Development Of Poor Family Selection System Using Simple Multi Attribute Rating Technique Exploiting Rank Method

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Abstract. In overcoming the problem of poverty, the Office of Community and Village Empowerment of Sampang Regency implements the GEMASAHABAT (Joint Movement Towards Harmonious and Dignified Movement). This program is a program of providing assistance to poor families, but with a large number of poor families, a ranking process is needed to find out poor families that are right on target. The program can be assisted by the existence of a method designed into a decision support system that can include assessment parameters related to ranking poor families, a method deemed appropriate in assisting the ranking process, namely the Simple Multi-Attribute Branch Technique Exploiting Ranks (SMARTER) method, where the method is part of the Multiple Criteria Decision-Making method. This method was chosen because it can rank data with multiple criteria. The results of this study are software that was developed based on 100% functionality test and 91% of speed tests stated that high speed and ease of implementation.

1. Introduction

Sampang Regency Development Vision 2013 - 2018 as mentioned in the Regional Medium-Term Development Plan (RPJMD) is "The realization of a Healthy Bureaucracy, Strong Communities and Friendly Environments for the Achievement of the Dignified Sampang District" with the mission "Improving Quality and Affordable Basic Services" to improve handling people with social welfare problems including handling poverty problems. The RPJMD also mandates that in poverty alleviation, an ongoing program based on village community empowerment is needed in the community.

As a manifestation of one of these visions and missions, Sampang Regency implements the GEMA SAHABAT Program (Joint Movement towards Harmonious and Dignified Sampang) which is a commitment to poverty alleviation programs between the Sampang Regent and the Governor of East Java Province in accordance with the Joint agreement as the development of the JALIN KESRA program (Another Road to Community Welfare).

The Government of Sampang District has designed a program to overcome poverty through GEMASAHABAT, where the program is not only a short-term effort to provide assistance to poor families but this program is sustainable to anticipate the poverty trap. Therefore, to facilitate the ranking of poor household heads, a decision-making system design is needed, namely the selection
procedure for ranking poor families so that assistance can be achieved on target. The decision support system uses the SMARTER (Simple Multi-Attribute Rating Technique Exploiting Ranks) method. SMARTER is a variant of the SMART method that is characterized by being applicable to problems of a compensatory nature in that it makes use of the additive aggregation procedure for alternative criteria[1]. SMARTER is a method of improvement from the SMART method because assigning exact numerical weights in SMART can be a difficult task which is susceptible to uncertainty and the confidence level associated with such weights[2]. This method is an extension of Weighted Sum that allows stakeholders to use value functions to assess alternative with respect to criteria[3]. This Model are particularly suited to discrete problems, i.e. problems were the number of alternatives is limited[4].

This method was chosen because it can complete practical decision making with a simple and easy-to-understand concept, with the ranking method, it is expected that the assessment will be more appropriate because it is based on the criteria weighting and sub-criteria weight that has been set so that it will get more results accurate to the head of poor households who are considered the most appropriate to receive this assistance.

2. Methodology

The Smarter (Simple Multi-Attribute Rating Technique Exploiting Ranks) method is a modification of the SMART (Simple Multi-Attribute Rating technique) method proposed by Edwards and Baron (1994), where both methods are used to determine the weight of each criterion. Weighting in the SMARTER method uses a range between 0 to 1, making it easier to calculate and compare values for each alternative[5].

General SMARTER method formula:

$$\sum_{j=1}^{K} W_i W_j, \forall i = 1 \text{ ton} \quad (1)$$

Weight W got from:

$$W_k = \left( \frac{1}{K} \right) \sum_{j=K}^{K} \left( \frac{1}{j} \right)$$

There are two things that underlie the SMARTER method (according to Edwards and Baron), namely:

1. Simple technique, so that it can be used by decision-makers.
2. Easy techniques to get reliable decisions.

What distinguishes between SMARTER and SMART methods is the weighting problem [6]. In the SMARTER method, weights are calculated using the Rank Order Centroid (ROC) weighting formula. This ROC is based on the level of importance or priority of the criteria [7]. ROC weighting is obtained by a simple mathematical procedure of priority. The basic idea can be illustrated by 2 attributes, A and B. If A is ranked first, then the weight must be between 0.5 and 1 so that the midpoint of the interval of 0.75 is taken as an approximate weight, which is the basis of a principle of minimum commitment. Like weight, B will be 0.25 (is the midpoint between 0 and 0.5) [5].

This procedure can be formulated as follows (if there are K criteria):

- \( W_1 > W_2 > W_3 > \ldots \ldots > W_K \)
- \( W_1 = (1 + \frac{1}{2} + \frac{1}{3} + \ldots + \frac{1}{k})/k \)
- \( W_2 = (0 + \frac{1}{2} + \frac{1}{3} + \ldots + \frac{1}{k})/k \)
- \( W_3 = (0 + 0 + \frac{1}{3} + \ldots + \frac{1}{k})/k \)
  
- \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots

Example: 2 attributes

- \( W_1 = (1 + 0.5 ) = 0.75 \)
- \( W_2 = ( 0 + 0.5 ) = 0.25 \)
Example: 3 attributes
$W_1 = (1 + \frac{1}{2} + \frac{1}{3}) = 0.6111$
$W_2 = (0 + \frac{1}{2} + \frac{1}{3}) = 0.2777$
$W_3 = (0 + 0 + \frac{1}{3}) = 0.1111$

In general, if K is the number of criteria, the weighting of the criteria to K is:

$$W_k = \left(\frac{1}{K}\right) \sum_{j=K}^{K} \left(\frac{1}{i}\right)$$  \hspace{1cm} (3)
The criteria used as input or parameters in the system include:

Table 1. Criteria as Input

| No | Criteria                                       | No | Criteria                                           |
|----|-----------------------------------------------|----|---------------------------------------------------|
| 1  | No Sort Family                                | 16 | Drinking water source                            |
| 2  | sub-district                                  | 17 | How to get drinking water                        |
| 3  | Village                                       | 18 | The main source of lighting                      |
| 4  | Address                                       | 19 | Electric power installed                         |
| 5  | Name of family head                           | 20 | Cooking fuel                                     |
| 6  | Number of family members                      | 21 | Use of bowel facilities                          |
| 7  | Number of families                            | 22 | Toilet type                                      |
| 8  | Welfare Status (Decile)                       | 23 | Feces disposal site                              |
| 9  | Status of ownership of residential buildings  | 24 | Ownership of 5.5 kg gas cylinders or more        |
| 10 | Status of residential land ownership          | 25 | Refrigerator / refrigerator ownership            |
| 11 | Widest floor type                             | 26 | AC ownership                                     |
| 12 | Widest wall type                              | 27 | Water heater ownership                           |
| 13 | Widest wall quality                           | 28 | Telephone connection ownership                   |
| 14 | Widest roof type                              | 29 | Television ownership                             |
| 15 | Widest roof quality                           | 30 | Gold ownership                                   |
| 31 | Ownership of computers                        | 32 | Bike ownership                                   |
| 33 | Motorcycle ownership                          | 34 | Car Ownership                                    |
| 35 | Boat ownership                                | 36 | Outboard motor ownership                        |
| 37 | Owned motorboat                               | 38 | Ship ownership                                   |
| 39 | Land ownership                                | 40 | Home ownership in another location              |
| 41 | There are members of a household that have their own business | 42 | Have a KKS                                      |
| 43 | PKH program participants                      | 44 | Participants in the Raskin program               |
| 45 | KUR program participants                      |    |                                                  |

Description in figure 1:

1. Start, the admin logs in using a password and username, if the password and username are incorrect then the admin must log in again.
2. If the admin has successfully logged in, the system will display a start page.
3. On the home page, the admin can see the menu selection and can input data (sub-district, village, sub-village, family data).
4. Admin to collect assessment indicators (criteria and sub-criteria).
5. The system performs the weighting process for each indicator using the formula:

\[
ROC : W_k = \left(\frac{1}{K}\right) \sum_{j=1}^{K} \left(\frac{1}{I}\right)
\]  

(4)
6. Admin to assess each family using indicators that have been weighted by the system, by entering the value in accordance with the evaluation of the situation of the related family.
7. After the admin makes an assessment the system will calculate the entire amount of value that is owned by the family.
8. The system ranks ascending automatically, end.

The test is carried out using the functionality test which is carried out with the aim to find out whether the conceptual translator into a decision support system has been done correctly or not, the following will be explained in Table 2 below:

**Table 2. System Functionality Test**

| Description                        | Testing Procedure                                      | Input                                             | Output                                                | Conclusion |
|------------------------------------|--------------------------------------------------------|---------------------------------------------------|-------------------------------------------------------|------------|
| Log in to the system               | Admin enters username and password then presses the login button | Input any username and password                  | Display warning form username and password incorrect | accepted   |
|                                    |                                                        | Enter correct username, wrong password             | Display the warning form username and password incorrect | accepted   |
|                                    |                                                        | Incorrect username input, correct password         | Display warning form username and password incorrect | accepted   |
| Input and edit master data         | The user selects the input menu and edits the master data | Data input is completely filled in accordance with the available forms | Data will be saved and will be displayed by the system | accepted   |
|                                    |                                                        | Change the data in the edit form correctly         | Data in the table will change according to what has been changed | accepted   |
| Erase data                         | The user selects the deleted data in the master table  | Click the delete button according to the table column you want to delete | The system will display a pop up if the data will be deleted or not. | accepted   |
| See data                           | Select the data view menu                              | Select the menu to display                         | The system will display the selected data              | accepted   |

Testing the User Acceptance Test conducted at the Office of Community and Village Empowerment is to give the user the right to directly assess the ranking system of poor families in the form of questionnaires. The assessment categories used for the questionnaire in units of % include:

1. Very High / Very Easy
2. High / Easy
3. Low / Difficult
4. Very Low / Very Difficult
Table 3. Question Table

| No | Question                        |
|----|---------------------------------|
| 1  | How fast is the data input process |
| 2  | Data Search Speed               |
| 3  | Data Processing Speed           |
| 4  | Ease of Weighting               |
| 5  | Ease of use of the software     |

3. Result and Discussion

From the system functionality test, it is found that the system runs well, because every time a problem is related to the user, the researcher will immediately improve the user interface that is being developed. So for the 100% functionality test results, the user can use software that has been produced from this research. In testing the data input speed, data processing, and data search resulted in 91.6% expressed high speed, as shown in Figure 2 below.

Figure 2. Speed Testing Results

For testing the ease of giving weight and ease of use of the application used 37.5% stated very easy and 62.5% stated easy. As shown in Figure 3 below. This shows that the implementation of software developed is quite helpful for the job. The work became more efficient in terms of time, compared to the old system which was still manual.
Figure 3. Weighting Test Results and User Interface

The new system provides convenience in the ranking according to the weighting that has been carried out against existing criteria.

4. Conclusion

The conclusion that can be drawn from the development of software prototypes for the Decision Support System ranking of poor families using the SMARTER method is that the system can make it easier for administrators to rank poor families automatically by and also the use of the SMARTER method can provide efficient use of the many assessment indicators in weighting the value of each criterion. Further research can be proposed for the development and improvement of the Decision Support System for ranking poor families is that by using different indicators it is possible that the assessment process can be different. a comparison using this method can then be combined with other methods.

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