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Implementation of Decision Support System with Simple Additive Weighting (SAW) Method for Determination of Social Assistance Recipients: A Case Study in Ciledug, Tangerang

Tengku Rafi Syahrial[1*], Meyrson Agintha Sitepu[2], Satrio Santoso[3], Ali Mustofa Izzulhaq[4], Andreya Naufal Subagyo[5], Ati Zaidiah[6]
Universitas Pembangunan Nasional Veteran Jakarta
Corresponding Author: Tengku Rafi Syahrial 2210512129@mahasiswa.upnvj.ac.id

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A B S T R A C T

This can lead to dissatisfaction among the community and reduce the effectiveness of social assistance programs. This research aims to develop a Decision Support System (SPK) based on the Simple Additive Weighting (SAW) method to ensure a fairer, more objective, and efficient distribution of social assistance. The SAW method is used to assess aid recipients based on five main criteria, namely family income, number of dependents, home conditions, employment status, and age of the head of the family. Each criterion is weighted according to its level of importance, and the data obtained from the respondents is processed through a process of normalization and final score calculation to determine eligible beneficiaries. The implementation of this method in RT 02, RW 06, Ciledug, Tangerang City, showed a significant increase in the efficiency and accuracy of the selection of social assistance recipients.

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INTRODUCTION

Social assistance (bansos) is one of the programs designed to reduce the economic burden of the underprivileged, improve the standard of living, and help vulnerable groups in facing various social and economic challenges. This program not only functions as a form of government concern for people in need, but also as one of the efforts to support the achievement of social justice in the community. In this modern era, social assistance has become an important instrument in various government policies, especially to reduce economic disparities and ensure that every individual has access to decent basic needs.

However, the implementation of social assistance often faces significant challenges, both in terms of planning and implementation. One of the main problems is the process of selecting prospective aid recipients that is fair, relevant, and can be applied systematically. The manual selection process, which is often still used, has the potential to cause various problems such as subjectivity bias, limited human resources, inefficient time, and the risk of data inaccuracy. As a result, the assistance provided is not always on target, which has the potential to cause dissatisfaction among the community and inefficiency in the use of the government budget.

In the midst of these challenges, the use of data-based and technology-based approaches is becoming increasingly relevant. This approach allows for more accurate, transparent, and measurable decision-making. One of the technologies that can be used in this case is the Decision Support System (SPK), which is a system designed to support decision-making by utilizing certain algorithms. In the context of social assistance distribution, SPK offers a solution in assessing the eligibility of prospective recipients based on the criteria that have been set. This system can reduce the risk of bias, improve the efficiency of the selection process, and ensure that help is received by those who really need it.

The Simple Additive Weighting (SAW) method is one of the most suitable approaches to be applied in SPK. This method is known for its simplicity as well as the ability to produce evaluations based on the weight of predetermined criteria. Through SAW, each alternative (potential recipient) is assessed based on the total value of all criteria, where each criterion has a weight that represents its level of importance. This allows the selection process to be carried out objectively and consistently, thus supporting transparency in decision-making.

This research focuses on the application of the SAW method in the context of social assistance distribution in the RT 02 RW 06 area, Ciledug, Tangerang City. The data used includes five main criteria that have been set, namely:

a. Family income level to identify the economic level of the recipient
b. Number of family members who are dependents to assess needs based on family size
c. Physical condition of the house to measure the level of feasibility of the residence
d. The employment status of the head of the family as an indicator of economic stability
e. The age of the head of the family to consider vulnerable groups such as the elderly.

Through this research, it is hoped that a system can be produced that not only increases the effectiveness of the selection process for social assistance recipients in the study area, but also makes a real contribution to the development of a fairer social assistance distribution method in the future. The results of this research can be a reference for the implementation of similar systems in other regions, so that the government and related institutions can be more optimal in carrying out social assistance programs, achieve more equitable distribution targets, and have a wider positive impact on the community.

LITERATURE REVIEW

Decision Support System (SPK)

A Decision Support System (SPK) is a computer-based system designed to assist decision-makers in determining the best option from several available alternatives. SPK integrates data, analytics models, and software to support a more structured and objective decision-making process. According to Turban et al. (2011), SPK provides data-driven analysis capabilities that allow users to prioritize alternatives based on predetermined criteria. In the context of determining social assistance recipients, SPK plays an important role in eliminating subjectivity, so that decisions taken are more accurate and fairer. By combining criteria such as income, number of dependents, home conditions, occupation, and age, SPK allows the selection of aid recipients to be carried out more transparently.

Related Research

The Simple Additive Weighting (SAW) method is one of the simplest and most frequently used methods in SPK. According to Sukerti (2018), the SAW method works by normalizing the value of the criteria so that it allows comparisons between alternatives. This method involves three main steps:

a. Compiling a Decision Matrix: Alternative values are calculated based on predetermined criteria.
b. Normalization: Each criterion value is normalized using the maximum value to ensure the value is on a uniform scale.
c. Final Score Calculation: The value of the normalization result is multiplied by the weight of the criteria, then added together to produce the final score.

In his research, Sukerti (2018) used the SAW method to recommend tourist attractions on Nusa Penida Island. The results of the study show that the SAW method is able to provide objective recommendations based on the weight of criteria such as accessibility, facilities, and beauty. These findings are relevant in this study because they show the flexibility of the SAW method in various contexts, including the selection of social assistance recipients.

METHODOLOGY

Simple Additive Weighting (SAW) Method

The Simple Additive Weighting (SAW) method is one of the multicriteria decision-making techniques that is often used because of its simplicity. This method works by giving weight to each relevant criterion, and then calculating the final score based on the normalization value of each alternative. In the context of this study, the SAW method was applied to determine social assistance recipients who met the eligibility criteria objectively.

Determining the Data on Criteria and Subcriteria for Social Assistance Recipients

This study established five main criteria to determine the eligibility of social assistance recipients in RT 02, RW 06, Ciledug, Tangerang City. Each criterion has a certain weight according to its level of importance, which is determined through deliberation with the local environmental administrator.

RESEARCH RESULT

Determining the Weight of the Criteria

From the criteria contained in the previous section, a level of importance of the criteria is made based on the weight value that has been determined, along with the weight rating of the criteria.

Table 1. Description of Type and Weight of Criteria

Code	Weight	Type
C1	35%	Cost
C2	30%	Benefit
C3	20%	Cost
C4	10%	Cost
C5	5%	Cost

Determining Alternatives

Determining alternatives in the context of Decision Support Systems (SPK) means choosing or identifying options to be evaluated based on predetermined criteria. This alternative is the choice of solution or action that is the object of assessment in the decision-making process.

Table 2. Alternate Codes

Alternatif	Code
Sutikno	A1
Ngudi wismantoro	A2
Maryanta	A3
Abdul Hakim	A4
Fadli Ahmad	A5
Sumarno	A6
Eko Setiawan	A7
Herianto	A8
Udin	A9
Muhadi Utomo	A10

Adriansyah Sulaiman	A11
Ahmad Rudianto	A12
Bayu Setiawan	A13
Fajar Aji	A14
Rafi Adrian	A15
Miska	A16
Aril Fikrie	A17
Suswanto	A18
Suryono	A19

Case Examples

The following calculation is manual based on case examples. And below is a table containing information from social assistance recipients.

Table 3. Assessment Data of Prospective Social Assistance Recipients

Name of the Head of Family	House No.	Total Monthly Income	Number of dependent family members	Current Physical Condition of the House	Job Status of the Head of Family	How Old Is The Head Of Family
Sutikno	9	Rp. 3.5 million - 5 million	4	Livable, requires minor repairs	Non-permanent employment, formal sector	31-40 years old
Ngudi wismantoro	16	Rp. 2 million - 3,5 million	3	Livable, requires minor repairs	Non-permanent employment, formal sector	41-50 years old
Maryanta	11	Rp. 5 million-7 million	4	livable	Permanent employment, formal sector	31-40 years old
Abdul Hakim	14	Rp. 1 million-2 million	2	livable, in need of repair besar	Informal Jobs without a stable income	41-50 years old
Fadli Ahmad	13	Rp. 5 million-7 million	3	livable	Permanent employment, formal	31-40 years old

Name of the Head of Family	House No.	Total Monthly Income	Number of dependent family members	Current Physical Condition of the House	Job Status of the Head of Family	How Old Is The Head Of Family
					sector	
Sumarno	17	More than 7m	4	livable	Permanent employment, formal sector	41-50 years old
Eko Setiawan	20	Rp. 3,5 million -5 million	3	livable, requires minor repairs	Non-permanent employment, formal sector	31-40 years old
Herianto	5	Rp. 2j million - 3,5 million	3	layak huni, memerlukan perbaikan sedang	Informal Jobs With a stable income	31-40 tahun
Udin	4	Rp. 1 million -2 million	3	layak huni, memerlukan perbaikan kecil	Non-permanent employment, formal sector	31-40 tahun
Muhadi Utomo	10	Rp. 3,5 million -5 million	5-6	livable	Permanent employment, informal sector	41-50 years old
Adriansyah Sulaiman	1	Rp. 5 million -7 million	2	livable, requires minor repairs	Informal Jobs With a stable income	31-40 years old
Ahmad Rudianto	3	Rp. 3,5 million -5 million	4	Habitable, minimal damage	Permanent employment, informal sector	41-50 years old
Bayu	2	Less than 1	0-1	livable,	Informal	25-30

Name of the Head of Family	House No.	Total Monthly Income	Number of dependent family members	Current Physical Condition of the House	Job Status of the Head of Family	How Old Is The Head Of Family
Setiawan		million		requires moderate repairs	Jobs without a stable income	years old
Fajar Aji	6	Less than 1 million	2	livable, requires moderate repairs	Non-permanent employment, formal sector	31-40 years old
Rafi Adrian	12	Rp. 2 million - 3,5 million	3	livable, requires moderate repairs	Informal Jobs without a stable income	41-50 years old
Miska	8	Less than 1 million	0-1	Habitable, minimal damage	Informal Jobs without a stable income	Under 25 years old
Aril Fikrie	7	Less than 1 million	2	Habitable, minimal damage	Informal Jobs without a stable income	25-30 years old
Suswanto	19	Rp. 1 million -2 million	2	livable, requires minor repairs	Non-permanent employment, formal sector	Under 25 years old
Suryono	100	Rp. 3,5 million -5 million	4	livable, requires minor repairs	Informal Jobs With a stable income	41-50 years old

After conducting a survey on the classification of aid recipient criteria, the next step in the Simple Additive Weighting (SAW) method is to determine the suitability rating of each alternative to each criterion. These ratings provide a quantitative assessment based on survey data or a specific scale, reflecting how well the alternative meets criteria such as income level, number of dependents, or employment status. These values are compiled in a decision matrix, which is then normalized to equalize the scale of the assessment. This process continues with the calculation of preference values to determine the best alternative according to the weight of the criteria that have been set. The following is the matrix value of the criteria for receiving social assistance.

Table 4. Matrix Values of Each Alternative on Each Criterion

Alternatif	Criteria				
	C1	C2	C3	C4	C5
A1	4	4	4	4	4
A2	3	3	2	4	3
A3	5	4	6	6	3
A4	2	2	2	2	4
A5	5	3	6	6	4
A6	6	4	6	6	3
A7	4	3	4	4	4
A8	3	3	3	3	4
A9	2	3	4	4	4
A10	4	5	6	5	3
A11	5	2	4	3	4
A12	4	4	5	5	3
A13	1	1	3	2	5
A14	1	2	1	4	4
A15	3	3	1	2	3
A16	1	1	5	4	6
A17	1	2	5	4	6
A18	2	2	4	4	6
A19	3	5	4	3	3

Next is to create a decision matrix X based on the Matrix Table of alternative matches on each criterion as follows:

$$x = \begin{Bmatrix} 4 & 4 & 4 & 4 & 4 \\ 3 & 3 & 2 & 4 & 3 \\ 5 & 4 & 6 & 6 & 3 \\ 2 & 2 & 2 & 2 & 4 \\ 5 & 3 & 6 & 6 & 4 \\ 6 & 4 & 6 & 6 & 3 \\ 4 & 3 & 4 & 4 & 4 \\ 3 & 3 & 3 & 3 & 4 \\ 2 & 3 & 4 & 4 & 4 \\ 4 & 5 & 6 & 6 & 3 \\ 5 & 2 & 4 & 3 & 4 \\ 4 & 4 & 5 & 5 & 3 \\ 1 & 1 & 3 & 2 & 5 \\ 1 & 2 & 1 & 4 & 4 \\ 3 & 3 & 1 & 2 & 3 \\ 1 & 1 & 5 & 4 & 6 \\ 1 & 2 & 5 & 4 & 6 \\ 2 & 2 & 4 & 4 & 6 \\ 3 & 5 & 4 & 3 & 3 \end{Bmatrix}$$

The next step is to normalize the X matrix, which aims to calculate the value of each criterion assuming that the criteria can be either benefit or cost. This normalization process aims to equalize the scale of assessment in each criterion, so that it can be used in the calculation of preference values as follows:

For Alternative 1 (A1)

$$r_{11} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{4} = \frac{1}{4} = 0{,}25$$

$$r_{12} = \frac{4}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{4}{5} = 0.8$$

$$r_{13} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{4} = \frac{1}{4} = 0{,}25$$

$$r_{14} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{4} = \frac{2}{4} = 0{,}5$$

$$r_{15} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{4} = \frac{3}{4} = 0{,}75$$

For Alternatif 2 (A2)

$$r_{21} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{3} = \frac{1}{3} = 0.333333333$$

$$r_{22} = \frac{3}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{3}{5} = 0.6$$

$$r_{23} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{2} = \frac{1}{2} = 0{,}5$$

$$r_{24} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{4} = \frac{2}{4} = 0{,}5$$

$$r_{25} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{3} = \frac{3}{3} = 1$$

For Alternatif 3 (A3)

$$r_{31} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{5} = \frac{1}{5} = 0.2$$

$$r_{32} = \frac{4}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{4}{5} = 0.8$$

$$r_{33} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{6} = \frac{1}{6} = 0.166666667$$

$$r_{34} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{6} = \frac{2}{6} = 0.333333333$$

$$r_{35} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{3} = \frac{3}{3} = 1$$

For Alternatif 4 (A4)

$$r_{41} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{2} = \frac{1}{2} = 0.5$$

$$r_{42} = \frac{2}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{2}{5} = 0.4$$

$$r_{43} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{2} = \frac{1}{2} = 0.5$$

$$r_{44} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{2} = \frac{2}{2} = 1$$

$$r_{45} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{4} = \frac{3}{4} = 0{,}75$$

For Alternatif 5 (A5)

$$r_{51} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{4} = \frac{1}{4} = 0.25$$

$$r_{52} = \frac{3}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{3}{5} = 0.6$$

$$r_{53} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{6} = \frac{1}{6} = 0.166666667$$

$$r_{54} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{6} = \frac{2}{6} = 0.333333333$$

$$r_{55} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{4} = \frac{3}{4} = 0{,}75$$

For Alternatif 6 (A6)

$$r_{61} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{6} = \frac{1}{6} = 0.166666667$$

$$r_{62} = \frac{4}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{4}{5} = 0.8$$

$$r_{63} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{6} = \frac{1}{6} = 0.166666667$$

$$r_{64} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{6} = \frac{2}{6} = 0.333333333$$

$$r_{65} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{3} = \frac{3}{3} = 1$$

For Alternatif 7 (A7)

$$r_{71} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{4} = \frac{1}{4} = 0.25$$
$$r_{72} = \frac{3}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{3}{5} = 0.6$$
$$r_{73} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{4} = \frac{1}{4} = 0.25$$
$$r_{74} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{4} = \frac{2}{4} = 0.5$$
$$r_{75} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{4} = \frac{3}{4} = 0{,}75$$

For Alternatif 8 (A8)

$$r_{81} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{3} = \frac{1}{3} = 0.333333333$$
$$r_{82} = \frac{3}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{3}{5} = 0.6$$
$$r_{83} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{3} = \frac{1}{3} = 0.333333333$$
$$r_{84} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{3} = \frac{2}{3} = 0.66666667$$
$$r_{85} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{4} = \frac{3}{4} = 0{,}75$$

For Alternatif 9 (A9)

$$r_{91} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{2} = \frac{1}{2} = 0.5$$
$$r_{92} = \frac{3}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{3}{5} = 0.6$$
$$r_{93} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{4} = \frac{1}{4} = 0.25$$
$$r_{94} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{4} = \frac{2}{4} = 0.5$$
$$r_{95} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{4} = \frac{3}{4} = 0{,}75$$

For Alternatif 9 (A9)

$$r_{91} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{2} = \frac{1}{2} = 0.5$$
$$r_{92} = \frac{3}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{3}{5} = 0.6$$
$$r_{93} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{4} = \frac{1}{4} = 0.25$$
$$r_{94} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{4} = \frac{2}{4} = 0.5$$
$$r_{95} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{4} = \frac{3}{4} = 0{,}75$$

For Alternatif 10 (A10)

$$r_{101} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{4} = \frac{1}{4} = 0.25$$

$$r_{102} = \frac{5}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{5}{5} = 1$$

$$r_{103} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{6} = \frac{1}{6} = 0.166666667$$

$$r_{104} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{5} = \frac{2}{5} = 0.4$$

$$r_{105} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{3} = \frac{3}{3} = 1$$

For Alternatif 11 (A11)

$$r_{111} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{5} = \frac{1}{5} = 0.2$$

$$r_{112} = \frac{2}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{2}{5} = 0,4$$

$$r_{113} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{4} = \frac{1}{4} = 0.25$$

$$r_{114} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{3} = \frac{2}{3} = 0.66666667$$

$$r_{115} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{4} = \frac{3}{4} = 0,75$$

For Alternatif 12 (A12)

$$r_{121} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{4} = \frac{1}{4} = 0.25$$

$$r_{122} = \frac{4}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{4}{5} = 0,8$$

$$r_{123} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{5} = \frac{1}{5} = 0.2$$

$$r_{124} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{5} = \frac{2}{5} = 0.4$$

$$r_{125} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{3} = \frac{3}{4} = 0,75$$

For Alternatif 13 (A13)

$$r_{131} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{4} = \frac{1}{4} = 0.25$$

$$r_{132} = \frac{4}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{4}{5} = 0,8$$

$$r_{133} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{5} = \frac{1}{5} = 0.2$$

$$r_{134} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{5} = \frac{2}{5} = 0.4$$

$$r_{135} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{3} = \frac{3}{4} = 0,75$$

For Alternatif 14 (A14)

$$r_{141} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{1} = \frac{1}{1} = 1$$
$$r_{142} = \frac{2}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{2}{5} = 0{,}4$$
$$r_{143} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{1} = \frac{1}{1} = 1$$
$$r_{144} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{4} = \frac{2}{4} = 0.5$$
$$r_{145} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{4} = \frac{3}{4} = 0{,}75$$

For Alternatif 15 (A15)

$$r_{151} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{3} = \frac{1}{3} = 0{,}33333333$$
$$r_{152} = \frac{3}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{3}{5} = 0{,}6$$
$$r_{153} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{1} = \frac{1}{1} = 1$$
$$r_{154} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{2} = \frac{2}{4} = 0.5$$
$$r_{155} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{3} = \frac{3}{4} = 0{,}75$$

For Alternatif 16 (A16)

$$r_{161} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{1} = \frac{1}{1} = 1$$
$$r_{162} = \frac{1}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{1}{5} = 0{,}2$$
$$r_{163} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{5} = \frac{1}{5} = 0{,}2$$
$$r_{164} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{4} = \frac{2}{4} = 0.5$$
$$r_{165} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{6} = \frac{3}{6} = 0{,}5$$

For Alternatif 17 (A17)

$$r_{171} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{1} = \frac{1}{1} = 1$$
$$r_{172} = \frac{2}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{2}{5} = 0{,}4$$
$$r_{173} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{5} = \frac{1}{5} = 0{,}2$$
$$r_{174} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{2} = \frac{2}{2} = 1$$
$$r_{175} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{5} = \frac{3}{5} = 0{,}6$$

For Alternatif 18 (A18)

$$r_{181} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{2} = \frac{1}{2} = 0{,}5$$

$$r_{182} = \frac{2}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{2}{5} = 0{,}4$$

$$r_{183} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{4} = \frac{1}{4} = 0{,}25$$

$$r_{184} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{4} = \frac{2}{4} = 0{,}5$$

$$r_{185} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{6} = \frac{3}{6} = 0{,}5$$

For Alternatif 19 (A19)

$$r_{191} = \frac{Min\{4,3,5,2,5,6,4,3,2,4,5,4,1,1,3,1,1,2,3\}}{3} = \frac{1}{3} = 0{,}333333333$$

$$r_{192} = \frac{5}{Max\{4,3,4,2,3,4,3,3,3,5,2,4,1,2,3,1,2,2,5\}} = \frac{5}{5} = 1$$

$$r_{193} = \frac{Min\{4,2,6,2,6,6,4,3,4,6,4,5,3,1,1,5,5,4,4\}}{4} = \frac{1}{4} = 0{,}25$$

$$r_{194} = \frac{Min\{4,4,6,2,6,6,4,3,4,5,3,5,2,4,2,4,2,4,3\}}{3} = \frac{2}{3} = 0{,}66666667$$

$$r_{195} = \frac{Min\{4,3,3,4,4,3,4,4,4,3,4,3,5,4,3,6,5,6,3\}}{3} = \frac{3}{3} = 1$$

After calculating each criterion using the SAW method, the normalization results are compiled in a table that shows the values of each alternative based on the criteria that have been normalized. This table serves as the basis for the final calculation stage of the preference value taking into account the weights of each criterion.

Table 5. Results of the Normalization Calculation of SAW

Alternatif	Criteria				
	C1	C2	C3	C4	C5
A1	0.25	0.8	0.25	0.5	0.75
A2	0.333333333	0.6	0.5	0.5	1
A3	0.2	0.8	0.166666667	0.333333333	1
A4	0.5	0.4	0.5	1	0.75
A5	0.2	0.6	0.166666667	0.333333333	0.75
A6	0.166666667	0.8	0.166666667	0.333333333	1
A7	0.25	0.6	0.25	0.5	0.75
A8	0.333333333	0.6	0.333333333	0.666666667	0.75
A9	0.5	0.6	0.25	0.5	0.75
A10	0.25	1	0.166666667	0.4	1

Alternatif	Criteria				
	C1	C2	C3	C4	C5
A11	0.2	0.4	0.25	0.666666667	0.75
A12	0.25	0.8	0.2	0.4	1
A13	1	0.2	0.333333333	1	0.6
A14	1	0.4	1	0.5	0.75
A15	0.333333333	0.6	1	1	1
A16	1	0.2	0.2	0.5	0.5
A17	1	0.4	0.2	1	0.6
A18	0.5	0.4	0.25	0.5	0.5
A19	0.333333333	1	0.25	0.666666667	1

After calculation and normalization using the SAW method, the ranking results were obtained by calculating the preference value of each alternative based on the weight of the criteria. This ranking shows the order of alternatives from the most qualified to the least suitable, with the highest-value alternatives considered the best choice. The following is the normalization of the R matrix obtained from the results of the normalization of the X matrix as follows:

$$r = \begin{Bmatrix} 0,25 & 0,8 & 0,25 & 0,5 & 0,75 \\ 0,333 & 0,6 & 0,5 & 0,5 & 1 \\ 0,2 & 0,8 & 0,1667 & 0,333 & 1 \\ 0,5 & 0,4 & 0,5 & 1 & 0,75 \\ 0,2 & 0,6 & 0,1667 & 0,333 & 0,75 \\ 0,1667 & 0,8 & 0,1667 & 0,333 & 1 \\ 0,25 & 0,6 & 0,25 & 0,5 & 0,75 \\ 0,333 & 0,6 & 0,333 & 0,667 & 0,75 \\ 0,5 & 0,6 & 0,25 & 0,5 & 0,75 \\ 0,25 & 1 & 0,1667 & 0,4 & 1 \\ 0,2 & 0,4 & 0,25 & 0,667 & 0,75 \\ 0,25 & 0,8 & 0,2 & 0,4 & 1 \\ 1 & 0,2 & 0,333 & 1 & 0,6 \\ 1 & 0,4 & 1 & 0,5 & 0,75 \\ 0,333 & 0,6 & 1 & 1 & 1 \\ 1 & 0,2 & 0,2 & 0,5 & 0,5 \\ 1 & 0,4 & 0,2 & 1 & 0,6 \\ 0,5 & 0,4 & 0,25 & 0,5 & 0,5 \\ 0,333 & 1 & 0,25 & 0,667 & 1 \end{Bmatrix}$$

The next step is to multiply the matrix W by R and add up the results of its multiplication to determine the best alternative. The alternative with the highest rated score will be considered the best, with the steps described as follows:

$V_1 = (0{,}35)(0.25) + (0{,}30)(0.8) + (0.2)(0.25) + (0{,}1)(0.5) + (0{,}05)(0.75) = 0.465$

$V_2 = (0{,}35)(0.333333333) + (0{,}30)(0.6) + (0.2)(0.5) + (0{,}1)(0.5) + (0{,}05)(1) = 0.496666667$

$V_3 = (0{,}35)(0.2) + (0{,}30)(0.8) + (0.2)(0.166666667) + (0{,}1)(0.333333333) + (0{,}05)(1) = 0.426666667$

$V_4 = (0{,}35)(0.5) + (0{,}30)(0.4) + (0.2)(0.5) + (0{,}1)(1) + (0{,}05)(0.75) = 0.5325$

$V_5 = (0{,}35)(0.2) + (0{,}30)(0.6) + (0.2)(0.166666667) + (0{,}1)(0.333333333) + (0{,}05)(0.75) = 0.354166667$

$V_6 = (0{,}35)(0.166666667) + (0{,}30)(0.8) + (0.2)(0.166666667) + (0{,}1)(0.333333333) + (0{,}05)(1) = 0.415$

$V_7 = (0{,}35)(0.25) + (0{,}30)(0.6) + (0.2)(0.25) + (0{,}0.5)(d) + (0{,}05)(0.75) = 0.405$

$V_8 = (0{,}35)(0.333333333) + (0{,}30)(0.6) + (0.2)(0.333333333) + (0{,}1)(0.666666667) + (0{,}05)(0.75) = 0.4675$

$V_9 = (0{,}35)(0.5) + (0{,}30)(0.6) + (0.2)(0.25) + (0{,}1)(0.5) + (0{,}05)(0.75) = 0.4925$

$V_{10} = (0{,}35)(0.25) + (0{,}30)(1) + (0.2)(0.166666667) + (0{,}1)(0.4) + (0{,}05)(1) = 0.510833333$

$V_{11} = (0{,}35)(0.2) + (0{,}30)(0.4) + (0.2)(0.25) + (0{,}1)(0.666666667) + (0{,}05)(0.75) = 0.344166667$

$V_{12} = (0{,}35)(0.25) + (0{,}30)(0.8) + (0.2)(0.2) + (0{,}1)(0.4) + (0{,}05)(1) = 0.4575$

$V_{13} = (0{,}35)(1) + (0{,}30)(0.2) + (0.2)(0.333333333) + (0{,}1)(1) + (0{,}05)(0.6) = 0.606666667$

$V_{14} = (0{,}35)(1) + (0{,}30)(0.4) + (0.2)(1) + (0{,}1)(0.5) + (0{,}05)(0.75) = 0.7575$

$V_{15} = (0{,}35)(0.333333333) + (0{,}30)(0.6) + (0.2)(1) + (0{,}1)(1) + (0{,}05)(1) = 0.646666667$

$V_{16} = (0{,}35)(1) + (0{,}30)(0.2) + (0.2)(0.2) + (0{,}1)(0.5) + (0{,}05)(0.5) = 0.525$

$V_{17} = (0{,}35)(1) + (0{,}30)(0.4) + (0.2)(0.2) + (0{,}1)(1) + (0{,}05)(0.6) = 0.64$

$V_{18} = (0{,}35)(0.5) + (0{,}30)(0.4) + (0.2)(0.25) + (0{,}1)(0.5) + (0{,}05)(0.5) = 0.42$

$V_{19} = (0{,}35)(0.333333333) + (0{,}30)(1) + (0.2)(0.25) + (0{,}1)(0.666666667) + (0{,}05)(1) = 0.583333333$

Based on this calculation, the results of the ranking using the SAW method are obtained in the table below:

Table 6. Results of Ranking of Prospective Social Assistance Recipients

Alternatif	Code	Weight Calculation	Ranking
Sutikno	A1	0.465	12
Ngudi Wismantoro	A2	0.496666667	9
Maryanta	A3	0.426666667	14
Abdul Hakim	A4	0.5325	6
Fadli Ahmad	A5	0.354166667	18
Sumarno	A6	0.415	16
Eko Setiawan	A7	0.405	17
Herianto	A8	0.4675	11

Alternatif	Code	Weight Calculation	Ranking
Udin	A9	0.4925	10
Muhadi Utomo	A10	0.510833333	8
Adriansyah Sulaiman	A11	0.344166667	19
Ahmad Rudianto	A12	0.4575	13
Bayu Setiawan	A13	0.606666667	4
Fajar Aji	A14	0.7575	1
Rafi Adrian	A15	0.646666667	2
Miska	A16	0.525	7
Aril Fikrie	A17	0.64	3
Suswanto	A18	0.42	15
Suryono	A19	0.583333333	5

CONCLUSIONS AND RECOMMENDATIONS

This study aims to apply the Simple Additive Weighting (SAW) method in the Decision Support System (SPK) to select social assistance recipients (bansos) in an objective and measurable manner. Based on the results of the analysis and calculation of preference values, an alternative ranking was obtained that showed the priority level of each prospective recipient based on predetermined criteria.

The five main criteria used in this process are the level of family income, the number of family members who are dependents, the physical condition of the house, the employment status of the head of the family, and the age of the head of the family. Using the SAW method, preference scores are calculated for each alternative, and the highest rated recipients are considered to be the individuals or families most in need of social assistance.

From the results of this study, several conclusions can be drawn:

a. The SAW method is effective in providing calculation results based on the weight of the criteria that have been determined. The results of the ranking provide a clear picture of the potential recipients who best meet the eligibility criteria for social assistance.
b. Prospective recipients with more vulnerable socio-economic conditions (for example, low income, poor housing conditions, or a large number of dependents) tend to have a higher preference value, in accordance with the purpose of distributing social assistance to help those in need.

c. The alternative with the highest score, namely Fajar Aji (A14), was identified as the recipient who needs social assistance the most, followed by Rafi Adrian (A15) and Aril Fikrie (A17). On the other hand, the alternative with the lowest score, namely Adriansyah Sulaiman (A11), is ranked last because it does not meet the eligibility criteria for social assistance significantly.

Overall, the application of the SAW method in SPK has proven that this approach can help the decision-making process become more transparent, objective, and measurable, thereby increasing the effectiveness of social assistance distribution.

Based on the research that has been conducted, here are some suggestions that can be proposed to improve the implementation of SPK in the selection of social assistance recipients:

a. Criterion Data Enrichment
   The criteria used in this study already cover important aspects, but the addition of other criteria, such as the level of education of the head of the family, access to health services, or previous records of social assistance receipts, can help provide more comprehensive and accurate results.
b. Strengthening the Digitalization System
   The implementation of an SPK-based digital system that is integrated with population data can speed up and simplify the selection process for prospective social assistance recipients. It can also minimize the potential for manual errors and improve time efficiency.
c. Validation Test and Calibration Weight Criteria
   The weight of the criteria in the SAW method should be validated periodically by involving experts and relevant stakeholders, so that the weights used truly reflect the government's priorities and dynamic community conditions.
d. Development of Advanced Decision Support Systems
e. The SAW method is a simple and effective approach, but future research may consider other methods, such as TOPSIS, AHP, or SMART, to obtain comparison of results and increase flexibility in decision-making.
f. Socialization and Community Involvement
   It is important for the government to socialize the methods used in the selection process of social assistance recipients so that the public understands transparency and fairness in this process. In addition, community involvement in data validation can help ensure that aid recipients are indeed on target.

ADVANCED RESEARCH

This research is expected to be a reference and basis for the development of a better social assistance selection system in the future, so that social assistance programs can have a more significant impact in improving community welfare.

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