

DETERMINATION OF ELIGIBILITY FOR RECEIVING THE FAMILY HOPE PROGRAM ASSISTANCE USING THE EVALUATION BASED ON DISTANCE FROM AVERAGE SOLUTION (EDAS) METHOD

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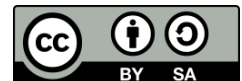
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ABSTRACT

Poverty remains a major issue in the development of a country, including in Air Merah Village, Kampung Rakyat Subdistrict, Labuhanbatu Selatan Regency. The government has launched the Program Keluarga Harapan (PKH) as an effort to alleviate poverty through conditional social assistance. However, the process of determining potential beneficiaries in the village is still carried out manually with data that are rarely updated, which may lead to mistargeting. This study aims to apply the Evaluation Based on Distance from Average Solution (EDAS) method in determining the eligibility of PKH beneficiaries and to produce a ranking of recipients that is more objective and accurate. The results of the EDAS calculation show that the top ten potential beneficiaries are A49 (Paini), A94 (Yanti), A73 (Sri Lusiani), A13 (Hariyani), A1 (Paini), A31 (Maisaroh Sirait), A2 (Albani Siregar), A6 (Boynam), A21 (Iswarti), and A3 (Anita), who obtained the highest Assessment Scores. The conclusion of this study is that the EDAS method is able to provide objective and accurate rankings, and can be used as a decision support system in determining PKH beneficiary eligibility in a fair and efficient manner.

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1. INTRODUCTION

Poverty is a major constraint in the development of a nation. This condition reflects the inability of individuals to fulfill their basic needs, such as food, clothing, shelter, education, and healthcare services. Various factors

contribute to poverty, including low income levels, limited access to productive resources, hunger and malnutrition, poor health conditions, as well as inadequate access to education and other essential basic services [1].

The Family Hope Program (PKH) has been implemented since 2007. PKH is a conditional social assistance program targeted at poor and vulnerable families or individuals registered in the Integrated Social Welfare Data system managed by the Ministry of Social Affairs. The determination of beneficiaries is carried out by the Social Welfare Data and Information Center in accordance with the provisions of the Regulation of the Minister of Social Affairs of the Republic of Indonesia Number 1 of 2018, Article 1 [2]. The benefits of PKH are currently also extended to include persons with disabilities and the elderly, with the aim of maintaining social welfare. Air Merah Village, located in Kampung Rakyat Subdistrict, South Labuhanbatu Regency, North Sumatra, is one of the areas where PKH has been implemented, as it has in many other regions across Indonesia.

Currently, several challenges are still encountered in determining the eligibility of PKH beneficiaries in Air Merah Village. The main issue is that the data used are often not updated regularly, which leads to inaccuracies in targeting during the selection of potential recipients. In addition, the process of collecting data on prospective beneficiaries is still carried out manually, resulting in suboptimal ranking and decision-making. Therefore, a solution is needed to address these issues, namely through the implementation of a decision support system approach. In determining prospective PKH beneficiaries, various key criteria must be taken into consideration. PKH beneficiaries are categorized into seven aspects based on family members and specific needs, namely elementary school students (SD), early childhood (toddlers), pregnant women, junior high school students (SMP), senior high school students (SMA), individuals with severe disabilities, and the elderly. However, the determination of beneficiaries still often faces challenges, such as data inaccuracies and subjectivity in the evaluation process. Therefore, an objective and structured approach is required to facilitate the selection of prospective PKH recipients in order to ensure more accurate targeting [3].

In this study, the author employs a decision support approach using the Evaluation Based on Distance from Average Solution (EDAS) method to facilitate the determination of eligibility criteria for prospective PKH social assistance recipients. This approach is particularly useful when decision-making requires the simultaneous consideration of multiple and diverse factors. The EDAS method assists decision-makers in evaluating alternatives comprehensively by considering the relationship between each alternative and the average value of the selected criteria [4].

The novelty of this study lies in the application of the Evaluation Based on Distance from Average Solution (EDAS) method to determine the eligibility of PKH beneficiaries at the village level, particularly in Air Merah Village. While previous studies have applied various multi-criteria decision-making methods such as AHP, VIKOR, and MFEP in social assistance selection, the use of EDAS in the context of PKH beneficiary determination remains limited. This study contributes by demonstrating how EDAS can be effectively utilized to produce a more objective and data-driven ranking system, especially in cases where multiple criteria must be evaluated simultaneously [5]. The urgency of this research is driven by the need to improve the accuracy and fairness of social assistance distribution. Inaccurate targeting of PKH beneficiaries may lead to inequality, where eligible recipients are excluded while ineligible individuals receive assistance. Such conditions reduce the effectiveness of government programs aimed at poverty alleviation. Therefore, implementing a systematic and reliable decision support method is essential to minimize subjectivity, enhance transparency, and ensure that assistance is distributed to those who truly need it [6].

This study aims to implement the EDAS method in determining the eligibility of PKH beneficiaries in Air Merah Village and to generate a ranking of prospective recipients based on objective evaluation results. Furthermore, this research seeks to provide a decision support model that can assist stakeholders, particularly local authorities, in making more accurate, efficient, and accountable decisions regarding the distribution of social assistance [7].

2. RESEARCH METHOD

This study was conducted at the Air Merah Village office, located on Kampung Jawa Street, Air Merah Village, Kampung Rakyat Subdistrict, South Labuhanbatu Regency, North Sumatra Province, Postal Code 21463. The research was carried out starting from January 2025 until completion. This study employs a quantitative research approach. The data used consist of a sample of prospective PKH beneficiaries obtained from the Air Merah Village office. The method applied in this study is the Evaluation Based on Distance from Average Solution (EDAS).

A variable is an attribute or characteristic whose value is to be measured or analyzed. The identification and definition of research variables are essential for examining the relationships among two or more variables under study. Since the ranking of prospective PKH social assistance beneficiaries in Air Merah Village involves various criteria, the variables used in this study are presented in Table 1 [8].

Table 1: Research Variables

Variable	Description
y	Program Keluarga Harapan (PKH)
x_1	Pregnant Women
x_2	Early Childhood (Toddlers)
x_3	Elementary School Students (SD)
x_4	Junior High School Students (SMP)
x_5	Senior High School Students (SMA)
x_6	Persons with Severe Disabilities
x_7	Elderly

2.1 EDAS Method

The Evaluation Based on Distance from Average Solution (EDAS) method was first developed by Mehdi Keshavarz-Ghorabae in 2015. This method was introduced as an approach within Decision Support Systems (DSS) to evaluate and solve problems by calculating the distance from both positive and negative solutions. Its systematic calculation process enables the method to produce evaluation results that are both fast and accurate. The best alternative is determined based on the highest final evaluation score, known as the Assessment Score (AS) [6].

The following are the steps for applying the EDAS method:

1. Construct the decision matrix (X)

$$X = [X_{ij}]_{n \times m} = \begin{bmatrix} X_{11} & X_{12} & \cdots & X_{1m} \\ X_{21} & X_{22} & \cdots & X_{2m} \\ \vdots & \vdots & \ddots & \vdots \\ X_{n1} & X_{n2} & \cdots & X_{nm} \end{bmatrix} \quad (1)$$

2. Calculate the average value for each criterion (AV).

$$AV_j = \frac{\sum_{i=1}^n X_{ij}}{n} \quad (2)$$

where:

AV_j = The average value of each criterion

$\sum_{i=1}^n x_{ij}$ = The total value of each criterion

n = The total number of data points

3. Calculate the Positive Distance from Average (PDA) and the Negative Distance from Average (NDA) based on the type of criteria (benefit or cost). For benefit criteria, apply equations (3) and (4) as follows:

$$PDA_{ij} = \frac{\max(0(x_{ij} - AV_j))}{AV_j} \quad (3)$$

$$NDA_{ij} = \frac{\max(0(AV_j - x_{ij}))}{AV_j} \quad (4)$$

If the criteria are non-benefit (cost), apply equations (5) and (6) as follows:

$$PDA_{ij} = \frac{\max(0(AV_j - x_{ij}))}{AV_j} \quad (5)$$

$$NDA_{ij} = \frac{\max(0(X_{ij} - AV_j))}{AV_j} \quad (6)$$

Description:

PDA_{ij} = The Positive Distance from Average

NDA_{ij} = The Negative Distance from Average

X_{ij} = The value of the i alternative under the j criterion

AV_j = The average value of each criterion

4. Determine the aggregated values of PDA and NDA for each alternative using equations (7) and (8).

$$SP_i = \sum_{j=1}^m w_j PDA_{ij} \quad (7)$$

$$SN_i = \sum_{j=1}^m w_j NDA_{ij} \quad (8)$$

where:

SP_i = The weighted sum of PDA

SN_i = The weighted sum of NDA

$\sum_{j=1}^m w_j PDA_{ij}$ = The total of each PDA value multiplied by its corresponding criterion weight

$\sum_{j=1}^m w_j NDA_{ij}$ = The total of each NDA value multiplied by its corresponding criterion weight

In the EDAS method, the normalization process is carried out when calculating the NSP (Normalized SP) and NSN (Normalized SN) values, by comparing the SP and SN values of each alternative against the maximum value of each respective measure.

5. Using Equations (9) and (10), normalize the SP and SN evaluations for all possible solutions.

$$NSP_i = \frac{SP_i}{\max_i (SP_i)} \quad (9)$$

$$NSN_i = 1 - \frac{SN_i}{\max_i (SN_i)} \quad (10)$$

where:

NSP_i = SP normalization value

NSN_i = SN normalization value

SP_i = Weighted sum of PDA

SN_i = Weighted sum of NDA

$\max_i (SP_i)$ = Maximum value of SP_i

$\max_i (SN_i)$ = Maximum value of SN_i

6. Apply the formula to determine the AS value for each possible alternative.

$$AS_i = \frac{1}{2} (NSP_i + NSN_i) \quad (11)$$

where $0 \leq AS_i \leq 1$

Description:

AS_i = Assessment score value

NSP_i = SP normalization value

NSN_i = SN normalization value

7. Ranking

The final step is to perform ranking based on the final AS values. The AS values are arranged from the highest to the lowest. The highest AS value indicates that the corresponding alternative is the best among all available alternatives [5].

2.2 Research Procedure

The following are the research procedures:

- a. Identification of the Problem Scope.
- b. Data Collection.
- c. Method Implementation Analysis.

The method is applied after all data have been collected using the EDAS approach, with the following steps:

- 1). Constructing the decision matrix (X).
- 2). Calculating the average value for each criterion.
- 3). Determining the Positive Distance from Average (PDA) and the Negative Distance from Average (NDA) according to the type of criteria (benefit or cost).
- 4). Calculating the aggregated values of PDA and NDA for each alternative.
- 5). Normalizing the SP and SN values for all alternatives.
- 6). Calculating the Assessment Score (AS) for each alternative.
- 7). Ranking the alternatives.

The following is the flowchart of this research.

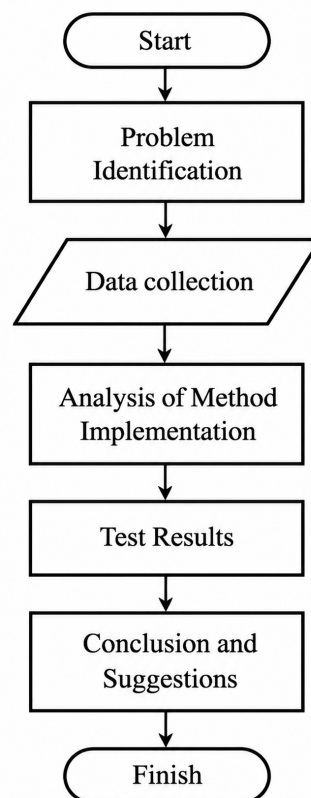


Figure 1: Flowchart

3. RESULT AND ANALYSIS

Based on the results of interviews conducted with the internal stakeholders of the PKH program in Air Merah Village, seven main criteria were identified: C1 (pregnant women), C2 (early childhood), C3 (elementary school children), C4 (junior high school children), C5 (senior high school children), C6 (individuals with severe disabilities), and C7 (elderly individuals). Each criterion is assigned a different weight, as presented in Table 2. The collected data of prospective beneficiaries will subsequently be analyzed using the EDAS method to determine their eligibility ranking as recipients of PKH assistance in Air Merah Village.

The results of the average solution (AV) calculations can be seen in Table 4, using an approach identical to the standard AV calculation method.

Table 4: Average Solution (AV) Results

Average Solution Values	Results
AV_1	0,0612
AV_2	0,3979
AV_3	0,6735
AV_4	0,5612
AV_5	0,4388
AV_6	0
AV_7	0,4898

c. Calculating Positive Distance (PDA) and Negative Distance (NDA)

The next step after obtaining the Average Solution (AV) is to calculate the Positive Distance from Average (PDA) and Negative Distance from Average (NDA), which are computed using Equations (3) and (4), as all criteria are of the benefit type.

C1 = Pregnant women

$$\begin{aligned}
 PDA_{1,1} &= \frac{\max(0, (x_{1,1} - AV_1))}{AV_1} \\
 &= \max\left(0, \frac{1 - 0,0612}{0,0612}\right) \\
 &= \max\left(0, \frac{0,9388}{0,0612}\right) \\
 &= \max(0, 15,3399) \\
 &= 15,3399
 \end{aligned}$$

$$\begin{aligned}
 PDA_{1,2} &= \frac{\max(0, (x_{1,2} - AV_1))}{AV_1} \\
 &= \max\left(0, \frac{0 - 0,0612}{0,0612}\right) \\
 &= \max\left(0, \frac{-0,0612}{0,0612}\right) \\
 &= \max(0, -1) \\
 &= 0
 \end{aligned}$$

$$\begin{aligned}
 PDA_{1,3} &= \frac{\max(0, (x_{1,3} - AV_1))}{AV_1} \\
 &= \max\left(0, \frac{0 - 0,0612}{0,0612}\right) \\
 &= \max\left(0, \frac{-0,0612}{0,0612}\right) \\
 &= \max(0, -1) \\
 &= 0
 \end{aligned}$$

$$\begin{aligned}
 PDA_{1,4} &= \frac{\max(0, (x_{1,4} - AV_1))}{AV_1} \\
 &= \max\left(0, \frac{0 - 0,0612}{0,0612}\right) \\
 &= \max\left(0, \frac{-0,0612}{0,0612}\right) \\
 &= \max(0, -1) \\
 &= 0
 \end{aligned}$$

Through similar calculations applied to the entire dataset, the Positive Distance from the Average Solution (PDA) values are obtained and can be observed in Table 4.

Table 5: Positive Distance from Average (PDA) Results

Alternative Names	PDA						
	C_1	C_2	C_3	C_4	C_5	C_6	C_7
A_1	15.3399	0	0.4848	0	0	~	3.0833
A_2	0	1.5132	3.4543	0.7819	1.2789	~	0
A_3	0	4.0264	0	0.7819	1.2789	~	0
A_4	0	0	0.4848	0.7819	0	~	0
A_5	0	0	0	0.7819	1.2789	~	1.0416
\vdots	\vdots	\vdots	\vdots	\vdots	\vdots	\vdots	\vdots
A_{95}	0	0	0.4848	0.7819	1.2789	~	0
A_{96}	0	0	0.4848	0	0	~	0
A_{97}	0	0	0	0.7819	1.2789	~	0
A_{98}	0	1.5132	0.4848	0.7819	0	~	0

Using a similar calculation across the entire dataset, the Negative Distance from the Average Solution (NDA) values are obtained and can be observed in Table 5.

Table 6: Negative Distance from Average Results

Alternative Names	NDA						
	C_1	C_2	C_3	C_4	C_5	C_6	C_7
A_1	0	1	0	1	1	~	0
A_2	1	0	0	0	0	~	1
A_3	1	0	1	0	0	~	1
A_4	1	1	0	0	1	~	1
A_5	1	1	1	0	0	~	0
\vdots	\vdots	\vdots	\vdots	\vdots	\vdots	\vdots	\vdots
A_{95}	1	1	0	0	0	~	1
A_{96}	1	1	0	1	1	~	1
A_{97}	1	1	1	0	0	~	1
A_{98}	1	0	0	0	1	~	1

d. Calculation of the Weighted Sum of PDA/NDA (SP/SN)

Each PDA and NDA value is multiplied by its respective weight to obtain the SP (positive score) and SN (negative score) values. For example, SP_1 is calculated by multiplying the j criterion value (PDA) by its corresponding predetermined weight (w_j), and then summing the results across all criteria.

$$SP_i = \sum_{j=1}^m w_j PDA_{ij}$$

$$SP_1 = \sum_{j=1}^{98} w_j PDA_{1j}$$

$$\begin{aligned}
 P_1 &= w_1 \times PDA_{1,1} + w_2 \times PDA_{1,2} + w_3 \times PDA_{1,3} + w_4 \times PDA_{1,4} + w_5 \times PDA_{1,5} + w_7 \times PDA_{1,7} \\
 &= (0,20 \times 15,3399) + (0,20 \times 0) + (0,15 \times 0,4848) + (0,15 \times 0) + (0,12 \times 0) + (0,08 \times 3,0833) \\
 &= 3,0679 + 0 + 0,0727 + 0 + 0 + 0,2467 \\
 &= 3,3873
 \end{aligned}$$

The following presents the calculated SP/SN values. When the same procedure is applied to all alternatives, the results can be observed in Table 6.

Table 7: SP/SN Results

Alternative Names	SP	SN
A_1	3.3873	0.47
A_2	1.0915	0.28
A_3	1.0761	0.43
A_4	0.19	0.60
A_5	0.3541	0.55
\vdots	\vdots	\vdots
A_{95}	0.3435	0.48
A_{96}	0.0727	0.75
A_{97}	0.2707	0.63
A_{98}	0.4926	0.40

e. Calculating Normalized SP/SN Values (NSP/NSN)

After obtaining the SP and SN values, the next step is normalization by comparing each of these values to the maximum value obtained.

$$NSP_i = \frac{SP_i}{Max_i(SP_i)}$$

$$\begin{aligned}
 NSP_1 &= \frac{SP_1}{Max(SP)} \\
 &= \frac{3,3873}{3,4879} \\
 &= 0,9712
 \end{aligned}$$

$$NSP_i = \frac{SP_i}{Max_i(SP_i)}$$

$$\begin{aligned}
 NSP_2 &= \frac{SP_2}{Max(SP)} \\
 &= \frac{1,0915}{3,4879} \\
 &= 0,3129
 \end{aligned}$$

A similar calculation method can also be applied to obtain the values for other alternatives. The results of the calculations can be seen in Table 7.

Table 8: NSP/NSN Results

Alternative Names	NSP	NSN
A_1	0.9712	0.4268
A_2	0.3129	0.6585
A_3	0.3085	0.4756
A_4	0.0545	0.2683
A_5	0.1015	0.3293
\vdots	\vdots	\vdots
A_{95}	0.0985	0.4146
A_{96}	0.0208	0.0854
A_{97}	0.0776	0.2317
A_{98}	0.1412	0.5122

f. Calculation of Assessment Score (AS)

After the normalization process, the final evaluation score is calculated.

$$AS_i = \frac{1}{2}(NSP_i + NSN_i)$$

$$\begin{aligned} AS_1 &= \frac{1}{2}(NSP_1 + NSN_1) \\ &= \frac{1}{2}(0,9712 + 0,4268) \\ &= 0,699 \end{aligned}$$

$$AS_i = \frac{1}{2}(NSP_i + NSN_i)$$

$$\begin{aligned} AS_2 &= \frac{1}{2}(NSP_2 + NSN_2) \\ &= \frac{1}{2}(0,3129 + 0,6585) \\ &= 0,4857 \end{aligned}$$

The following presents the results of the comprehensive AS (Assessment Score) calculation for all eligible alternatives, which can be observed in Table 8.

Table 9: AS Results

Alternative Names	AS
A_1	0.699
A_2	0.4857
A_3	0.3921
A_4	0.1614
A_5	0.2154
\vdots	\vdots
A_{95}	0.2566
A_{96}	0.0531
A_{97}	0.1547
A_{98}	0.3267

g. Final Results

The final results of all calculations, arranged from the highest to the lowest values, are presented in Table 9.

Table 10: AS Results

Alternative Names	Values	Rank
A_{49}	0.7866	1
A_{94}	0.7866	2
A_{73}	0.7839	3
A_{13}	0.7231	4
A_1	0.6990	5
\vdots	\vdots	\vdots
A_{50}	0.0119	95
A_{88}	0.0119	96
A_{89}	0.0119	97
A_{92}	0.0119	98

From the calculation results, the average solution (AS) values for each alternative are obtained. The higher the AS value, the higher the eligibility level of the alternative to be selected as a beneficiary of the PKH assistance program. The EDAS method produces the ranking of prospective PKH assistance beneficiaries as shown in Table 4.10. Alternative A49 obtained the highest rank (rank 1) with a score of 0.7866. Rank 2 was achieved by alternative A94 with a score of 0.7866, followed by rank 3, alternative A73 with a score of 0.7839. Rank 4 was obtained by alternative A13 with a score of 0.7231, and rank 5 by alternative A1 with a score of 0.6990. Rank 6 was assigned to alternative A31 with a score of 0.6756, while rank 7 was obtained by alternative A2 with a score of 0.4857. Rank 8 was achieved by alternative A6 with a score of 0.4528, rank 9 by alternative A21 with a score of 0.4219, and rank 10 by alternative A3 with a score of 0.392. Furthermore, alternative A64 is ranked 11th with a score of 0.3807, followed by A35 in 12th place with a score of 0.3512. Alternatives A26, A34, and A45 share similar values of 0.3455, occupying ranks 13, 14, and 15 respectively. Rank 16 is obtained by alternative A33 with a score of 0.3373. Meanwhile, alternatives A30, A41, A56, and A60 share the same score of 0.3267, occupying ranks 17 to 20, followed by the subsequent rankings accordingly.

The average solution (AS) results from 98 candidate beneficiary alternatives show that the top 20 highest-ranked alternatives are presented in the following bar chart.

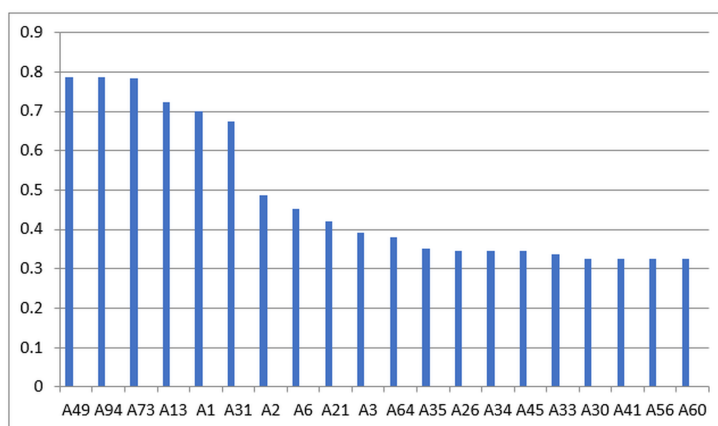


Figure 2: Top 20 Ranking Diagram

4. CONCLUSION

The EDAS method produces the ranking of prospective PKH assistance beneficiaries as shown in Table 4.10. Alternative A49 obtained the highest rank (rank 1) with a score of 0.7866. Rank 2 was achieved by alternative A94 with a score of 0.7866, followed by rank 3, alternative A73 with a score of 0.7839. Rank 4 was obtained by alternative A13 with a score of 0.7231, and rank 5 by alternative A1 with a score of 0.6990. Rank 6 was assigned to alternative A31 with a score of 0.6756, while rank 7 was obtained by alternative A2 with a score of 0.4857. Rank 8 was achieved by alternative A6 with a score of 0.4528, rank 9 by alternative A21 with a score of 0.4219, and rank 10 by alternative A3 with a score of 0.392. Furthermore, alternative A64 is ranked 11th with a score of 0.3807, followed by A35 in 12th place with a score of 0.3512. Alternatives A26, A34, and A45 share similar values of 0.3455, occupying ranks 13, 14, and 15 respectively. Rank 16 is obtained by alternative A33 with a score of 0.3373. Meanwhile, alternatives A30, A41, A56, and A60 share the same score of 0.3267, occupying ranks 17 to 20, followed by the subsequent rankings accordingly.

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