

Application of MCDM-AHP and EDAS Methods for Selection of the Best Residential Locations Areas

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Abstract: The population density has led to an expansion of the area where people live. This opportunity is exploited by housing developers to build many locations for the development of residential areas. The purpose of writing this paper is to provide proper consideration in housing selection which can be seen from various parameters as selection criteria. The method support that can be used in residential selection is the collaboration of the MCDM-AHP and EDAS methods. This method can be used as a recommendation against the concept of multi-criteria. The more criteria used, the higher the level of difficulty to support decision making. With the collaboration of the MDCM-AHP method, it can be used to provide an assessment of multi-criteria that have optimal values, while the EDAS method will be used as a strength in evaluating the selection of alternatives based on positive and negative distances for different types of criteria through normalized values. Determination of the weighting value of the criteria is obtained through the iteration stages using the mathematical algebra matrices method and proven by expert choice apps. The decision support results obtained provide a ranking value with the first priority being PR06 with an accumulative weight of 0.552 followed by the second and third ranks respectively PR04 and PR05 with a weight of 0.545 and 0.522 respectively. Thus supporting decision making with the recommendation of the MCDM-AHP and EDAS method collaboration can provide an optimal assessment of residential selection in a detailed and accurate manner.

Keywords: EDAS, MCDM-AHP, Multi-criteria, Residential location area, Selection.

INTRODUCTION

An increase in the population of an area will create an expansion of the area as a new place of residence. The government provides opportunities for developers as developers in the process of building housing in various areas that have been granted land acquisition by the government. Communities who act as customers really expect strategic housing locations and locations an housing solution (Goode, 2023). This strategic location is a mature consideration for customers who will occupy the location as their place of residence. In this study, the criteria for choosing a place to live and housing location that became a priority consisted of 11 main criteria, namely security, business center, distance to the city center, public facilities, land area, distance to the main road, supporting information systems, frequency of public transportation, distance to the bus terminal, advantages of public transportation, and distance to refuel.

Selection to obtain the right place and housing location for the community, of course, provides a very high level of difficulty for home buyers who are the people's dream (Mari, 2021). The more the number of criteria expected, the more complicated it is to make the right selection. In this study, the criteria used have two types, namely criteria with the category of benefits, which means that they provide higher added value and type of cost criteria, which can reduce the added value of the location of the housing.

Support for decision making on the selection of housing locations using the collaboration of two methods, namely MCDM-AHP and EDAS. The use of MCDM-AHP method in this study was used to provide an assessment of the weight of criteria with different types (Waas et al., 2022),(Elboshy et al., 2022) and the EDAS method was used to determine the ranking process for assessing the benefits and costs (Fan et al., 2019) of housing locations as an alternative form of appropriate and optimal selection. Some related research that can be used as a concept

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development and use of the EDAS method is a priority for an autonomous maintenance system with the support of technology 4.0 (Srivastava et al., 2020), and other research related to this method is the problem of using attributes that conflict in numerical selection of supplier selection as a new model in comparison to the EDAS method (Yazdani et al., 2020). In principle, the use of the EDAS method has many similarities in the use of selection and selection (Schitea et al., 2019),(Zhang et al., 2019). There is related research that really inspired the writing of this article which is related to the selection of technology, namely the selection of industrial robots based on cross-efficiency evaluations with the EDAS method in a very good concept to understand (Fan et al., 2019). The EDAS method was chosen in this research because it has somewhat different and unique research capabilities in terms of determining contradictory types of criteria, so that normalization of the data processing process is needed, the alternative review process is determined based on the distance of positive and negative values obtained by alternatives based on the value obtained for each criterion. to get the weighted value. The collaboration of these two methods will prove that the results obtained are better than the previously written MCDM collaboration method (Deepu & Ravi, 2021), (Sarkodie et al., 2022),(Garai & Garg, 2023).

The application of the EDAS method pays close attention to the scope of discussion of all data processing as a calculation of the average evaluation distance for the type of criteria to be used by determining the distance of the average positive matrices $PDA_{(i,j)}$ and the distance of the average negative matrices average $NDA_{(i,j)}$. As a determination of PDA and NDA weights in this study (Chinram et al., 2021), collaboration with the Analytic Hierarchy Process (AHP) method was used as the development of this method. Decision-making support that can be used to produce an optimal assessment of the weight of criteria with a plurality of criteria can use the Multi-criteria Decision Making method from the Analytic Hierarchy Process (MCDM-AHP) method (de Oliveira et al., 2023). Determining the optimal weight criteria will provide a strict assessment in the normalization assessment process for all alternatives in the NSP_i and NSS_i processes, so that in the end it will find an appraisal score for ranking AS_i . Determination of ranking values from the largest to the smallest, the largest value will provide decision support as the highest predicate.

The weighting technique for the criterion value using the MCDM and MADM method has the same characteristics as the EDAS method, namely using the concept of two-dimensional matrices, the real difference is only seen in the determination of row elements. on matrices elements always pay attention to the position in position $X_{(i,j)}$ to the matrices in question (Jana & Hezam, 2024). To determine the calculation of matrices in the MCDM-AHP method, the main focus is on filling in the comparison of matrices criteria through the help of questionnaire instrumentation, where if an error occurs in filling out the matrix repetition process the value will experience uncontrolled enlargement to get the weight of the criteria (Puška et al., 2024), thus it must be repeated from the start because this affects the inconsistency value obtained through the expert choice application as a test result (Dagistanli & Üstün, 2023).

Testing the consistency value can be done using mathematical algebra matrices and expert choice applications. Tests carried out using mathematic algebra matrices, must go through the repetition stages of multiplying pairwise matrices. The process of repeating multiplication of pairwise matrices is carried out to obtain optimal eigenvector values (Van Mieghem & Jokić, 2024) (Saaty, 2010). The optimal eigenvector value can be proven by reducing the result of the last eigenvector with the result of the previous eigenvector which must be zero, if this has not been obtained, then the pairwise matrix multiplication process must be carried out continuously until the difference between the eigenvector is zero (Fernandes & Palheira, 2024). This is the real difference between the AHP method and the MCDM concept put forward by Saaty in the seventies. Obtaining optimal eigenvector values using the mathematic algebra matrices method through the stages of obtaining the consistency vector of λ max, consistency index, to consistency ratio. The final value of accepting or rejecting a decision is based on the acquisition of a consistency ratio value, the value of which must be less than or equal to ten percent. Testing the second consistency value can be done using the expert choice application. This method in the entry process must be supported by the data entry conversion process obtained from respondents through questionnaire instrumentation. Data conversion was carried out using the geometric mean to convert total numerical data into the AHP scale as a form of input pairwise matrices. The calculation process contained in the expert choice application is the same as the mathematical algebra matrices, this condition can be proven by inputting the same data on the matrices in the expert choice application and the mathematical algebra matrices and obtaining the results of the eigenvector values of all criteria (Akmaludin, Hartati, et al., 2020).

The contributions that can be made from this research are 1) providing a new valuation concept for residential houses in a number of residential location areas as an accurate assessment based on the average positive and negative distance solutions based on the type of criteria used. 2) Application of the weighting technique with the MCDM-AHP method through an iteration process to obtain optimum values with the concept of mathematical algebra matrices where the results are relevant by proving the level of accuracy through expert choice apps.

LITERATURE REVIEW

Multi-criteria Decision Making-Analytic Hierarchy Process (MCDM-AHP)

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The application of the Multi-criteria Decision Making-Analytic Hierarchy Process (MCDM-AHP) method is a very complicated and lengthy method of elaboration to obtain eigenvector values (Akmaludin, Cahyadi, et al., 2020). It must go through the iteration stages of matrices multiplication until it ends in not finding any difference in the eigenvector values from the subtraction of the last eigenvector value with the previous eigenvector value. This problem has not been widely applied by researchers to prove whether the eigenvector values generated and used to support decision making can be said to be optimal. This is the uniqueness of the MCDM-AHP method. Input from a number of respondents with the help of instrumentation in the form of a questionnaire is very important to serve as an input value for the formation of pairwise comparison matrices (Ágoston & Csató, 2024),(Tekile et al., 2023) . Here the relationship between the two methods which will be studied further is clearly visible. These two methods illustrate that two stages of normalization need to be carried out, namely determining contradictory criteria and their connection with data processing listed on a number of alternatives to be collaborated to determine positive and negative distances to obtain values assessment score.

In this study the use of the MCDM-AHP method has stages starting from the weighting process with a comparison of each of the first criteria to the last criterion (Jihadi et al., 2021) that can be used with equation 1, compiling the total value of the comparison to be arranged as pairwise matrices which can be done using the equation 2, the consistency test of all criteria which includes a consistency index that can use equation 3, λ max, the consistency vector as a process that helps to obtain a consistency ratio that can use equation 4. The final result of the consistency ratio will be used as an assessment of the acquisition of the eigenvector value states that decision support is acceptable or not with the barometric value of the consistency ratio (Pant et al., 2022) must be less than or equal to 10 percent. If accepted, then the process of calculating either mathematically or using the expert choice application can be continued and if the opposite happens, then the decision-making process must be repeated regarding the receipt of the questionnaire. It is under these conditions that the MCDM-AHP method is said to be superior with a mature level of accuracy, so it must be done very carefully.

$$C = \frac{n*(n-1)}{2} \tag{1}$$

$$M_{(r,c)} = \begin{bmatrix} a_{(1,1)} & a_{(1,2)} & a_{(1,3)} & \dots & a_{(1,c)} \\ a_{(2,1)} & a_{(2,2)} & a_{(2,3)} & \dots & a_{(2,c)} \\ a_{(3,1)} & a_{(3,2)} & a_{(3,3)} & \dots & a_{(3,c)} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{(r,1)} & a_{(r,2)} & a_{(r,3)} & \dots & a_{(r,c)} \end{bmatrix} \tag{2}$$

$$CI = \frac{(\lambda \max - n)}{(n-1)} \tag{3}$$

$$CR = \frac{CI}{RI} \tag{4}$$

To support the acquisition of a consistency ratio value with the MCDM-AHP method, it must be adjusted to the size of the order matrices, both at the criteria level and at the alternative level, if necessary, to alternative decisions. The consistency ratio is obtained based on the acquisition of the consistency index which acts as the quantifier while the denominator is obtained from the random index which is adjusted to the number of order matrices as shown in Table 1.

Table 1. Random Index (Akmaludin et al., 2023)

N-ordo	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0	0	0.6	0.9	1.12	1.24	1.32	1.41	1.45	1.48	1.51	1.48	1.56	1.57	1.58

Evaluation based on Distance from Average Solution (EDAS)

The Evaluation method based on Distance from Average Solution (EDAS) is a multi-criteria decision-making method based on the highest appraisal score (AS) to get the best choice of all weighted results (Ganshina & Smirnova, 2022). The EDAS method uses the average solution to assess alternatives, taking into account the positive and negative distances from the average value. The use of the EDAS method is very appropriate for criteria that have conflicting characteristics and do not affect the accuracy value (Ghorabae et al., 2015). This is the advantage of this method, because it has simple steps but has a good level of accuracy in providing support for decision making. Several stages of the steps that must be passed to the application of the EDAS method are:

1. Formation of decision matrices $X_{(m,n)}$ which is formed from m rows and n columns, the role of rows as alternatives and columns as criteria, consider equation 5.

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$$X_{(m,n)} = \begin{bmatrix} x_{01} & \dots & x_{0j} & \dots & x_{0n} \\ \vdots & \ddots & \ddots & \ddots & \vdots \\ x_{i1} & \dots & x_{ij} & \dots & x_{in} \\ \vdots & \ddots & \ddots & \ddots & \vdots \\ x_{m1} & \dots & x_{m2} & \dots & x_{mn} \end{bmatrix} \quad (5)$$

2. Determine average solution (average solution) A_v can be found using equation (6).

$$A_v = [Av_j] 1xm ; Av_j = \frac{\sum_{i=1}^n x_{ij}}{n} \quad (6)$$

3. Determine positive distance of the average matrices PDA_{ij} with benefit criteria can be done using equation 7.

$$PDA_{ij} = \begin{cases} \frac{\text{Max}(0, (X_{ij} - Av_j))}{Av_j}, & \text{jika kriteria benefit} \\ \frac{\text{Max}(0, (Xv_j - X_{ij}))}{Av_j}, & \text{jika kriteria cost} \end{cases} \quad (7)$$

4. Determine negative distance from the average matrices NDA_{ij} can be done using equation 8.

$$NDA_{ij} = \begin{cases} \frac{\text{Max}(0, (Xv_j - X_{ij}))}{Av_j}, & \text{jika kriteria benefit} \\ \frac{\text{Max}(0, (X_{ij} - Xv_j))}{Av_j}, & \text{jika kriteria cost} \end{cases} \quad (8)$$

5. Determine positive weighted amount SP_i which can be found using equation 9.

$$SP_i = \sum_{j=1}^m W_j * PDA_{ij} \quad (9)$$

6. Determine negative weighted number SN_i which can be found using equation 10.

$$SN_i = \sum_{j=1}^m W_j * NDA_{ij} \quad (10)$$

7. Determine normalization of positive values SNP_i and normalization to negative values SNS_i , which can be done using equation 11 and equation 12.

$$SNP_i = \frac{SP_i}{\max_i(XP_i)} \quad (11)$$

$$SNS_i = 1 - \frac{SN_i}{\max_i(XN_i)} \quad (12)$$

8. Determine the value of the score As_i by using equation 13.

$$As_i = \frac{1}{2} x (NSP_i + NSN_i); \text{dengan } 0 \leq AS_i \leq 1 \quad (13)$$

METHOD

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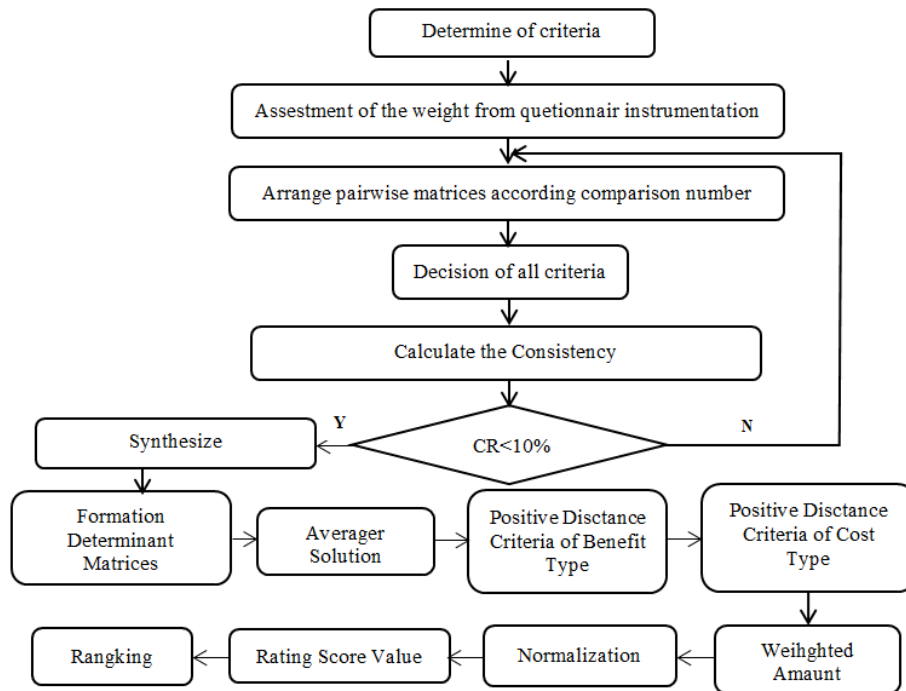


Fig. 1. MCDM-AHP-EDAS Algoritm

RESULT

Looking for a place to live that suits the owner's wishes, of course not just having it, but because there are many things that need attention. The factors that are top rated are mainly strategic locations and not all housing has a good location to be a place to live. In order not to be disappointed after buying a house, it is better to pay attention to the environment as a whole. Several barometers of assessment are a benchmark for choosing a place to live in a residential area that is of interest to many people in order to create comfort for living, in this study using eleven criteria, namely security, business center, distance to city center, public facilities, land area, distance to the main road , supporting information systems, frequency of public transportation, distance to the bus terminal, advantages of public transportation, and distance to refuel. These criteria have two different types, the type of criteria that provides added value to the assessment is categorized as a benefit and the type of criteria that provides a reduction in value is categorized as a cost, the more criteria used describe the more difficult the consideration of decision making. Both types of criteria in order to have the same rating will be seen in the normalization process so that the rating obtained which is the average of the results of normalization NSP_i and NSN_i can be used as decision support.

Starting from the determination of the main criteria based on input from a number of respondents, there are eleven selected criteria which are priorities which are complemented by each type of criterion, pay attention to table 1.

Table 1. Main Type and Criteria

Kode	Kriteria	Type
C1	Security	Benefit
C2	Central Business	Benefit
C3	City Center Distancd	Cost
C4	Public facility	Benefit
C5	Land Area	Benefit
C6	Distance to Main road	Cost
C7	Supporting Information System	Benefit
C8	Public Transport Frequency	Benefit
C9	Bus Terminal Distance	Cost
C10	Advantage of Public Transportation	Benefit
C11	Refuling Distance	Cost

The arrangement of the resulting decision matrices for selecting housing locations can be shown in Table 2 which consists of twelve housings represented by alternatives starting from PR01 to PR12. The type of benefit criteria is written with dimension (B) and the type of non-benefit or cost criteria is written with dimension (C), the formation of table 2 can be done using equation 5 according to the location of the data elements, obtained from reviewing the results one by one from residential locations based on the provisions of each criterion with the following results. Look at table 2.

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Table 2. Decision matrices

Criteria Alt \ Type	C ₁ (B)	C ₂ (B)	C ₃ (C)	C ₄ (B)	C ₅ (B)	C ₆ (C)	C ₇ (B)	C ₈ (B)	C ₉ (C)	C ₁₀ (B)	C ₁₁ (C)
PR01	8	7	4	6	7	5	5	5	3	6	7
PR02	6	7	7	7	7	4	7	5	3	6	8
PR03	7	8	7	4	8	4	6	5	3	7	7
PR04	6	9	5	8	6	4	7	6	4	5	4
PR05	8	6	3	9	8	3	7	6	4	7	9
PR06	5	7	6	5	7	4	6	4	5	7	8
PR07	7	6	6	7	7	6	6	8	3	6	3
PR08	8	5	6	6	9	6	6	9	4	8	4
PR09	5	5	5	7	5	5	5	7	3	9	7
PR10	6	8	5	3	7	4	3	7	4	4	8
PR11	7	7	4	8	7	3	6	5	6	6	9
PR12	6	4	5	6	6	3	6	5	8	7	6

Obtaining table 2 from each criterion can be found an average solution by using equation 6. The results obtained are in accordance with equation 6 for the average solution shown in table 3. The function of the average solution aims to calculate the positive distance of the PDA from the average solution value and the NDA of the average solution value.

Table 3. The average solution for each criterion

C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	C ₇	C ₈	C ₉	C ₁₀	C ₁₁
3.333	4.083	6.000	8.000	5.417	4.167	4.417	2.667	4.167	3.417	6.667

The acquisition value of the positive distance of the average PDA solution must pay attention to the type of criteria, for the type of benefit criteria ($X_{ij} - Av_j$) which is divided by the average solution criteria, and for criteria with type cost ($Xv_j - X_{ij}$) which is divided by the average criterion solution, with the formation of the positive distance matrices of the PDA, then results that are negative are given a total zero value, so they have no value to the multiplication of the criterion weights, this means that they do not affect the assessment of the multiplication of the criteria weights. The final result of the positive distance of PDA can be done by using equation 7 and the results obtained can be seen in table 4.

Table 4. The positive distance of the average PDA solution

Alt.	C ₁ (B)	C ₂ (B)	C ₃ (C)	C ₄ (B)	C ₅ (B)	C ₆ (C)	C ₇ (B)	C ₈ (B)	C ₉ (C)	C ₁₀ (B)	C ₁₁ (C)
PR01	0.200	0.000	0.000	0.000	0.000	0.280	0.000	0.000	0.040	0.000	0.000
PR02	0.200	0.224	0.167	0.125	0.108	0.000	0.132	0.000	0.280	0.171	0.000
PR03	0.200	0.000	0.000	0.125	0.000	0.040	0.132	0.000	0.000	0.171	0.000
PR04	0.000	0.224	0.167	0.000	0.000	0.040	0.132	0.500	0.040	0.000	0.400
PR05	0.000	0.224	0.167	0.000	0.108	0.000	0.132	0.125	0.280	0.171	0.000
PR06	0.000	0.000	0.000	0.000	0.000	0.280	0.000	0.000	0.000	0.171	0.000
PR07	0.200	0.224	0.000	0.125	0.292	0.280	0.000	0.000	0.040	0.000	0.550
PR08	0.000	0.000	0.333	0.125	0.108	0.000	0.132	0.500	0.000	0.000	0.400
PR09	0.200	0.000	0.167	0.125	0.108	0.040	0.000	0.500	0.000	0.000	0.000
PR10	0.000	0.000	0.000	0.125	0.000	0.000	0.132	0.125	0.040	0.171	0.000
PR11	0.000	0.000	0.000	0.000	0.292	0.040	0.000	0.000	0.040	0.000	0.000
PR12	0.000	0.000	0.167	0.000	0.000	0.280	0.000	0.000	0.040	0.000	0.100

The value of the negative distance gain AND the average solution must pay attention to the type of criteria, for the type of benefit criteria ($Xv_j - X_{ij}$) which is divided by the average solution criteria, and for criteria with type cost ($X_{ij} - Av_j$) which is divided by the average solution of the criteria, with the formation of the NDA negative distance matrices, then the results that are negative are given a total zero value, so that they have no value in terms of multiplication of the criterion matrices, this aims not to affect the assessment of the multiplication of the criterion weights. The final result of the negative NDA distance can be done using equation 8 and the results can be seen in table 5.

Table 5. Negative distances AND average solutions

Alt.	C ₁ (B)	C ₂ (B)	C ₃ (C)	C ₄ (B)	C ₅ (B)	C ₆ (C)	C ₇ (B)	C ₈ (B)	C ₉ (C)	C ₁₀ (B)	C ₁₁ (C)
PR01	0.000	0.020	0.167	0.125	0.077	0.000	0.094	0.250	0.000	0.122	0.050
PR02	0.000	0.000	0.000	0.000	0.000	0.440	0.000	0.250	0.000	0.000	0.200
PR03	0.000	0.020	0.167	0.000	0.262	0.000	0.000	0.250	0.200	0.000	0.050
PR04	0.400	0.000	0.000	0.125	0.077	0.000	0.000	0.000	0.000	0.122	0.000
PR05	0.100	0.000	0.000	0.250	0.000	0.200	0.000	0.000	0.000	0.000	0.350
PR06	0.100	0.265	0.333	0.125	0.262	0.000	0.094	0.250	0.200	0.000	0.200
PR07	0.000	0.000	0.000	0.000	0.000	0.000	0.094	0.250	0.000	0.122	0.000
PR08	0.100	0.020	0.000	0.000	0.000	0.200	0.000	0.000	0.200	0.122	0.000
PR09	0.000	0.265	0.000	0.000	0.000	0.000	0.094	0.000	0.200	0.122	0.050

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PR10	0.100	0.020	0.167	0.000	0.077	0.440	0.000	0.000	0.000	0.000	0.200
PR11	0.100	0.020	0.333	0.000	0.000	0.000	0.321	0.250	0.000	0.122	0.350
PR12	0.100	0.265	0.000	0.125	0.262	0.000	0.094	0.250	0.000	0.122	0.000

Taking into account the presence of the formation of table 4 and table 5, it takes the weight of each criterion to determine the final value for ranking all alternatives. To find the amount of weight, of course, collaboration with the multi-criteria decision making-analytic hierarchy process (MCDM-AHP) method can be used. The MCDM-AHP method has initial stages that are identical to the EDAS method, especially in the arrangement of matrices elements, in fact the stages of completion are very much different. The use of the EDAS method is a good idea to use the weight of the criteria carried out through research in the weighting of the criteria using the MCDM-AHP and not to be determined manually based on personal wishes or input from those who have been determined. The MCDM-AHP method has many advantages, such as the assessment is carried out through questionnaire instrumentation from a number of respondents and the weight calculation is obtained based on the acquisition of the eigenvector value.

There are two ways to prove the eigenvector value. The first method for obtaining eigenvector values is by using mathematical algebra matrices, the steps taken to obtain eigenvector values must be able to find the optimal value for the eigenvector and the stages are very long and must carry out tests for consistency, both the consistency index to the consistency ratio. The resulting consistency ratio value must be less than or equal to 10 percent. The second way to obtain eigenvector values is by using the help of expert choice apps. This method, in addition to obtaining eigenvector values, can also find out inconsistency values with the same feasibility assessment as the consistency ratio value using the mathematical algebra matrices method, namely the inconsistency value must be less than 10 percent.

With the mathematical algebra matrices method, the acquisition of eigenvector values has several long process stages and must be carried out with a high level of accuracy, namely:

1. Determine a number of criteria that will be used for processing by considering the importance value of each criterion, according to the number of criteria being compared and can be done using equation 1.
2. Arrange pairwise matrices against the number of criteria used in accordance with equation 2, to do multiplication matrices to obtain eigenvector values. The matrices multiplication process must be carried out at least one iteration to obtain the optimal eigenvector value, if the first iteration has not been found, then the second iteration must be carried out and so on until the optimal eigenvector value is obtained. The optimal eigenvector value is said to be complete if the reduction in the acquisition of the last eigenvector value with the previous eigenvector value is marked by no difference. This means that the optimal eigenvector value has been found, if the opposite happens, such as an enlargement of the eigenvector value, then the input must be repeated or checked on input from a number of respondents in the preparation of pairwise matrices.
3. Perform consistency testing. Consistency testing can be carried out by multiplying the initial pairwise matrices with optimal eigenvector values. The result obtained from the multiplication is used to determine the consistency vector.
4. The average value of the consistency vector as the basis for obtaining λ max, consistency index, and consistency ratio according to equation 3 and equation 5. The final result of the consistency ratio can be used as a measure of the feasibility of the resulting process. The value of the consistency ratio is a measure of the acceptance or rejection of a provisional decision. To be accepted as decision support, the resulting consistency ratio value must be less than or equal to 10 percent.

The calculation process to determine the acquisition of the eigenvector value to the consistency ratio can be carried out in stages towards selecting the housing location which is the best alternative, with these four stages it is indeed very long, but in this study it will be displayed in the entry pairwise matrices using the following mathematical algebra matrices method, starting from the arrangement of matrix data elements with order eleven obtained from the input of 168 respondents validated by strata random sampling technique, note table 6 which can be an illustration of the settlement of obtaining optimal eigenvector values.

Table 6. Eigenvector optimal mathematic algebra matrices

Criteria	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	EV
Security	1.000	1.112	1.224	2.131	2.182	3.062	3.204	4.221	4.117	4.125	4.132	0.189
Central Business	0.899	1.000	1.023	1.261	2.164	2.044	2.024	2.117	2.205	3.062	3.051	0.134
City Center Distance	0.817	0.978	1.000	1.992	2.307	2.152	3.063	3.201	3.022	3.996	4.225	0.164
Public Facility	0.469	0.793	0.502	1.000	2.033	2.104	2.117	2.192	3.117	3.104	3.944	0.121
Land Area	0.458	0.462	0.433	0.492	1.000	1.114	1.241	1.186	1.218	2.052	2.084	0.070
Distance to Main Road	0.327	0.489	0.465	0.475	0.898	1.000	1.102	1.204	3.022	2.172	2.052	0.074
Supporting Information System	0.312	0.494	0.326	0.472	0.806	0.907	1.000	2.076	2.119	3.115	3.152	0.077
Public Transport Frequency	0.237	0.472	0.312	0.456	0.843	0.831	0.482	1.000	1.332	2.186	2.042	0.056
Bus Terminal Distance	0.243	0.454	0.331	0.321	0.821	0.331	0.472	0.751	1.000	2.204	2.112	0.049
Advance of Public Transport	0.242	0.327	0.250	0.322	0.487	0.460	0.321	0.457	0.454	1.000	1.173	0.034
Refueling Distance	0.242	0.3278	0.2367	0.2535	0.4798	0.4873	0.3173	0.490	0.4735	0.8525	1.000	0.032
<i>The Result of λ max=</i>	11.283	<i>CI =</i>	0.028	<i>CR =</i>	0.019	0.4897					<i>Total=</i>	1.000

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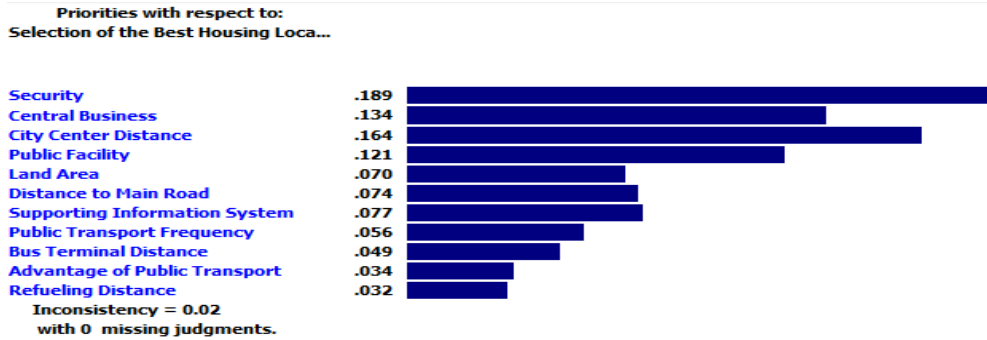


Fig. 2. Eigenvector menggunakan expert choice apps

Paying attention to fig. 2, shows priority respect for the acquisition of eigenvector values using expert choice apps. The eigenvector values generated for each criterion have identical weights to the eigenvector values obtained using the mathematical algebra matrices method, pay close attention to these results, both the eigenvector values and the inconsistency magnitude are 0.02 with zero missing judgment (without any errors in the entry element matrices). With two proofs of acquisition of this optimal eigenvector value, of course it gives confidence in the assessment of decision making support. The eigenvector values will be used to determine the weight of the eleven criteria that will be applied in collaboration with the EDAS method.

Providing an assessment of support for decision making with the collaboration of the MCDM-AHP method and the EDAS method, the obtained eigenvector values can be used as a calculation of the PDA and NDA weighted sums to continue the calculation process with the EDAS method. The process of obtaining the weighted amount of PDA can be done using equation 9 which is shown in table 9, while the acquisition of the weighted amount of NDA can be done using equation 10, which is shown in table 10.

Table 9. PDA Weighted Number

EV	0.189	0.134	0.164	0.121	0.070	0.074	0.077	0.056	0.049	0.034	0.032
Criteria	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	C ₇	C ₈	C ₉	C ₁₀	C ₁₁
Alt.\ Type	(B)	(B)	(C)	(B)	(B)	(C)	(B)	(B)	(C)	(B)	(C)
PR01	0.038	0.000	0.000	0.000	0.000	0.021	0.000	0.000	0.002	0.000	0.000
PR02	0.038	0.030	0.027	0.015	0.008	0.000	0.010	0.000	0.014	0.006	0.000
PR03	0.038	0.000	0.000	0.015	0.000	0.003	0.010	0.000	0.000	0.006	0.000
PR04	0.000	0.030	0.027	0.000	0.000	0.003	0.010	0.028	0.002	0.000	0.013
PR05	0.000	0.030	0.027	0.000	0.008	0.000	0.010	0.007	0.014	0.006	0.000
PR06	0.000	0.000	0.000	0.000	0.000	0.021	0.000	0.000	0.000	0.006	0.000
PR07	0.038	0.030	0.000	0.015	0.020	0.021	0.000	0.000	0.002	0.000	0.018
PR08	0.000	0.000	0.055	0.015	0.008	0.000	0.010	0.028	0.000	0.000	0.013
PR09	0.038	0.000	0.027	0.015	0.008	0.003	0.000	0.028	0.000	0.000	0.000
PR10	0.000	0.000	0.000	0.015	0.000	0.000	0.010	0.007	0.002	0.006	0.000
PR11	0.000	0.000	0.000	0.000	0.020	0.003	0.000	0.000	0.002	0.000	0.000
PR12	0.000	0.000	0.027	0.000	0.000	0.021	0.000	0.000	0.002	0.000	0.003

Look at table 9, the weighted number of PDAs is obtained based on the average positive distance of the PDA with the acquisition of optimal eigenvector values sourced from searches with mathematic algebra matrices or based on expert choice apps which provide the same acquisition value with each other, so that the acquisition of normalized values will be easy to find. obtained SP and NSP values.

Table 10. NDA Weighted Amount

EV	0.189	0.134	0.164	0.121	0.070	0.074	0.077	0.056	0.049	0.034	0.032
Criteria	C ₁	C ₂	C ₃	C ₄	C ₅	C ₆	C ₇	C ₈	C ₉	C ₁₀	C ₁₁
Alt.\ Type	(B)	(B)	(C)	(B)	(B)	(C)	(B)	(B)	(C)	(B)	(C)
PR01	0.000	0.003	0.027	0.015	0.005	0.000	0.007	0.014	0.000	0.004	0.002
PR02	0.000	0.000	0.000	0.000	0.000	0.033	0.000	0.014	0.000	0.000	0.006
PR03	0.000	0.003	0.027	0.000	0.018	0.000	0.000	0.014	0.010	0.000	0.002
PR04	0.076	0.000	0.000	0.015	0.005	0.000	0.000	0.000	0.000	0.004	0.000
PR05	0.019	0.000	0.000	0.030	0.000	0.015	0.000	0.000	0.000	0.000	0.011
PR06	0.019	0.036	0.055	0.015	0.018	0.000	0.007	0.014	0.010	0.000	0.006
PR07	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.014	0.000	0.004	0.000
PR08	0.019	0.003	0.000	0.000	0.000	0.015	0.000	0.000	0.010	0.004	0.000

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PR09	0.000	0.036	0.000	0.000	0.000	0.000	0.007	0.000	0.010	0.004	0.002
PR10	0.019	0.003	0.027	0.000	0.005	0.033	0.000	0.000	0.000	0.000	0.006
PR11	0.019	0.003	0.055	0.000	0.000	0.000	0.025	0.014	0.000	0.004	0.011
PR12	0.019	0.036	0.000	0.015	0.018	0.000	0.007	0.014	0.000	0.004	0.000

Look at table 10, the weighted number of NDAs is obtained based on the positive average distance of the NDA with the acquisition of optimal eigenvector values sourced from searches with mathematic algebra matrices or based on expert choice apps which provide the same acquisition values for each other, so that SN and NSN values can be searched easily and with both table 9 and table 10 it will be possible to determine the ranking system gain from all alternatives, as shown in table 11.

Table 11. Score and Ranking of Alternative

Alt.	AS	Ranking
PR04	0.663	1
PR02	0.648	2
PR06	0.590	3
PR08	0.575	4
PR09	0.565	5
PR07	0.559	6
PR05	0.554	7
PR12	0.495	8
PR03	0.449	9
PR11	0.448	10
PR01	0.421	11
PR10	0.395	12

DISCUSSIONS

The simple EDAS method is able to solve the problem with an average solution based on the positive and negative distances of PDA and NDA. Determination of positive and negative distances must pay attention to the type of criteria used, the use of understanding must be real and cannot be reversed to obtain the right results. If there is an inverse understanding of the type of criteria used, a calculation will occur which will have fatal consequences. The essence of the EDAS method is at this point and must be full of accuracy in the calculation process. The weighting technique for the criteria should use the Analytic Hierarchy Process (AHP) method because the AHP method obtains results based on full and objective research, not based on the subjective will of researchers. So that the results obtained through the collaboration of the MCDM-AHPn method with the EDAS method will be more convincing as a form of research that really needs to be done in producing decision support for calculating the value of the assessment score AS_i .

CONCLUSION

Decision support collaboration using the MCDM-AHP and EDAS methods has proven to be very optimal in the evaluation of housing locations. The calculation process for determining housing locations using these twelve criteria can provide consideration in supporting decision making. The more the number of criteria used, of course, the higher the difficulty level will be. With the collaboration of the MCDM-AHP and EDAS methods, it provides the best solution in evaluating housing location selection with the concept of two-dimensional matrices. The final acquisition as a form of decision support obtained results in a score of $[[AS]]_i$ which is stated in the highest score as the best priority to be the choice of housing location, namely PR04 with a weight of 0.663 as the highest value. Thus the results obtained through the collaboration of the MCDM-AHP and EDAS methods are able to provide the best solution in the process of evaluating and selecting housing locations.

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