

Residence Selection in Banyumas District by Using Analytical Hierarchy Process Case Study: North and South Purwokerto Area

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Abstract. The need for a house continues to increase. It can be seen from the calculation data of resettlement needs in Banyumas district in 2013 of 64,236 homes. This study aims to determine of residence choice along with the criteria of the highest priority, which focused on 6 criteria that are type, facility, location, environment, security, and price in order to support the regulation of spatial and territorial layout plan of Banyumas District by using Analytical Hierarchy Process with 6 residence samples: Griya Satria Bukit Permata, Griya Kedungrandu Regency, Green Kanaya, Grand Satria Wiradadi II, and Griya Karang Indah The result shows that the residence type criteria have the highest weight of (0.358), and the highest residence priority is Griya Satria Bukit Permata residence with the value of 0.416.

Keywords: analytical hierarchy process, residence selection, criteria, alternative.

1 Introduction

The house is a basic necessity with its function as a residence. The need for a house continues to increase, it can be seen from the calculation data of residential needs of Banyumas district in 2013 for 64,236 houses [1]. The banking credit facility that allows us to have a home in a short time is one of the developing factors of residence business in Banyumas where it can be seen by the number of applications for building permits and residence development. In 2012 there were 20 developers who got the site plan validation with a total land area of 297,528 m² [2].

The determination of residence options should be based on the rules and requirements of each potential customer. Based on the regulation of spatial and territorial layout plan of Banyumas District, it is expected that the selected residential layout can pay attention to several elements, namely the availability of green open space, healthy house, and limited impact of industrial waste [2].

There are several aspects that can be used in decreasing the level of residence needs, which are the need based on the house function [3] [4] [5], needs based on hierarchy [6] [7], home needs based on urban residence area planning instructions [8], and house selection in accordance with aspects of the physical environment [9][10].

Analytical Hierarchy Process method is a method that can be used for decision making with various problems. Generally it can be divided into three main phases which are

hierarchical structure [11], priority analysis [12][13], and verification of consistency. It requires paired comparison measurements to obtain priority scales with the weights to each of the criteria and alternatives used which allows for inconsistencies [14]. Priority Scale is used based on primary data collection in the form of interviews and questionnaires to the respondents that are potential customers and residence developer marketing.

Hariyanto et al. [15] from the analysis resulted in the location of the development settlement area located in Sukomanunggal district, the second priority was located in Sambikerep district, and the third priority was located in Lakarsantri district with the Analytical Hierarchy Process (AHP) method.

The comparisons were made by the judgment of decision makers by assessing the importance level of an element over other elements. The scale of paired comparison assessment with the intensity of its importance consists of several levels [16] which are seen in table 1 below.

Table 1. Paired Comparison Rating Scale.

Relative intensity	Definition	Information
1	Of equal value	Two requirements are of equal value
3	Slightly more value	Experience slightly favours one requirement over another
5	Essential or strong value	Experience strongly favours one requirement over another
7	Very strong value	A requirement is strongly favoured and its dominance is demonstrated in practice
9	Extreme value	The evidence favouring one over another is of the highest possible order of affirmation
2,4,6,8	Intermediate values between two adjacent judgments	When compromise is needed

The best choice determination is taken through the priority score with the highest percentage. This paired comparison can be obtained through measurement of the level of importance, interest, emotion, experiences, and facts of a person, as the basis of a relative strength reflection scale.

Therefore, this research will analyze house planning in Banyumas District to determine the residence priority choice location which focused on 6 criteria that are type, facility, location, environment, security, and price to support spatial and territorial layout plan in Banyumas District by using Analytical Hierarchy Process (AHP). The results of this system will also form a map showing the location of the residence.

2 Research Method

AHP focuses on the hierarchical structure of the decision to describe the problem in every situation faced by the decision maker. It uses the uncertainty factor by finding the closest

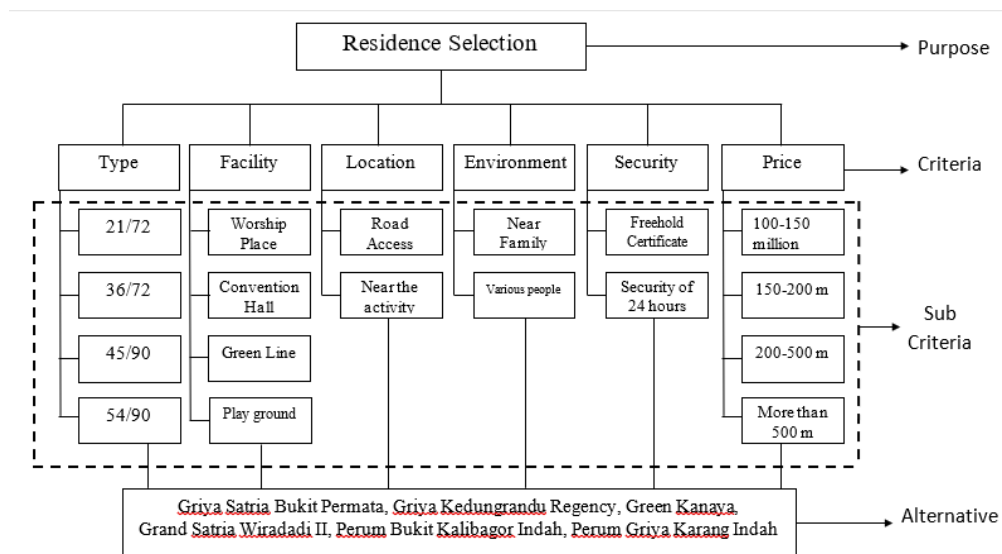


Fig. 1. Hierarchy Structure for Residence Selection.

Priority to the decision taken. In this study, there are four levels of hierarchy namely objectives, criteria, sub-criteria, and alternative solutions. A candidate that serves as an alternative was defined to choose residence to prospective customers.

2.1 Calculating The Comparison Of Criteria

The paired comparison is used to measure the criterion relationship with the initial goal of determining the alternative of residence selection. Giving weighting criteria based on the results of distributing questionnaires to communities in the area around North and South Purwokerto.

The validation value is calculated based on the number of respondents, rCount and rTable. Each respondent is given each of the 6 questions, which later answers from all respondents (15 respondents) will be calculated the level of correlation (rCount) of each question. Based on the number of respondents (15 respondents), the table obtained was 0,553 (significance level 0,05). The result of the validity of each question is $S1 = 0.553 < 0.856$, $S2 = 0.553 < 0.973$, $S3 = 0.553 < 0.775$, $S4 = 0.553 < 0.963$, $S5 = 0.553 < 0.928$, $S6 = 0.553 < 0.864$

Table 2. Matrix Of Paired Comparisons Of Each Criterion.

Criteria	Type	Facility	Location	Environment	Security	Price
Type	1	7	5	3	3	2
Facility	0.143	1	1	0.333	1	0.143
Location	0	1	1	0.143	0.333	0.2
Environment	0.333	3	7	1	1	0.333
Security	0.333	1	3	1	1	0.333
Price	0.5	7	5	3	3	1
Total	2.509	20	22	8.476	9.333	4.009

Based on table 2 above, the highest value is the total criteria value of the location with a value of 22. The criteria of the facility is the second highest total column value of 20 while the environment and price have the lowest total column value.

Table 3. Test Of Consistency Level To Criteria.

Criteria	Priority	Eigen	Consistency Index
Type	0.358	6.462	CI = (Eigen _{Max} - n) / (n-1) =0.072
Facility	0.056	6.257	
Location	0.046	6.201	
Environment	0.152	6.343	Consistency Ratio CR = CI / RI =0.058
Security	0.105	6.355	
Price	0.284	6.534	
Total		38.151	
Eigen Max		6.358	

Based on table 3 above, it can be seen that the highest priority in determining the residence selection location is on the type criteria with the value of 0.358 and the lowest priority value on the location criterion of 0.046. The Consistency Index (CI) is 0.072, Random Index (RI) of 1.24 and the Consistency Ratio (CR) of 0.058. Because the CR ratio rating is less than 0.1, then this assessment is acceptable.

2.2 Determining The Alternative Priority Rating Of Each Paired Matrix

After the priority value of each criterion was obtained, the priority of each residence as an alternative choice of prospective customers was calculated.

Table 4. Alternative Priority Values Of Type Criteria.

Alternative	Priority	Eigen	Consistency Index
Griya satria bukit permata	0.447	0.152	CI = (Eigen _{Max} - n) / (n-1) = -1.211
Griya kedungrandu regency	0.208	0.149	
Green kanaya	0.149	0.138	Consistency Ratio CR = CI / RI
Grand satria wiradadi ii	0.150	0.180	
Griya karang indah	0.047	0.150	

Total	0.769	= -1.082
Eigen max	0.154	

Based on table 4 above, it can be seen that the priority of each alternative to the highest type of criteria is the alternative of Grand Satria Bukit Permata Residence with the value of 0.447 and the lowest priority value in alternative of Griya Karang Indah Residence of 0.047. The Consistency Index (CI) is -1.211, the Random Index (RI) of 1.12, and the Ratio Consistency (CR) of -1.082. Because the CR ratio rating is less than 0.1, then this assessment is acceptable.

Table 5. Global Priorities And Rating Of Each Alternative

Alternative	Gloibal priority	Rating
Griya satria bukit permata	0.416	I
Griya kedungrandu regency	0.208	II
Green kanaya	0.193	III
Grand satria wiradadi ii	0.134	IV
Griya karang indah	0.048	V

From the results of the alternative priority matrix in table 5, it can be explained that the alternative selection of residence areas in Banyumas district has the priority on the option of Griya Satria Bukit Permata Residence with a global priority value of 0.416.

3 Interface Design

3.1 Software Implementation

The picture below shows the recommendation page used by the prospective consumer to give weight value for each criterion in the process of residence selection. Based on the literature study, the review that the author did has not been implemented into an application-based recommendation page that is used to give weight to each criterion in the process of determining the feasibility decision.

Alternative Weight

Kriteria : CO1 - Refresh 🔍

A01 - Griya Satria Bukit Permata | 1 - (equal) | A01 - Griya Satria Bukit Permata Edit

Alternative	A01 Griya Satria Bukit Permata	A02 Griya Kedungrandu Regency	A03 Green Kanaya	A04 Grand Satria Wanadadi II	A05 Griya Karang Indah
A01 Griya Satria Bukit Permata	1.00000	0.33333	0.14286	1.00000	1.00000
A02 Griya Kedungrandu Regency	3.00000	1.00000	0.33333	1.00000	1.00000
A03 Green Kanaya	7.00000	3.00000	1.00000	1.00000	1.00000
A04 Grand Satria Wanadadi II	1.00000	1.00000	1.00000	1.00000	1.00000
A05 Griya Karang Indah	1.00000	1.00000	1.00000	1.00000	1.00000

Process

Fig. 2. Weighting Recommendation Page.

Alternative Calculations

Type	A01 Griya Satria Bukit Permata	A02 Griya Kedungrandu Regency	A03 Green Kanaya	A04 Grand Satria Wanadadi II	A05 Griya Karang Indah	Priority Vector
A01 - Griya Satria Bukit Permata	1.00000	3.00000	5.00000	1.00000	1.00000	0.33343
A02 - Griya Kedungrandu Regency	0.33333	1.00000	1.00000	1.00000	1.00000	0.14966
A03 - Green Kanaya	0.20000	1.00000	1.00000	1.00000	1.00000	0.14211
A04 - Grand Satria Wanadadi II	1.00000	1.00000	1.00000	1.00000	1.00000	0.1874
A05 - Griya Karang Indah	1.00000	1.00000	1.00000	1.00000	1.00000	0.1874
Total	3.53333	7	9	5	5	1
Principial Eigen Value (Imax)						5.37873
Consistency Index (CI)						0.09468
Consistency Ratio (CR)						0.08454

Fig. 3. Weighting Recommendation Page.

FINAL RESULT

Alternative	C01	C02	C03	C04	C05	C06	Value	RANK
Weight Eigen	0.33574	0.14895	0.09998	0.11254	0.1514	0.1514		
A01 - Griya Satria Bukit Permata	0.33343	0.11413	0.30633	0.2	0.2	0.2	0.24264	1
A03 - Green Kanaya	0.14211	0.33996	0.25835	0.2	0.2	0.2	0.20725	2
A02 - Griya Kedungrandu Regency	0.14966	0.17691	0.24392	0.2	0.2	0.2	0.18405	3
A05 - Griya Karang Indah	0.1874	0.1845	0.09907	0.2	0.2	0.2	0.18337	4
A04 - Grand Satria Wanadadi II	0.1874	0.1845	0.09233	0.2	0.2	0.2	0.1827	5

Fig. 4. Weighting Recommendation Page.

4 Conclusions

Through the use of Analytical Hierarchy Process method, it is concluded that it can assist in developing hierarchy and defining alternatives to solve the existing problems. Through the weighting priority results, the residence type has the highest weight in the criteria of the prospective consumer determining the residence option with a value of (0.358).

The highest priority residence choice alternative with the first rank is in Griya Satria Bukit Permata Residence with the value of (0.416). This Decision Support System can also be used as a tool for prospective customers to determine residence selection by taking the final value of the highest-ranking residence.

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