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IMPLEMENTATION OF ADDITIVE RATIO ASSESSMENT (ARAS) METHOD ON DECISION SUPPORT SYSTEM FOR RECIPIENT OF INHABITABLE HOUSE

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Abstract— In Air Jamban distric office, there are problems for the distribution of housing assistance, one of which is that it is very difficult for related parties to provide assistance to prospective recipients who are in dire need and on target. The assessment system for prospective beneficiaries for inhabitable house is still subjective. Therefore, this study will discuss a decision support system in order to help the Air Jamban village in determining the beneficiaries of livable housing based on 8 predetermined criteria, namely fuel for cooking (C1), home status (C2), number of children (C3) , income (C4), house floor type (C5), house roof type (C6), wall type (C7) and house area (C8) using the Additive Ratio Assessment (ARAS) method and using 10 alternative data. The results of the ARAS method calculation there are 6 names that can be recommended, the highest (Ki) value is 0.101034482, 0.099586176, 0.097412263, 0.093309699, 0.091426639 and 0.090745596

Keywords*: Decision Support System, Inhabitable House, Additive Ratio Assessment Method, Implementation.*

Abstrak*—Di kantor kelurahan Air Jamban, terdapat permasalahan untuk distribusi bantuan rumah layak huni, salah satunya adalah pihak terkait sangat sulit untuk memberikan bantuan kepada calon penerima yang sangat membutuhkan dan tepat sasaran. Sistem penilaian kepada calon penerima bantuan rumah layak huni masih bersifat subjektif. Oleh karena itu, penelitian ini akan membahas sistem pendukung keputusan agar dapat membantu kelurahan Air Jamban dalam menentukan penerima bantuan rumah layak huni berdasarkan 8 kriteria yang telah ditetapkan yaitu bahan bakar untuk memasak (C1), status rumah (C2), jumlah anak (C3), pendapatan (C4), jenis lantai rumah (C5), jenis atap rumah (C6), jenis dinding (C7) dan luas rumah (C8) dengan menggunakan Metode Additive Ratio Assessment (ARAS) serta menggunakan 10 data alternatif. Hasil dari perhitungan metode ARAS terdapat 6 nama yang bisa direkomendasikan dengan nilai (K_i) tertinggi yaitu 0,101034482, 0,099586176, 0,097412263, 0,093309699, 0,091426639 dan 0,090745596.*

Kata Kunci*: Sistem Pendukung Keputusan, Rumah Layak Huni, Metode Aras, Implementasi.*

INTRODUCTION

In-Law Number 1 of 2011 concerning Housing and Settlement Areas it is stated in Article 1 Paragraph 7 that a house is a building that functions as a habitable residence, means of fostering family, a reflection of the dignity and dignity of its inhabitants as well as assets for its owner [1]. Houses that are not livable or cause for concern should receive a grant. However, in its realization, funding assistance from the government is often still lacking and even not on target [2]. One of the efforts of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 39 / PRT / M / 2015 states that low-income people, hereinafter abbreviated as MBR, are people who have limited purchasing power so they need to get government support to obtain a decent home [3]. Air Jamban District is a district in Bengkalis Regency which is one of the districts that has received government attention for the program for housing assistance. In the process of determining beneficiaries, the district still experienced difficulties in determining the recipients of aid because of the large amount of prospective recipient data and the criteria that must be considered in processing the data [4]. The assistance to be given must be well targeted to the people who really need it [5]. At present the process of assessing the determination of beneficiaries for decent housing is not in accordance with the appropriate criteria [6] and is

still based on manual calculations and not based on certain criteria [7]. However, the assistance provided is relatively unable to meet the needs of the community in the target number because so many people have submitted applications [8]. So, we need a system that can determine the quality of each criterion and help the decision making process [9]. For this reason, an objective assessment and selection process should be carried out so that the decision making system is right on its target.

Therefore, this study will discuss a decision support system to assist the Air Jamban village in determining the beneficiaries of inhabitable house based on established criteria. Decision Support System is a tool that serves to determine whether or not the public gets a house renovation from the government that is appropriate and appropriate [10]. The results given by the system as decision support can provide an alternative problem solving that exists so that decisions made for the better [11].

The decision support system is a computerized based information system, to produce several alternative decisions to help solve problems using data and models [12]. In this study, each criterion will be qualityed for beneficiaries of inhabitable house using the Additive Ratio Assessment (ARAS) method.

The Additive Ratio Assessment (ARAS) method is one of the multi-criteria decision-making methods based on the utility degree ranking concept by comparing the overall index value of each alternative to the overall optimal alternative index value [13]. ARAS is a method based on a situation where an alternative must have the largest ratio or final value to produce the best or optimal solution [14]. The reason the authors use the Additive Ratio Assessment (ARAS) method is that this method is easier and the method used for ranking by comparing with other alternatives so that it gets more precise and accurate results [15].

In previous research, this method was used in the selection of YouTube content worth watching for children [16]. The Additive Ratio Assessment (ARAS) method is also used in the selection of the best chair and team leader [17]. Previous research to determine the best housing based on conditions and location using entropy and level methods [13]. A similar study was carried out by Abdul Yunus Labolo under the title of a lecturer performance evaluation decision support system using the Additive Ratio Assessment (ARAS) method [18]. The Additive Ratio Assessment (ARAS) method has also been used for security service workforce selection[19]. The village assessment is best carried out by the district government decision support system with the Additive Ratio Assessment (ARAS) method in research conducted by ANAS [14].

The purpose of this study is to apply the Additive Ratio Assessment (ARAS) method in determining the eligibility decisions of prospective beneficiaries of inhabitable house with some predetermined criteria. With the decision support system, data processing becomes faster.

MATERIALS AND METHODS

The stages of research on the implementation of a decision support system for recipient of inhabitable house using the Additive Ratio Assessment (ARAS) method are as follows:

1. Identifying problems, namely problems found in providing decisions to beneficiaries of inhabitable houseby the literature and information obtained
2. Analyzing the problem, namely the problem found in the research object, and then carried out an analysis.is.
3. Data collection, which is collecting data needed in this study by observation, interview, and literature.
4. Determine the criteria, which is to be a reference in the calculation process using the Additive Ratio Assessment (ARAS) method in determining a decision.
5. Data analysis, i.e. the data that has been obtained will be managed as well as from the data can also be given a quality for each criterion.
6. Implementation of the Additive Ratio Assessment (ARAS) method to obtain the best results in determining a decision.
7. Alternative ranking, i.e. doing the ranking process to get the highest value from all alternative data.
8. System evaluation i.e. conducts an evaluation process with accuracy as a comparison between actual data and system calculation data using the Additive Ratio Assessment (ARAS) method.
9. Conclusion, which is taking a conclusion on the data that has been analyzed and processed beforehand so that it becomes the result of this study.

The data source for this study the authors got from the Air Jamban village through direct observation. The data that will be used as research is a list of proposed names of beneficiaries of inhabitable housebeneficiaries. There are 10 names obtained to implement it in the Additive Ratio Assessment (ARAS) method so that it will help the Air Jamban district to make the best decision.

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Data collection techniques used by the author are:

1. Observation, the authors collect data from the object of research directly by making observations at the Air Jamban village office.
2. Literature study, the authors approach with references such as journals or books in accordance with the research topic.
3. Interviews, the authors discuss the parties concerned to be able to obtain information on what is needed for research material.

The data analysis method in this study uses the Additive Ratio Assessment (ARAS). The Additive Ratio Assessment (ARAS) method is based on the concept of ranking using utility degrees by comparing the overall index value of each alternative to the optimal alternative overall index value [17]. The following is a calculation step using the Additive Ratio Assessment (ARAS) method [17]:

1. Formation of the Decision Making Matrix.

$$\mathbf{X}=\begin{bmatrix} X_{01} & \cdots & X_{0j} & \cdots & X_{0n} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ X_{i1} & \cdots & X_{ij} & \cdots & X_{in} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ X_{n1} & \cdots & X_{mj} & \cdots & X_{mn} \end{bmatrix}$$

$$i=\overline{0,m};\ j=\overline{1,n}; \quad \text{..... (1)}$$

where:
m = number of alternatives
n = number of criteria
X_{ij} = the performance value of alternative *i* to *j*
X_{0j} = the optimum value of the criteria

2. Normalization *Decision Making Matrix* for all criteria.

$$\mathbf{X}=\begin{bmatrix} X_{01} & \cdots & X_{0j} & \cdots & X_{0n} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ X_{i1} & \cdots & X_{ij} & \cdots & X_{in} \\ \vdots & \ddots & \vdots & \ddots & \vdots \\ X_{n1} & \cdots & X_{mj} & \cdots & X_{mn} \end{bmatrix}$$

$$i=\overline{0,m};\ j=\overline{1,n}; \quad \text{..... (2)}$$

If the proposed criteria are of maximum value then the normalization is :

$$X_{ij}=\frac{X_{ij}}{\sum_{i=0}^{m} X_{ij}} \quad \text{..... (3)}$$

If the proposed criteria are of minimum value, the normalization process will have 2 stages:

$$X_{ij}=\frac{1}{X*ij} \ ; \ X_{ij}=\frac{X_{ij}}{\sum_{i=0}^{m} X_{ij}} \quad \text{..... (4)}$$

3. Determine the normalized quality of the matrix in step 2.

$$\sum_{j=1}^{n} W_j = 1 \quad \text{..... (5)}$$

4. Determine the optimum function value.

$$S_i = \sum_{j=1}^{n} X_{ij} \ ; \ i = o,m \quad \text{..... (6)}$$

S_i is the overall index value of the i-th alternative [20].

5. Determine the level of rangking.

$$K_i = \frac{S_i}{S_0} \ ; i = \overline{o,m} \quad \text{..... (7)}$$

RESULT AND DISCUSSION

1. Alternative Data

In making a decision support system, data is needed to be processed and referred to as alternative data (Ai) as in Table 1.

Table 1. List of Proposed Names

No	Full Name	Gender
1	Akuanto	Male
2	Yuliana	Female
3	Suryadi	Male
4	Hamsinah	Female
5	Abdul Gani	Male
6	Ahmadi	Male
7	Dewi	Female
8	Saripah	Female
9	Wulan	Female
10	Junaidi	Male

2. Determine Quality Criteria and Value

To determine the ranking of each alternative data, the qualitying process is done first. The determination of the importance quality of each criterion (Wj) can be seen in Table 2.

Table 2. Criteria

No	Criteria (C_i)	Information	Score Quality (%)
1	C1	Cooking fuel	10
2	C2	Home status	15
3	C3	Number of children	10
4	C4	Income	10
5	C5	Floor type of house	15
6	C6	Types of roofs	10
7	C7	Type of wall of the house	15
8	C8	Size of house	15

In Table 2 it is explained that the criteria are given initials (Ci) and information from each criterion, then quality and variable values are given. Fuel criteria for cooking (C1) as in Table 3.

Table 3. Criteria C1

Variablel	Criteria	Quality Value
Firewood	Very low	5
Charcoals	Low	4
Kerosone	Enough	3
Gas	High	2

In Table 3 there are variables of firewood, charcoals, kerosene, and gas. The highest quality value is 5 and the lowest quality is 2 for gas variables.

Table 4. Criteria C2

Variable	Criteria	Quality Value
Certificate	High	5
Un-Certificate	Low	2

In Table 4 there are 2 variables, namely the status of houses that have certificates and are not certified.

Table 5. Criteria C3

Variable	Criteria	Quality Value
1 person	Low	5
2 persons	Enough	4
3 persons	High	3
4 persons atau more persons	Very high	2

In Table 5 the highest quality with a value of 5 with low criteria and very high criteria is given a quality value of 2 with a variable of 4 people or more children.

Table 6. Criteria C4

Variable	Criteria	Quality Value
C4 <= 500.000	Very Low	5
500.000 <C4<= 2.500.000	Low	4
2.500.000 <C4 <5.000.000	Enough	3
C4>=5.000.000	High	2

In Table 6 for income if less than Rp. 500,000 will be given a quality of 5.

Table 7. Criteria C5

Variable	Criteria	Quality Value
Soil	Very low	5
Cement/Wood	Enough	4
Ceramic	High	3

In Table 7 for criteria for the type of house floor if the soil variable is given a quality of 5 because part of the assessment criteria will get help while ceramics are given a quality value of 3.

Table 8. Criteria C6

Variable	Criteria	Quality Value
Rumbia	Very low	5
Zinc	Low	4
Tile	Enough	3
Concrete	High	2

In Table 8 for criteria on the type of roof of the house, if the variable uses the type of thatched roof, then a quality of 5 is given.

Table 9. Criteria C7

Variable	Criteria	Quality Value
Bamboo	Very Low	5
Wood	Low	4
Cement	High	3

Table 9 for the bamboo variable is given a quality value of 5 and the cement variable is given a quality of 2 because it is considered better than bamboo..

Table 10. Criteria C8

Variable	Criteria	Quality Value
$\leq$ 6x8 m²	Low	5
6x8 m²	Enough	4
$\geq$ 6x8 m²	High	3

In Table 10 for outside the house (building) if the size is less than 6x8 m2 will be given a quality of 5 and a great opportunity in the criteria for determining the provision of inhabitable house.

3. Implementation of the Additive Ratio Assessment (ARAS) Method

Step 1: Formation of a decision matrix (Decision Making Matrix)

Table 11. Decision Matrix

(A_i)	C1	C2	C3	C4	C5	C6	C7	C8
A0	**5**	**5**	**5**	**5**	**5**	**5**	**4**	**5**
A1	3	5	4	5	3	4	4	4
A2	2	5	3	4	3	5	4	5
A3	3	5	3	5	5	5	4	4
A4	3	5	3	5	5	4	4	4
A5	3	5	4	4	3	4	4	2
A6	3	2	2	5	3	4	2	2
A7	3	2	5	5	5	3	2	5
A8	3	2	4	4	5	3	2	4
A9	3	5	3	5	3	4	4	4
A10	3	5	3	4	5	5	4	5

For all criteria the value is *Max*

Step 2: Normalized decision matrix for all criteria.

Matriks X=

$$\begin{bmatrix} 5 & 5 & 5 & 5 & 5 & 5 & 4 & 5 \\ 3 & 5 & 4 & 5 & 3 & 4 & 4 & 4 \\ 2 & 5 & 3 & 4 & 3 & 5 & 4 & 5 \\ 3 & 5 & 3 & 5 & 5 & 5 & 4 & 4 \\ 3 & 5 & 3 & 5 & 5 & 4 & 4 & 4 \\ 3 & 5 & 4 & 4 & 3 & 4 & 4 & 4 \\ 3 & 2 & 2 & 5 & 3 & 4 & 2 & 2 \\ 3 & 2 & 5 & 5 & 5 & 3 & 2 & 5 \\ 3 & 2 & 4 & 4 & 5 & 4 & 2 & 4 \\ 3 & 5 & 3 & 5 & 3 & 4 & 4 & 4 \\ 3 & 5 & 3 & 4 & 5 & 5 & 4 & 5 \end{bmatrix}$$

The above matrix is summed down so that it gets a result **[34,46,39,51,45,46,38,44].** Then normalize the matrix for all criteria (C_i). Furthermore, the results of the calculation of the decision matrix of the criteria C1 to C8 obtained the normalized values as follows:

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0,1470588	0,1086956	0,1282051	0,0980392	0,1111111	0,1086956	0,1086956	0,1052631	0,1136363
0,0882352	0,1086956	0,1025641	0,0980392	0,0666666	0,0869565	0,0869565	0,1052631	0,0909090
0,0588235	0,1086956	0,0769230	0,0784313	0,0666666	0,1086956	0,1086956	0,1052631	0,1136363
0,0882352	0,1086956	0,0769230	0,0980392	0,1111111	0,1086956	0,1086956	0,1052631	0,0909090
0,0882352	0,1086956	0,0769230	0,0980392	0,1111111	0,0869565	0,0869565	0,1052631	0,0909090
0,0882352	0,1086956	0,1025641	0,0784313	0,0666666	0,0869565	0,0869565	0,1052631	0,0454545
0,0882352	0,0434782	0,0512820	0,0980392	0,0666666	0,0869565	0,0869565	0,0526315	0,0454545
0,0882352	0,0434782	0,1282051	0,0980392	0,1111111	0,0652173	0,0652173	0,0526315	0,1136363
0,0882352	0,0434782	0,1025641	0,0784313	0,1111111	0,0652173	0,0652173	0,0526315	0,0909090
0,0882352	0,1086956	0,0769230	0,0980392	0,0666666	0,0869565	0,0869565	0,1052631	0,0909090
0,0882352	0,1086956	0,0769230	0,0784313	0,1111111	0,1086956	0,1086956	0,1052631	0,1136363

Step 3: Determine the normalized quality by multiplying the normalized matrix in step 2.

The qualitys used for the multiplication in step 3 are **[0,1] , [0,15] , [0,1] , [0,1] , [0,15] , [0,1] , [0,15] ,[0,15].**

This quality value is obtained from Table 2 that was determined in the previous step. The results of all the criteria that can be obtained to form a matrix are as follows:

0,014705882	0,016304348	0,012820513	0,009803922	0,016666667	0,010869565	0,015789474	0,017045455
0,008823529	0,016304348	0,01025641	0,009803922	0,01	0,008695652	0,015789474	0,013636364
0,005882353	0,016304348	0,007692308	0,007843137	0,01	0,010869565	0,015789474	0,017045455
0,008823529	0,016304348	0,007692308	0,009803922	0,016666667	0,010869565	0,015789474	0,013636364
0,008823529	0,016304348	0,007692308	0,009803922	0,016666667	0,008695652	0,015789474	0,013636364
0,008823529	0,016304348	0,01025641	0,007843137	0,01	0,008695652	0,015789474	0,006818182
0,008823529	0,006521739	0,005128205	0,009803922	0,01	0,008695652	0,007894737	0,006818182
0,008823529	0,006521739	0,012820513	0,009803922	0,016666667	0,006521739	0,007894737	0,017045455
0,008823529	0,006521739	0,01025641	0,007843137	0,016666667	0,006521739	0,007894737	0,013636364
0,008823529	0,016304348	0,007692308	0,009803922	0,01	0,008695652	0,015789474	0,013636364
0,008823529	0,016304348	0,007692308	0,007843137	0,016666667	0,010869565	0,015789474	0,017045455

Step 4: Determine the optimum function value by adding up the criterion values for each alternative of the matrix multiplication with qualitys. The following are the results of calculations for the optimum function value.

0,114005825
0,093309699
0,091426639
0,099586176
0,097412263
0,084530732
0,063685966
0,0860983
0,078164322
0,090745596
0,101034482

Step 5: Determine the highest rank of each alternative by distributing alternative values to alternative 0 (A_0).

$$K_0 = \frac{0,114005825}{1} = 0,114005825$$
$$K_1 = \frac{0,093309699}{1} = 0,093309699$$
$$K_2 = \frac{0,091426639}{1} = 0,091426639$$
$$K_3 = \frac{0,099586176}{1} = 0,099586176$$
$$K_4 = \frac{0,097412263}{1} = 0,097412263$$
$$K_5 = \frac{0,084530732}{1} = 0,084530732$$
$$K_6 = \frac{0,063685966}{1} = 0,063685966$$
$$K_7 = \frac{0,0860983}{1} = 0,0860983$$
$$K_8 = \frac{0,078164322}{1} = 0,078164322$$
$$K_9 = \frac{0,090745596}{1} = 0,090745596$$
$$K_{10} = \frac{0,101034482}{1} = 0,101034482$$

From the results of the above calculation, we can get the results of the ranking levels of each alternative. The results of the calculation of the highest-ranking of all alternatives. The values of each are sorted from the highest value to the lowest value as in Table 12.

Table 12. Rankings of Top Rated

(A_i)	Score (K_i)	Rangking	Conclusion
A1	**0,101034482**	1	**Recommended**
A2	**0,099586176**	2	**Recommended**
A3	**0,097412263**	3	**Recommended**
A4	**0,093309699**	4	**Recommended**
A5	**0,091426639**	5	**Recommended**
A6	**0,090745596**	6	**Recommended**
A7	0,0860983	7	**No**
A8	0,084530732	8	**No**
A9	0,078164322	9	**No**
A10	0,063685966	10	**No**

In Table 12 it is known that all alternative data that has been processed using the Additive Ratio Assessment (ARAS) method has different values (Ki). The value (Ki) to be recommended is an alternative that gets a value of 0.090 to 0.100. So Rank 1 is Junaidi, Rank 2 is Suryadi, Rank 3 is Hamsinah, Rank 4 is Akuanto 5 is Yuliana, and Rank 6 is Wulan.

CONCLUSION

In this research, the decision support system for recipient of inhabitable house was analyzed by data and the calculation process using the Additive Ratio Assessment (ARAS) method. The implementation of the Additive Ratio Assessment (ARAS) method is very helpful to assist in decision making. There are 8 criteria used in this study and 10 alternative data to determine the eligibility of beneficiaries for livable housing. Based on calculations using the Additive Ratio Assessment (ARAS) method, a decision is obtained for 6 recommendations because it has the best value.

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