest, so that, the demand for housing also, increases. The increase in housing needs has occurred throughout Indonesia including in Makassar as one of the most densely populated cities in Indonesia outside Java Island with a population of more than 1.3 million in 2010. This phenomena is seen by business actors as an attractive opportunity that also, influences the emergence of new developers engaged in the property business, this factor has led to the emergence of various housing alternatives that target various segments ranging from the lower, middle to upper class economic communities with offers a variety of alternatives in terms of price, design, facilities and location. In the selection of housing, it is very important for potential investors or buyers to know the various characteristics regarding housing that will be purchased not only in terms of building and land prices but also other important criteria such as the availability and quality of public facilities like clean water and electricity infrastructure and supporting facilities such as roads, parks, houses of worship, environmental safety criteria, strategic location, exterior and interior design and so on. Many of alternative housing available and also, the criteria that must be considered give rise to much confusion that can cause problems in choosing the right housing alternative. This problem can be caused by various factors such as: the analysis carried out at this time is still simple and experimental, so that, the risk of human error when the selection process occurs is still very high and in terms of time is less efficient because it requires time and costs for prospective buyers to compare the various alternative housig available. The number of criteria and sub-criteria that influence the process of selecting housing alternatives makes it difficult for prospective buyers to consider the interests interrelationships and influence of each criterion and also subcriteria subjectively. The many alternative locations of housing that target various segments of people's income pose difficulties for prospective buyers in subjectively considering the characteristics of each alternative housing available. Based on the description and background of the previous problems, the researcher raised the case to researched and to build a decision support system for the needs of selecting housing investment in the Makassar city using Analytic Hierarchy

Process (AHP) modeling. The purpose of this research is to build a Decision Support System (DSS) using the analytic hierarchy process modeling for cases of selecting property investments in the Makassar city that are in accordance with the needs and preferences of prospective investors or buyers.

Literature review

Decision support system: The decision support concept or Decision Support System (DSS) was first revealed in the 1970's by Gorry and Scott (1971). According to Gorry and Scott (1971) who define DSS as "an interactive computer-based system which helps decision makers to use data and various models to solve unstructured problems.

Components of DSS: According to Turban and Aronson (2005), the DSS application has four main subsystems that determine the technical capabilities of the DSS.

Data management subsystem: The data management subsystem includes a database that contains data that is relevant to a situation and managed by software called a Database Management System (DBMS).

Management model subsystem: A software package that includes financial, statistical, management science or other qualitative models that provide the right analytical capabilities and software management.

User interface subsystem: The user communicates with and orders the decision support system through the subsystem. The user is the part that is considered by the system.

Knowledge-based management subsystem: The subsystem supports all other subsystems or acts directly as an independent component. Knowledge-based management subsystems are optional but can provide many benefits because they provide intelligence for these three main components. The SPK application consists of subsystems as shown in Fig. 1.

Analytic Hierarchy Process (AHP) concept: In the analytic hierarchy process, the problem is arranged into a hierarchical structure, so that, decision makers can involve all the factors that need to be considered as much as possible and there will be a clear link between one factor and another. The hierarchical model arrangement in the AHP method is shown in Fig. 2.

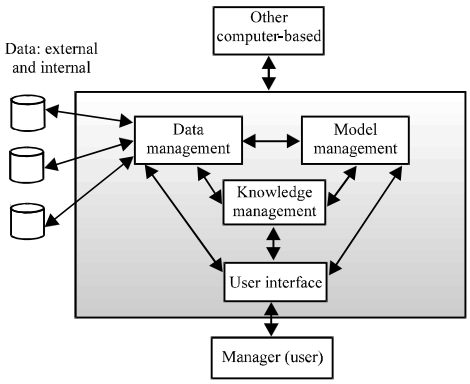

Fig. 1: Components of DSS

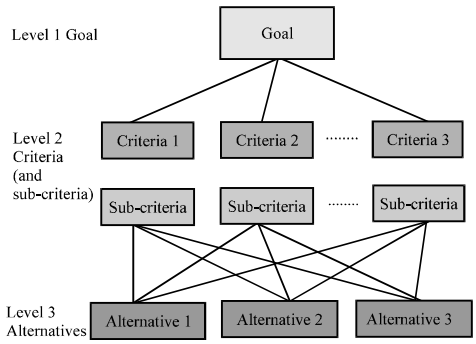

Fig. 2: AHP hierarchy

In solving problems with AHP, there are several principles that must be understood, according to Saaty (1994), the AHP method has three basic principles as follows:

Decomposition (decomposition): After the problem is defined, it is necessary to do decomposition which is to break the whole problem into its elements. If you want to get accurate results, then, the solution to the elements is done, so that, it does not allow further solving. The solution will produce several levels of a problem. Therefore, this analysis process is called hierarchy.

Comparative judgment: This principle makes an assessment of the relative importance of two elements at a certain level related to the level above, this assessment is the core of AHP because it influences the priority of the elements in the intended criteria. The results of this assessment look better when presented in the form of pairwise comparison matrices (pairwise comparison). According to Saaty for various problems, a scale of 1-9 is the best scale for expressing opinions (Saaty, 1994). The value and definition of qualitative opinions on the scale of the Saaty comparison can be measured using an analysis table as shown in Table 1.

Table 1: Saaty comparison scale

The fundamental scale for pairwise comparisons		
Intensity of importance	Definition	Explanation
1	Equal importance	Two elements contribute equally to the objective
3	Moderate importance	Experience and judgment moderately favor one element over another
5	Strong importance	Experience and judgment strong favor one element over another
7	Very strong importance	One element is favored very strongly over another, its dominace is demonstrated in practice
9	Extreme importance	The evidence favoring one element over another is of the highest possible order of affirmation

Intensities of 2, 4, 6 and 8 can be used to express intermediate values intensities of 1.1, 1.2, 1.3, etc can be used for elements that are very close in importance

Synthesis of priority: From each matrix pairwise comparison can be determined the eigenvector value to get regional priority. Because the pairwise comparison matrix is found at each level, global priority can be obtained by synthesizing between regional priorities. The procedure for synthesizing is different according to hierarchy. Ordering elements according to relative importance through a synthesis procedure is called priority setting. In researcher's previous researches, image enhancement system based on AHP and fuzzy theory has achieved significant result (Chyan, 2019) with high accuracy.

Definition of housing: There are several definition about housing/real estate. According to AI. (2010) the notion of residential property is vacant land or a piece of land that is developed used or provided for a residence such as single family houses, apartments, flats. Based on Indonesian Law No. 4 of 1992 concerning housing and settlements.

A house is a building that functions as a place of residence or residence and a means of fostering a family. Housing is a group of houses that function as a residential or residential environment equipped with environmental infrastructure and facilities. Settlements are parts of the environment outside protected areas, both in the form of urban and rural areas that function as neighborhoods or neighborhoods and places of activities that support livelihoods and livelihoods.

According to the a joint decree of the Minister of Home Affairs, Minister of Public Works, Minister of Public Housing in 1992 Housing properties can be categorized into several types, namely:

A simple house is a house built on land with a plot area of between 54-200 m^2 and the construction cost per m^2 does not exceed the highest unit price per m^2 for the construction of official housing for class C government that applies.

Medium-sized housing is a house built on land with a plot area between 200-600 m^2 and/or construction costs per m^2 between the highest unit price per m^2 for the development of government official housing class C to A that applies.

Luxury houses are houses built on land with a plot area of between 600 and 2000 m^2 or construction costs per m^2 above the highest unit price per m^2 for the construction of applicable class A official housing.

The choice of location for residential houses illustrates an individual's effort to balance two conflicting choices, for example, access from and to the city center and the land area coverage that can be obtained. According to Snyder and Anthony (1991) there are several criteria that must be considered in choosing a housing location:

Zoning: Regulations are related to the type and size of buildings, building height requirements, building equivalent lines.

Utilities (utilities): Includes availability and conditions of rainwater drainage, sanitation, gas, electricity and telephone installation and any other facilities to improve quality of life.

Technical factors (technical factor): Soil conditions, topography and drainage, design and costs.

Location (location): Availability on the market for proposed use, accessibility, condition of the environment and traffic conditions within the house neighborhood.

Aesthetics (eisthetics): Includes existing landscapes and landscapes.

Community: Especially, related to the environment including health and services organized by the government.

City service: Provision of education, health services and services organized by the government within the house neighborhood area.

Cost (cost): Costs and affordability of the housing for prospective owner.

MATERIALS AND METHODS

The flow system of the DSS for determining the location of home/property investment can be seen in Fig. 3.

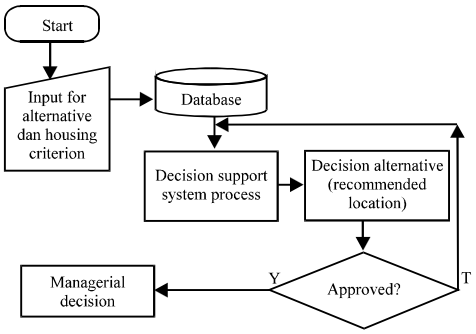

Fig. 3: Flow system of DSS

System design steps with AHP Model: Steps in designing a web-based home investment decision support system with the analytical hierarchical process method including:

Define the problem and determine the desired solution. It can be defined that, the problem is to find the location of the housing investment which is the most appropriate to choose with a solution using the hierarchical analysis process.

Make a hierarchical structure that begins with a general purpose, followed by sub-objectives, criteria and possible alternatives at the lowest criteria level. To choose the location of the desired housing investment, criteria are needed. For example, among others the prices infrastructure, distance from the city center and so on.

Make a paired comparison matrix that describes the relative contribution or influence of each element to each of the objectives or criteria above. Comparison is based on "judgment" from decision makers by assessing the importance of an element compared to other elements.

Calculates the eigenvectors of each paired comparison matrix. The value of the eigenvector is the weight of each element. This step is at the lowest hierarchy level until the goal is reached.

Check hierarchy consistency, if the value is more than 10%, the assessment of data judgment must be corrected. In filling in the comparison value in the previous step, it cannot be filled with arbitrary comparative values, for this reason a consistency ratiois needed which is a benchmark of whether the included comparative value can be justified.

RESULTS AND DISCUSSION

System requirements for running the DSS clients are compatible PC and internet browser.

Decision alternatives form page: In this menu, the user can enter alternative decisions in the form of prospective housing investment locations. To enter alternative locations, the user can simply type the name of the location on the form provided and press the add button, the result of entering the housing location data will automatically appear on the same page. back. The following example is a form that has been inputted by 3 alternative residential investment locations, namely Pesona Prima Griya, De Boulevard and Puri Mutiara as shown in Fig. 4.

Criterion form page: In this menu, the user can enter a list of criteria which are criteria criteria that will be considered when choosing a housing location. To enter the criteria, the user can simply type in the criteria name on the form provided and press the add button, the result of entering data criteria will automatically appear on the same page, if an input error occurs the user simply presses the reset button, then all the criteria list will be emptied again. The example in the following form as in Fig. 5 includes 3 criteria that are considered in choosing the location of housing investment that are price infrastructure and security.

Criterion weighting interface : On this interface, the user makes weighting on each criteria pair according to AHP modeling rules, the user can choose from the combo box the weighting that is appropriate for each pair of criteria displayed, after that the user has to submit the set weight criteria to enter the data into the system then the system will do computation and the results are immediately displayed on the same page in the form of eigenvector values of each criterion along with the ranking of each criterion ranging from the most important to the least important, it should be noted the value of consistency ratio as an indicator of consistency of weighting, if the value of the consistency ratio exceeds the tolerance limit, the system will display a warning for the user to repeat the weighting process. From the example of weighting carried out it can be seen that price is the most important criterion, followed by security and infrastructure in choosing the location of housing investment. Weighting is quite consistent with a consistency ratio of 1.66% as shown in Fig. 6.

Alternative weighting interface: On this interface, the user makes weighting on each alternative pair to each criterion, respectively, according to AHP modeling rules, the user can choose from the select box the appropriate weighting value for each alternative pair displayed, after that the user has to press the set weight criteria button to

Fig. 4: Decision alternative form

Fig. 5: Criterion input form

enter the data into the system, then the system will do computation and the results are immediately displayed on the same page in the form of eigenvector values of each alternative to each criterion along with the ratings of each alternative for each criterion from the most important to the least important, consistency ratio value as an indicator of consistency of weighting need to determined, if the value of the consistency ratio exceeds the tolerance limit, the system will display a warning for the user to repeat the weighting value process. From the example of weighting it can be seen that for the price criteria, Pesona Griya Prima was ranked first as the best alternative followed by Puri Mutiara and De Boulevard, for infrastructure criteria, De Boulevard was ranked first as the best alternative followed by Puri Mutiara and finally, Pesona Griya Prima and last on the security criteria, Puri Mutiara ranked first as the best alternative followed by De Boulevard and Pesona Prima Griya. From the results of the weighting carried out it can be seen that the weighting is still quite consistent by looking at the consistency ratios, i.e., for price criteria, consistency ratio of 3.39%, for infrastructure criteria the consistency ratio is 0% and finally, for security criteria the consistency ratio is 2.13%.

Fig. 6: Criterion weighting with AHP method

Fig. 7: Alternative ranking report

Alternative ranking report: This page provides a report on the final results of calculations with PHP modeling based on weighting criteria and alternatives made. The final results are given in the ranking of each alternative along with the eigenvector value. From the results obtained, based on the example, it can be seen from Fig. 7 that the location of Pesona Griya Prima is ranked first as an alternative recommended by the system as a location for proper investment based on calculations with AHP modeling.

CONCLUSION

An application system has been built to process housing data using AHP modeling to determine the order of priority of housing compatibility with prospective investors which will later become a consideration in determining housing that suits their preferences and needs. The accuracy of the system in providing housing recommendations is quite good but has not reached the highest level due to the limitations of the modeling method used.

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