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COMBINATION OF SAW METHOD AND LINEAR INTERPOLATION IN SELECTION OF RASKIN RECIPIENTS

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Abstract

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The government assistance program is one of the efforts to promote community welfare, as is the case with the Raskin assistance program. In the contribution of aid from the center to the regions, of course, many things are of concern, namely the equitable distribution and correct targeting of the rightful recipients. In reality, there are problems in determining the recipients of Raskin assistance due to the indication of an element of subjectivity in making decisions and the mismatch between candidate data and recipients due to not taking into account the assessment criteria in determining the selected candidates for assistance. This study proposes an evaluation of the selection process for Raskin beneficiaries with four criteria, namely Income (C1), Marital Status (C2), Dependent of Children (C3), and Age (C4). The method combines the Simple Additive Weighting (SAW) method in determining the nature of the criteria to calculate the final score and the Linear Interpolation technique for the scoring process to determine the difference in numerical values. The study results are seven alternative recipients of assistance selected into three selected alternatives. The analysis of the influential criteria shows that the Dependent of Children (C3) and Age (C4) criteria affect the final ranking of the alternative recipients of Raskin assistance.

Keywords: Decision Making, SAW, Linear Interpolation, Raskin Assistance, Best Alternative

1. INTRODUCTION

The provision of food assistance is one of the government's efforts to alleviate poverty and promote community welfare. With the rice assistance program for the poor, it is hoped that every level of society with low social strata can get assistance, especially food in their lives [1]. Constitution chapter 34 of the 1945 Constitution explains that the government is obliged to guarantee the lives of the poor and neglected children, develop a social security system, and empower the weak and underprivileged according to the law's human dignity. Needed in the form of food, health, and education needs [2]. Various government efforts in distributing food aid, including the rice assistance program for the poor, were carried out. This situation shows the government's seriousness in realizing sustainable development [3].

Raskin (Beras Miskin) is a social protection program supporting other programs such as improving nutrition, improving health and education, and increasing the productivity of Poor Households (RTM) [4] . The Raskin program was intensively developed in Indonesia as a way to provide assistance to poor households and improve community welfare. Distributing rice aid for the poor to the community is, of course, a top priority for the central government through the local government. Every data collection for the poor people was carried out to determine candidates for recipients of ineffective rice assistance[5]. One way is through the existence of a poor card program so that all people who have a poor card are entitled to food assistance.

In reality, of course, the amount of assistance, with the number of people who must be assisted, has always been a problem in determining the recipients of aid. Undeniably, many underprivileged communities have caused a mismatch between the candidate recipients and those receiving the assistance. Many things cause this problem. Research by [6] mentions that recording data for the manual selection process makes it difficult regarding time efficiency and data management processes related to Raskin recipients. Another study [7] explained that determining Raskin recipients is still subjective because it still does not consider the recipients based on the assessment criteria, causing errors and mismatches between candidate and recipient data [8]. This is also reinforced by research [9] which tells that there is still behavior from unscrupulous Raskin service officers who violate work rules and commit fraud in terms of service by reducing the community's Raskin ration and selling Raskin for their profit.

The explanation of the problems above is in accordance with what happened in providing assistance to Br's poor rice. Clean Tegal Darmasaba, Badung Regency. Often in providing rice assistance to the poor, there is no right target[10]between the candidate's and recipient's data. The purpose of this study is to propose a selection mechanism for determining recipients of poor rice by using a combination of Simple Additive Weighting (SAW and Linear Interpolation) methods to produce more objective decisions [11] and consider the assessment criteria that have been determined by the decision-makers, which in this case are officers. Village for rice assistance services for the poor.

The SAW method is used to calculate the normalization value based on the characteristics of the criteria, namely benefits and costs [12], and to determine the results of the alternative ranking of poor rice aid recipients. The linear interpolation technique is used to score numerical data to determine the comparison (GAP) of the difference in value between one alternative and another on the assessment criteria[13].

2. METHOD

2.1 Prosperous Rice Program (Raskin)

The Prosperous Rice Program, previously called Raskin, is an implementation of the Presidential Instruction on national rice policy. The President instructs Ministers and Heads of certain Non-Ministerial Government Institutions, as well as Governors and Regents/Mayors throughout Indonesia, to increase farmers' income, food security, rural economic development, and national economic stability[14]. In particular, Perum BULOG was instructed to provide and distribute subsidized rice for low-income groups, whose supply prioritizes the procurement of grain or rice from domestic farmers[3].

2.2 Simple Additive Weighting (SAW)

The SAW method is referred to as the weighted addition method because each alternative value for each weighted criterion is summed, and the value of the criteria is determined by an assessment of the range of values from 0 to 100. the advantage of the SAW method in determining the nature of the benefit or cost criteria, if the expected value of the criteria is higher, the better it is included in the benefit criteria. Suppose the value of the expected criteria gets smaller, the better. It is included in the cost criteria[15]. Besides that, the SAW method has a normalization process to make the criteria values similar. There are several stages, i.e[16][17]:

1. Determination of the value of the criteria
   Calculations are shown in Equation (1) :

$$NK = \sum(SK * X) \quad (1)$$

Description :
Description :
N.K. : The total value of each criterion
SK: Subcriterion value
X: Value of weight preference

2. Creating a decision matrix
   The decision matrix is based on the number of elements (n) criteria and the number of alternatives.
3. Matrix Normalization
   The matrix normalization process is intended to change the alternative compatibility rating value to a scale of values 0 to 1 according to the attribute's characteristic. Calculations for normalizing the matrix are shown in Equation (2).

$r_{ij} = \frac{Xij}{MaxXij}$ if the attribute characteristic includes benefit (2)

$r_{ij} = \frac{MinXij}{Xij}$ if the attribute characteristic includes the cost

Description:
r_{ij} = alternative performance ratings for each normalized attribute
$MaxX_{i\ j}$ = the maximum value of the element in each attribute
$MinX_{ij}$ = minimum value of elements in each attribute
Benefit = if the characteristic of the attribute, including profit and most significant value, is the best
Cost = if the aspect of attributes including cost and the smallest value is the best

4. Calculation of the final value and ranking
   The final value calculation uses the normalized performance rating (r_{ij}) of each A_i alternative to the attribute where C_j, which starts from i = 1,2, up to m and j = 1,2, to n. he calculation of the preference value of each alternative (V_i) is shown in the Equation (3).

$$V_i = \sum_{j=1}^{n} w_j r_{ij} \quad (3)$$

Description :
V_i = final value or alternative preference ranking
w_j = attribute weight value
r_{ij} = normalized performance rating values
The results of the most optimal V_i value indicate that the alternative A_i was chosen.

2.1 Linier Interpolation

Linear interpolation is used to determine the value between two ranges of values generated based on the equation function. Linear interpolation connects two value points with a linear relationship so that each point between two linear points can be determined by its value. The two points are (x0, y0) and (x1,y1). The Equation of a straight line formed from a polynomial that interpolates two value points can be seen in Equation (4) [18][13].

$$(x) = a_0 + a_1 x \quad (4)$$

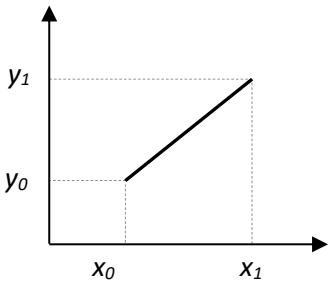

Figure 1. Linier Interpolation

Figure 1 shows a straight line that interpolates the points (x_0, y_0) and (x_1,y_1). Determining the Equation of linear interpolation of the values located at points P1(x_0, y_0) and P2 (x_1,y_1), can be seen in Equation (5).

$$\frac{y-y_0}{y_1-y_0} = \frac{x-x_0}{x_1-x_0} \quad (5)$$

So to determine the equation value from linear interpolation it can be seen in Equation (6).

$$y = \frac{y_1-y_0}{x_1-x_0}(x-x_0) + y_0 \quad (6)$$

3. Results and Discussion

3.1 Data Analysis

This research uses seven alternative data (A) candidates for Raskin assistance who come from residents of Br. Clean, alternative names using the alias Alternative 1 to Alternative 7 (A1 – A7). The selection process determines the three best alternative candidates for Raskin assistance. These seven alternatives have been registered in the poor card program, then the assessment criteria are determined by the decision-makers, namely income (C1), marital status (C2), dependent children (C3), and age (C4). A description of the nature of the criteria and the value of the weight of the criteria can be seen in Table 1.

Table 1. Criteria Details

No.	*Criteria(C)*	*Characteristic of Criteria*	*Weight of Criteria (%)*
1	Income (C1)	Cost	25
2	Marital Status (C2)	Benefit	15
3	Dependents of Children (C3)	Benefit	40
4	Age (C4)	Benefit	20

In the criteria for marital status (C2) there are criteria attributes. The value of the criteria attribute uses a scale of 1-5. It can be seen in Table 2.

Table 2. Criteria Marital Status Attribute

Criteria(C)	*Criteria Attribute*	*Value*
Marital Status (C2)	Married	5
	Divorce Live	4
	Divorce Dead	3
	Not Married	2

For the criteria for Dependents of Children (C3) and Age (C4), because the criteria value is in the form of numbers, it does not use a rating scale of 1-5.

3.2. Scoring Technique of Income Criteria Assessment Using Linear Interpolation

A scoring assessment is done to determine the difference in the value of each alternative value. The value of the C1 Income criteria is because, with a value scale, the difference in numbers is unknown. One assessment model can be used is linear interpolation by determining the upper limit value and the upper limit value of each criterion.

The income criteria assessment model uses linear interpolation. The interpolation's lower and upper limit values are determined according to the minimum and maximum alternative income values[19]. The result of this interpolation is that the greater the income price used, the greater the resulting score[18]. The interpolation of the Income criteria can be seen as follows:

A. Income lowe limit = Rp. 1.000.000, Upper limit = Rp. 2.500.000

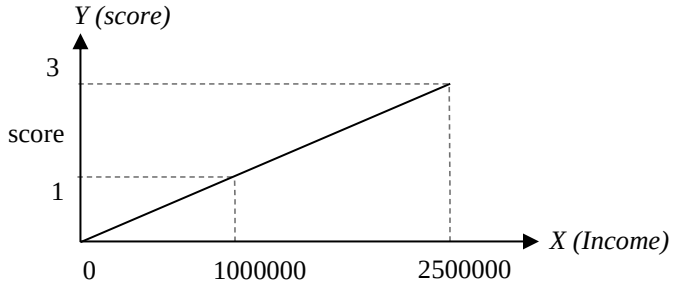

Figure 3. Linear Interpolation of Income Criteria

Figure 3 Explaining linear interpolation for the income criteria, it can be seen that the value of x_0 = 1000000, x_1 = 2500000, y_0 = 1, y_1 = 3. To find the interpolated value of income using Equation (6). If there is an example of alternative income = Rp. 1.200.000, then the calculation is:

$$p_1(1200000) = \frac{(3-1)}{2500000-1000000}(1200000-1000000) \quad +1$$

$$p_1(1200000) = \mathbf{0,27}$$

3.3. SAW Method Calculation

3.3.1. Alternative Value

At the initial stage, alternative values were determined for each criterion based on the data on candidate recipients of Raskin assistance at Banjar Bersih. Alternative value data can be seen in Table 3.

Table 3.Alternative Data

No.	*Alternatif(A)*	*Criteria*			
		C1	C2	C3	C4
1	A1	2000000	Divorce Dead	3	52
2	A2	1500000	Married	4	55
3	A3	2000000	Married	3	45
4	A4	1800000	Divorce Live	4	49
5	A5	1500000	Married	1	26
6	A6	1000000	Divorce Dead	2	47
7	A7	1000000	Married	1	47

3.3.2. Alternative Value Match Rating

The alternative value data in Table 3 then becomes the alternative suitability rating value, and the C1 criterion value is obtained from linear interpolation calculations. The value of the criteria C2 is obtained from the attribute values of C2 in Table 2. The values of the criteria C3 and C4 are inputted directly. Alternative suitability rating values can be seen in Table 4.

Table 4. Alternative Rating Values

No.	*Alternatif(A)*	*Criteria*			
		C1	C2	C3	C4
1	A1	2,33	3	3	52
2	A2	1,67	5	4	55
3	A3	2,33	5	3	45
4	A4	2,07	4	4	49
5	A5	1,67	5	1	26
6	A6	1	3	2	47
7	A7	1	5	1	47

3.3.3. Normalization Of Criteria Values

Normalization of criteria values is intended to make the criteria values in the same range. Normalization of criteria using Equation 2 based on the nature of the criteria in Table 1. The value of the normalization of criteria can be seen in Table 5.

Table 5.Criteria Normalization Value

No.	*Alternatif(A)*	*Criteria*			
		C1	C2	C3	C4
1	A1	0,5	0,6	0,75	0,94
2	A2	0,67	1	1	1
3	A3	0,5	1	0,75	0,82
4	A4	0,55	0,8	1	0,89
5	A5	0,67	1	0,25	0,47
6	A6	1	0,6	0,5	0,85

7	A7	1	1	0,25	0,85

3.3.4. Calculation of Final Preferences

The final preference value (Vi) is obtained by summing the process of multiplying the normalized matrix value against the weight value of each criterion following Equation (3) so that the final value of preference for each alternative 1 to 7 is obtained. The final value calculation is as follows :

V1 = (0,5*0,25)+(0,6*0,15)+(0,75*0,4)+(0,94*0,2) = **0,7**
V2 = (0,67*0,25)+(1*0,15)+(1*0,4)+(1*0,2) = **0,92**
V3 = (0,5*0,25)+(1*0,15)+(0,75*0,4)+(0,82*0,2) = **0,74**
V4 = (0,55*0,25)+(0,8*0,15)+(1*0,4)+(0,89*0,2) = **0,84**
V5 = (0,67*0,25)+(1*0,15)+(0,25*0,4)+(0,47*0,2) = **0,51**
V6 = (1*0,25)+(0,6*0,15)+(0,5*0,4)+(0,85*0,2) = **0,71**
V7 = (1*0,25)+(1*0,15)+(0,25*0,4)+(0,85*0,2) = **0,67**

3.3.5. Best Alternative Ranking

In the final stage of calculating the SAW method, alternative rankings are carried out based on the calculation of the final value of Vi. The final value of the alternatives is sorted from the largest to the smallest value, indicating the best alternative's value. From 7 alternative candidates, selected three alternative recipients of Raskin assistance. The final results of the best rankings that have been sorted from the largest to the smallest values can be seen in Table 6.

Table 6. Alternative Ranking Results

Alternatif Ranking	*Alternatif(A)*	*Final Score (Vi)*
1	A2	**0,92**
2	A4	**0,84**
3	A3	**0,74**
4	A6	**0,71**
5	A1	**0,7**
6	A7	**0,67**
7	A5	**0,51**

From the results in table 6, it can be explained that the 3 best alternatives for Raskin beneficiaries are the 1st best alternative, namely A2 with a value of 0.92, then the 2nd best alternative, namely A4 with a value of 0.84 and the 3rd best alternative, namely A3 with a value of 0, 74. If viewed from the alternative values for each criterion in Table 1, it can be analyzed that the Child Dependents criterion (C3) has an effect in calculating the final value because the weight value of the criteria is the highest. And if the alternative values in the Dependents of Children criteria (C3) and Age criteria (C4) tend to be large, the potential for the chosen alternative is even greater. While the value of the Income criterion (C1) does not have a significant effect because the income number has been scored by linear interpolation so that when it depends on the value of the lower and upper limits on the linear interpolation of income.

4. CONCLUSION

The conclusion of the study can be explained that the combination of the Simple Additive Weighting (SAW) method in calculating alternative final scores and Linear Interpolation Techniques in scoring the Income criteria assessment (C1) has been successfully used in the selection process for

alternative recipients of Raskin assistance. In the selection process from 7 alternative candidates, 3 selected alternatives were selected. with the largest to the smallest value.In addition to succeeding in determining the best alternative in this study, there is also an analysis of the criteria that affect the final results of the alternative ranking, namely Dependents of Children criteria (C1) and Age criteria (C4).

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