Model Fuzzy MADM in The Decision Support System of Mustahik Service Program Beneficiaries at Laznas PPPA Daarul Quran Center Tangerang

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Abstract

Charity is one of the good deeds taught in Islam. Doing charity is giving out or donating a piece of the property or money to someone else. The amil institution is one of the places where they receive donations and distribute them to those who are entitled. One of the amil institutions is Laznas PPPA Daarul Quran that has a mustahik service program where they must be focused on providing educational, health, venture capital, or other aid to mustahik. The problem we found is that mustahik selection is still conducted by hand, resulting in the lack of accuracy of mustahik. There are eight criteria in determining the mustahik; fardhu prayer, family income, reading Al-Quran, sunnah prayer, social activities, number of loads, residence, and marital status. The purpose of this research is to build a decision support system to facilitate the management and distribution of aid to make it more targeted. The method used in this research is Simple Additive Weighting or SAW with a model Fuzzy Multi-Attribute Decision Making or FMADM. The method is selected because it can choose the best alternative by calculating and weighting the weight value of any criteria, and then proceed to determining the mustahik and giving help based on the number of funds available.

Keywords*: decision support system, SAW, fuzzy MADM, mustahik, donation*

1. Introduction

In its development, information technology has become an option for organizations as effective and efficient business strategies in running business processes. The application of technology by humans in helping work is necessary to support productivity and results that want to be achieved, not least for organizations that manage zakat, infaq, sadaqah, and waqf (ZISWAF) funds [1].

PPPA Daarul Quran is one of the national amil zakat institutions that has obtained permission from the Ministry of Foreign Affairs to manage ZISWAF funds from the community. As one of Laznas, PPPA Daarul Quran has a program to distribute charity funds from the organization called Mustahik Service. Mustahik Service Program has been around since the establishment of the PPPA Daarul Quran in 2007 [2]. Assistance provided for personal benefits such as assistance for venture capital, tuition assistance, health expense assistance, or assistance provided for the public interest such as to build mosques, religious activities in the village, and others [3].

The process of assisting is carried out in a way that the community that needs help comes directly to the office by submitting proposals and bringing the required terms, then goes through several stages, including the interview and survey stage to consider the criteria of the recipient of assistance [4]. This process is a lot of time-consuming management. In addition, it is also feared that it will reduce objectivity in the selection of beneficiaries [5].

Every month, there are 80-120 applications for assistance that go into the Mustahik Services program [6]. While in a day, the Mustahik Service team was only able to survey two to three places, and it was limited in the Jabodetabek area.

Thus it poses the following problems:

- The more applicants, the more time-consuming it will take in decision-making.
- Improvements are needed for the methods and decision-making systems that have been running so far, as they are less effective.
- There is no computerized decision support system available to assist management in determining the best alternative.

The purpose of this research is to build a system of supporting computerized decisions and be one of the solutions to the problems faced so as not to be mistargeted in the management program of Mustahik PPPA Daarul Quran Service in distributing assistance to be more objective, transparent, and fair [7].

The use of Simple Additive Weighting (SAW) and Fuzzy Multiple Attribute Decision Making (Fuzzy MADM) methods has been widely done, such as research conducted by Elin Haerani and Ramdaril in his research entitled Design of Zakat Distribution Decision Support System Using Fuzzy Multiple Attribute Decision Making (FMADM) and Simple Additive Weighting (SAW) in Baznas Kota Pekanbaru [8]. The study explained that distribution is carried out periodically within three months. Distribution is done with consideration.

Criteria of zakat recipients calculated conventionally by the Baznas committee. Of course, this will allow for errors in calculation and decision-making. Therefore, a decision support system is needed that can support decisions in the distribution of zakat based on the criteria that are entitled to receive zakat so that the distribution process reaches the right person is entitled. The method used in the study was Simple Additive Weighting (SAW) [9]. The study concluded that the system could run according to the design and function that can provide the results of mustahik stamps that are entitled to receive zakat using Fuzzy Multiple Attribute Decision Making (FMADM) and Simple Additive Weighting (SAW) in accordance with the criteria set by the Committee baznas Kota Pekanbaru. The system built has been in accordance with the work program baznas Pekanbaru City and has managed to provide the results of mustahik ranking based on the highest vector value [10].

2. Materials and Methods

2.1 Decision Support System

The decision support system is a system that is made to support and obtain decisions in determining several choices that aim to be obtained from the computerized system based on the specified criteria. The support system of this decision using computerization as a tool makes it easier to make choices [11]. The decision-making process goes through the following stages:

1. Search Stage (intelligence)
   Decision-making learns the reality that occurs so that it can identify problems that occur, usually done analysis from the system to its forming subsystem so that it is obtained in the form of incorrect statement documents.
2. Choice Stage
   At this stage, the decision-maker chooses one of the solution alternatives made at the design stage, which is seen as the most appropriate action to address the problem at hand.
3. Design Stage
   At this stage decision-makers find, develop, and analyze all possible solutions that are through modeling that could represent the real condition of the problem.
4. Implementation Stage
   Decision-makers perform a series of solving actions selected at the choice stage. Successful implementation is characterized by missed problems.

SPK has a number of characteristics, abilities, and limitations [12] , namely:

1. SPK Characteristics.
2. Support the entire organization's activities.
3. Support multiple interconnected decisions.
4. It can be used repeatedly and is constant.
5. There are two main components, namely, data and models.
6. Use external and internal big data. f) Have what-if analysis and goal-seeking analysis capabilities.
7. Use several quantitative models.

2. SPK Capabilities

1. Support management decision-making in dealing with semi-structured and unstructured issues.
2. Assist managers at various levels of management, from top-level management to lower-level management.
3. Support decision making in groups and individuals.
4. Support inter-dependent and sequential decision-making.
5. Supporting the stages of decision making include intelligence, design, choice, and implementation.
6. Support various forms of decision-making process and type of decision.
7. The ability to adapt at all times and be flexible.
8. Ease of system interaction.
9. Increase effectiveness in decision making rather than efficiency.
10. Decision-making modeling and analysis capabilities.
11. Ease of accessing various data sources and formats.

3. SPK limitations

1. There are some management capabilities and human talents that cannot be modeled, so the models in the system do not all reflect the real problem.
2. The capabilities of an SPK are limited to the treasury of knowledge it possesses (basic knowledge as well as basic models).
3. The processes that SPK can do usually depend also on the capabilities of the software it uses.
4. SPK does not have the intuition ability that humans have. Because however advanced an SPK is, it is simply a collection of hardware, software, and operating systems that are not equipped with the ability to think.

B. Simple Additive Weighting (SAW)

Simple Additive Weighting (SAW) algorithms are often also known as weighted summing methods [13]. The basic concept of the SAW method is to look for a weighted summation of performance ratings on each alternate on all attributes. The SAW method requires the process of normalizing the decision matrix (X) to a scale that can be compared to all existing alternative ratings [14].

The steps of selecting the Simple Additive Weighting method are as follows [15]. Determining the criteria that will be used as a reference in decision making, namely Ci. The criteria in this study are:

Table 1. Criteria

No	Description	Criteria	Weights	Fractional
1	Fardhu Prayer	K1	20%	0.20
2	Family Income	K2	20%	0.20
3	Reading the Quran	K3	15%	0.15
4	Prayer sunnah rawatib	K4	10%	0.10
5	Study activities	K5	12%	0.12
6	Number of dependents	K6	10%	0.10
7	Where to stay	K7	8%	0.08
8	Marital status	K8	5%	0/05

Determine the match rating of each alternative on each criterion. The match rating of each criterion is:

Table 2. Each Alternate Match Rating On Each Criterion.

Nama	Nilai							
	K1	K2	K3	K4	K5	K6	K7	K8
A1	5	4	5	3	2	1	3	4
A2	5	3	3	2	2	3	1	3
A3	4	4	5	2	2	2	3	4
A4	3	2	4	2	2	1	1	2
A5	5	4	3	2	1	2	3	2
A6	2	1	5	2	1	1	3	1

Create a decision matrix based on criteria (Ci), then normalize the matrix based on equations that are adjusted to the type of attribute (profit attribute or cost attribute) so that it obtains a normalized matrix R [16].

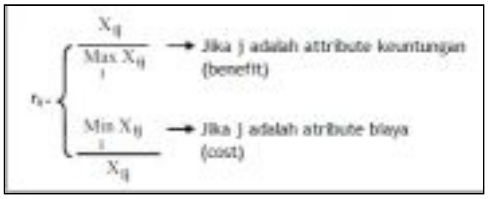

Figure 1. Normalization of Decisions

The end result is derived from the ranking process: the summation of the multiplication of the normalized matrix R with the weight vector so that it obtains the largest value chosen as the best alternative (Ai) as the solution.

$$V_i = \sum_{j=1}^{n} W_j \, r_{ij}$$

Figure 2. Preference Formula.

C. Multiple Attribute Decision Making (MADM) Fuzzy

Multiple Attribute Decision Making (FMADM) is a method used to find the optimal alternative to a number of alternatives with certain criteria. The essence of Fuzzy Multiple Attribute Decision Making (FMADM) is to specify a weight value for each attribute, then continue with the process.

3. Results and Analysis

3.1. Needs Analysis With SAW Method

Create a decision matrix (x) formed from the match rating table of each alternative on each criterion.

$$Rij=(\{\frac{xij}{\max xij}\})$$

That will select the alternative stipulated. The MADM algorithm can be defined as follows [17]:

- Provide the value of each alternate (Ai) on each specified criterion (Cj), where the value is obtained based on the crisp value; i=1,2,... m and j=1.2,... N.
- Provides a weight value (W) that is also obtained based on the crisp value.
- Normalize the matrix by calculating the normalized performance rating value (rij) of the Ai alternative to the Cj attribute based on an equation adjusted to the attribute type (profit/benefit attribute=MAXIMUM or cost attribute=MINIMUM). If it is a profit attribute, then the crisp (Xij) value of each attribute column is divided by the crisp MAX (MAX Xij) value of each column, while for the cost attribute, the crisp MIN (MIN Xij) value of each attribute column is divided by the crisp (Xij) value of each column.
- Perform the working process by multiplying the normalized matrix (R) by a weight value (W).
- Specifies the preference value for each alternate (Vi) by summing the result times between the normalized matrix (R) and the weight value (W). The larger Vi value indicates that Ai's alternative is more elected.

Fuzzy MADM completion steps with the Simple Additive Weighting (SAW) method can generally be described with the diagram below:

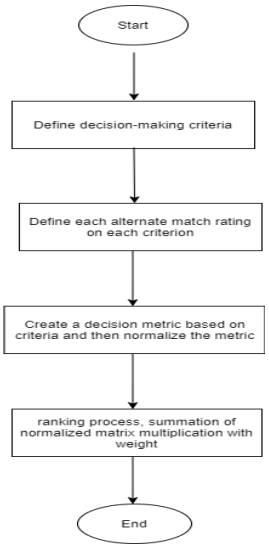

Figure 3. Research Framework FlowChart.

$$X = \begin{bmatrix} 5 & 4 & 5 & 3 & 2 & 1 & 3 & 4 \\ 5 & 3 & 3 & 2 & 2 & 3 & 1 & 3 \\ 4 & 4 & 5 & 2 & 2 & 2 & 3 & 4 \\ 3 & 2 & 4 & 2 & 2 & 1 & 1 & 2 \\ 5 & 4 & 3 & 2 & 1 & 2 & 3 & 2 \\ 2 & 1 & 5 & 2 & 1 & 1 & 3 & 1 \end{bmatrix}$$

The next step is to normalize matrix X into matrix R, with the criteria attribute being benefit, with the formula:

$$Rij=(\{\frac{xij}{\max xij}\})$$

If j is the benefit attribute, then the calculation becomes:

• Fardhu Prayer

$$R_{1.1} = \frac{5}{\max(5,5,4,3,5,2)} = \frac{5}{5} = 1$$

$$R_{2.1} = \frac{5}{\max(5,5,4,3,5,2)} = \frac{5}{5} = 1$$

$$R_{3.1} = \frac{4}{\max(5,5,4,3,5,2)} = \frac{4}{5} = 0{,}80$$

$$R_{4.1} = \frac{3}{\max(5,5,4,3,5,2)} = \frac{3}{5} = 0{,}60$$

$$R_{5.1} = \frac{5}{\max(5,5,4,3,5,2)} = \frac{5}{5} = 1$$

$$R_{6.1} = \frac{2}{\max(5,5,4,3,5,2)} = \frac{2}{5} = 0{,}40$$

• Family Income

$$R_{1.2} = \frac{4}{\max(4,3,4,2,4,1)} = \frac{4}{4} = 1$$

$$R_{2.2} = \frac{3}{\max(4,3,4,2,4,1)} = \frac{3}{4} = 0{,}75$$

$$R_{3.2} = \frac{4}{\max(4,3,4,2,4,1)} = \frac{4}{4} = 1$$

$$R_{4.2} = \frac{2}{\max(4,3,4,2,4,1)} = \frac{2}{4} = 0{,}50$$

$$R_{5.2} = \frac{4}{\max(4,3,4,2,4,1)} = \frac{4}{4} = 1$$

$$R_{6.2} = \frac{1}{\max(4,3,4,2,4,1)} = \frac{1}{4} = 0{,}25$$

• Reading the Quran

$$R_{1.3} = \frac{5}{\max(5,3,5,4,3,5)} = \frac{5}{5} = 1$$

$$R_{2.3} = \frac{3}{\max(5,3,5,4,3,5)} = \frac{3}{5} = 0{,}60$$

$$R_{3.3} = \frac{5}{\max(5,3,5,4,3,5)} = \frac{5}{5} = 1$$

$$R_{4.3} = \frac{4}{\max(5,3,5,4,3,5)} = \frac{4}{5} = 0{,}80$$

$$R_{5.3} = \frac{3}{\max(5,3,5,4,3,5)} = \frac{3}{5} = 0{,}60$$

$$R_{6.3} = \frac{5}{\max(5,3,5,4,3,5)} = \frac{5}{5} = 1$$

• Prayer sunnah Rawatib

$$R_{1.4} = \frac{3}{\max(3,2,2,2,2,2)} = \frac{3}{3} = 1$$

$$R_{2.4} = \frac{2}{\max(3,2,2,2,2,2)} = \frac{2}{3} = 0{,}67$$

$$R_{3.4} = \frac{2}{\max(3,2,2,2,2,2)} = \frac{2}{3} = 0{,}67$$

$$R_{4.4} = \frac{2}{\max(3,2,2,2,2,2)} = \frac{2}{3} = 0{,}67$$

$$R_{5.4} = \frac{2}{\max(3,2,2,2,2,2)} = \frac{2}{3} = 0{,}67$$

$$R_{6.4} = \frac{2}{\max(3,2,2,2,2,2)} = \frac{2}{3} = 0{,}67$$

• Study Activities

$$R_{1.5} = \frac{2}{\max(2,2,2,2,1,1)} = \frac{2}{2} = 1$$

$$R_{2.5} = \frac{2}{\max(2,2,2,2,1,1)} = \frac{2}{2} = 1$$

$$R_{3.5} = \frac{2}{\max(2,2,2,2,1,1)} = \frac{2}{2} = 1$$

$$R_{4.5} = \frac{2}{\max(2,2,2,2,1,1)} = \frac{2}{2} = 1$$

$$R_{5.5} = \frac{1}{\max(2,2,2,2,1,1)} = \frac{1}{2} = 0{,}5$$

$$R_{6.5} = \frac{1}{\max(2,2,2,2,1,1)} = \frac{1}{2} = 0{,}5$$

• Number of Dependents

$$R_{1.6} = \frac{1}{\max(1,3,2,1,2,1)} = \frac{1}{3} = 0{,}33$$

$$R_{2.6} = \frac{3}{\max(1,3,2,1,2,1)} = \frac{3}{3} = 1$$

$$R_{3.6} = \frac{2}{\max(1,3,2,1,2,1)} = \frac{2}{3} = 0{,}67$$

$$R_{4.6} = \frac{1}{\max(1,3,2,1,2,1)} = \frac{1}{3} = 0{,}33$$

$$R_{5.6} = \frac{2}{\max(1,3,2,1,2,1)} = \frac{2}{3} = 0{,}67$$

$$R_{6.6} = \frac{1}{\max(1,3,2,1,2,1)} = \frac{1}{3} = 0{,}33$$

• Where to Stay

$$R_{1.7} = \frac{3}{\max(3,1,3,1,3,3)} = \frac{3}{3} = 1$$

$$R_{2.7} = \frac{1}{\max(3,1,3,1,3,3)} = \frac{1}{3} = 0{,}33$$

$$R_{3.7} = \frac{3}{\max(3,1,3,1,3,3)} = \frac{3}{3} = 1$$

$$R_{4.7} = \frac{1}{\max(3,1,3,1,3,3)} = \frac{1}{3} = 0{,}33$$

$$R_{5.7} = \frac{3}{\max(3,1,3,1,3,3)} = \frac{3}{3} = 1$$

$$R_{6.7} = \frac{3}{\max(3,1,3,1,3,3)} = \frac{3}{3} = 1$$

$$R = \begin{bmatrix} R\,1.1 & R\,1.2 & R\,1.3 & R\,1.4 & R\,1.5 & R\,1.6 & R\,1.7 & R\,1.8 \\ R\,2.1 & R\,2.2 & R\,2.3 & R\,2.4 & R\,2.5 & R\,2.6 & R\,2.7 & R\,2.8 \\ R\,3.1 & R\,3.2 & R\,3.3 & R\,3.4 & R\,3.5 & R\,3.6 & R\,3.7 & R\,3.8 \\ R\,4.1 & R\,4.2 & R\,4.3 & R\,4.4 & R\,4.5 & R\,4.6 & R\,4.7 & R\,4.8 \\ R\,5.1 & R\,5.2 & R\,5.3 & R\,5.4 & R\,5.5 & R\,5.6 & R\,5.7 & R\,5.8 \\ R\,6.1 & R\,6.2 & R\,6.3 & R\,6.4 & R\,6.5 & R\,6.6 & R\,6.7 & R\,6.8 \end{bmatrix}$$

Figure 4. Matrix R.

Once the matrix becomes normalized, the next step is to perform a warking by summing from the multiplication of the normalized matrix row element (R) with a preference weight (W) corresponding to the matrix column element (W).

Table 3. Preference Calculation Results.

Nama	K1	K2	K3	K4	K5	K6	K7	K8
	20 %	20 %	15 %	10%	12 %	10%	8%	5%
A1	0.2	0.2	0.15	0.1	0.12	0.033	0.08	0.05
A2	0.2	0.15	0.09	0.067	0.12	0.1	0.027	0.038
A3	0.16	0.2	0.15	0.067	0.12	0.067	0.08	0.05
A4	0.12	0.1	0.12	0.067	0.12	0.033	0.027	0.025
A5	0.2	0.2	0.09	0.067	0.06	0.067	0.08	0.025
A6	0.08	0.05	0.15	0.067	0.06	0.033	0.08	0.013

Table 4. Results of The Value Acquisition Process

No	Name	Results
1	A1	0.933
2	A2	0.791
3	A3	0.893
4	A4	0.612
5	A5	0.788
6	A6	0.533

Next it will be sorted values from the highest to the lowest values.

Table 5. Rangking

Name	Results	Results
A1	0.933	1
A2	0.791	2
A3	0.893	3
A4	0.612	4
A5	0.788	5
A6	0.533	6

From the table above, the highest value is owned by alternative A1 with a value of 0.933. Thus, it can be concluded that the best alternative group of mustahik service program beneficiaries is A1.

B. Software Needs Analysis

This mustahik service decision support system is a system that serves to calculate the value of each alternative of each criterion. Software needs can be described through the Use Case and Activity diagrams below:

1. Use Case Diagram

The following process is the decision-making process of assisting The Mustahik PPPA Daarul Quran Service in Tangerang Center using a web-based system.

Figure 5. Use Case Diagram

Table 6. Description of Use Case Diagram Dashboard.

Use Case	Dashboard
Requirement	A2
Goal	Ensure permissions as per admin authority
Description	Admins can see Dashboard
Primary Actors	Admin
Main Flow/Basic Path	a. Admin view dashboard b. Admins see alternative data c. Admin sees criteria data d. Admins view calculations and rankings e. Admin sees SAW theory

Table 7. Description of Use Case Criteria Diagram.

Use Case Name	Criteria
Requirement	A3
Goal	Admins can add, change, delete criteria data and subcriteria.
Pre-condition	Admin signed in
Primary actors	Admin
Main flow/basic path	Admin view criteria data form Admin adds criteria data Admin adds sub-criteria data Admins can store data on criteria and subcriteria.
Alternate flow/Invariant 1	3A. Admin changes criteria data and sub criteria
Invariant	3B. Admin deletes data criteria and sub criteria

Table 8. Description of Use Case Diagram Ranking.

Use Case Name	Rangking
Requirement	A5
Goal	● Admin dapat menghitung nilai alternatif setiap kriteria. ● Admin dapat menentukan alternatif terbaik
Pre-condition	Admin telah login
Post-condition	Data Perhitungan tersimpan
Primary actors	Admin
Main flow/basic path	Admin melihat form perangkingan Admin menghitung Normalisasi Admin menghitung preferensi Admin menentukan alternatif terbaik

2) User Interface

Here is the Ranking page used to display the ranking calculation results.

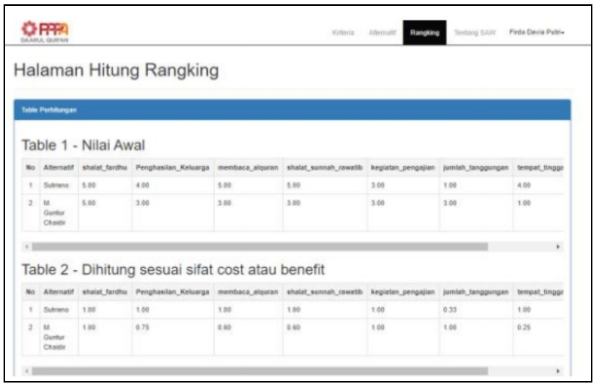

Figure 6. Ranking Page.

4. Conclusion

From the discussion of the decision support system in the recipient of mustahik service program in Laznas PPPA Daarul Quran Pusat Tangerang, it can be concluded that: With the support system of this decision, the assessment process can be done quickly, accurately, precisely, efficiently, and better than the present. A sound decision support system will facilitate decision-making to improve the performance of the staff of Mustahik PPPA Daarul Quran Service.

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