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Decision Support System for Determining Underprivileged Communities as a Government Guide in the Family Hope Program

Elsa Marindi
Indo Global Mandiri University

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Corresponding Author:

Elsa Marindi
Indo Global Mandiri University, Indonesia

Abstract

This study addresses the economic disparity in Indonesia by enhancing the selection process for beneficiaries of the Family Hope Program (PKH), a government initiative providing financial assistance to very poor households. Traditionally, the selection process is manual and prone to inefficiency and fraud. To improve objectivity and accuracy, a Decision Support System (DSS) utilizing the TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) method is proposed. TOPSIS ranks households based on multiple welfare criteria, such as income, housing conditions, and basic amenities, identifying those closest to the ideal solution. The system effectively prioritizes aid distribution by assigning a closeness coefficient to each household, enabling a more efficient allocation of resources. The results show that households with the highest coefficients, such as V1 (0.637367819), are prioritized for assistance, while those with lower scores, like V7 (0.139295032), are ranked lower. This method ensures that government aid reaches the most underprivileged communities.

Keywords: *Family Hope Program (PKH), Decision Support System (DSS), TOPSIS*

Abstrak

Studi ini membahas kesenjangan ekonomi di Indonesia dengan meningkatkan proses seleksi penerima manfaat Program Keluarga Harapan (PKH), sebuah inisiatif pemerintah yang menyediakan bantuan keuangan bagi rumah tangga yang sangat miskin. Secara tradisional, proses seleksi bersifat manual dan rentan terhadap inefisiensi dan penipuan. Untuk meningkatkan objektivitas dan akurasi, Sistem Pendukung Keputusan (SPK) yang memanfaatkan metode TOPSIS (Teknik Urutan Preferensi Berdasarkan Kesamaan dengan Solusi Ideal) diusulkan. TOPSIS memberi peringkat rumah tangga berdasarkan beberapa kriteria kesejahteraan, seperti pendapatan, kondisi perumahan, dan fasilitas dasar, untuk mengidentifikasi rumah tangga yang paling dekat dengan solusi ideal. Sistem ini secara efektif memprioritaskan distribusi bantuan dengan menetapkan koefisien kedekatan untuk setiap rumah tangga, yang memungkinkan alokasi sumber daya yang lebih efisien. Hasilnya menunjukkan bahwa rumah tangga dengan koefisien tertinggi, seperti V1 (0,637367819), diprioritaskan untuk mendapatkan bantuan, sedangkan rumah tangga dengan skor lebih rendah, seperti V7 (0,139295032), diberi peringkat lebih rendah. Metode ini memastikan bahwa bantuan pemerintah menjangkau masyarakat yang paling kurang mampu.

Kata kunci: Family Hope Program (PKH), Decision Support System (DSS), TOPSIS

1. INTRODUCTION

The economic gap between regions in Indonesia remains substantial, leading to an imbalance in the overall economic structure [1]-[3]. This disparity is reflected in the uneven distribution of income and the ongoing challenges people face in securing basic needs such as clothing, food, and housing, all essential for societal prosperity. Without meeting these fundamental needs, true prosperity cannot be attained. To tackle these issues, the government has introduced various poverty reduction initiatives, including the provision of social funds to disadvantaged communities. In Indonesia, prosperity levels are divided into deciles, ranging from Decile 1 to Decile 10, with Deciles 1 to 4 representing individuals with low to very low welfare levels. One of the government's main efforts to reduce poverty is the Family Hope Program (Program Keluarga Harapan, PKH), a social safety net that provides financial support to Very Poor Households (RTSM) that meet certain requirements. These requirements include factors such as housing conditions, income, family size, occupation, and basic amenities like flooring, walls, roofing, electricity, water, and sanitation facilities. These factors are used to determine which households should receive PKH assistance.

Normally, the process of registering PKH recipients is managed by the local RT head, who submits the information to the village authorities, and from there, the Social Service distributes the funds. However, the current process of selecting PKH beneficiaries still relies on traditional methods, such as manually recording eligible households, which is inefficient and susceptible to fraud. To improve the objectivity of the PKH selection process, a system is required to process the data and provide the necessary information, such as ranking community members. This system, known as a Decision Support System (DSS), can help identify PKH recipients more accurately based on set criteria [4]-[10]. To address these issues, the author suggests utilizing the TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) method to enhance decision-making in multi-criteria problems and ensure optimal results [11]-[15]. This approach involves evaluating alternatives based on the given criteria, normalizing the data, and selecting the best option based on the highest score. Incorporating this method into the DSS will enable more accurate household rankings, ensuring that aid is directed to the most deserving recipients.

2. METHOD

TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) is a multi-criteria decision-making method used to rank alternatives based on their similarity to an ideal solution. It works by identifying the best (ideal) and worst (negative ideal) solutions, then calculating how close each alternative is to these extremes. The alternative closest to the ideal solution and farthest from the negative ideal is ranked the highest. The key steps in TOPSIS are:

1. Construct the decision matrix: A matrix where rows represent alternatives and columns represent criteria.
2. Normalize the decision matrix: Each element of the matrix is normalized to eliminate scale differences using:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \quad (1)$$

where r_{ij} is the normalized value, x_{ij} is the original value, and m is the number of alternatives.

3. Calculate the weighted normalized decision matrix: Multiply each normalized value by its corresponding weight:

$$v_{ij} = w_j \cdot r_{ij} \quad (2)$$

where v_{ij} is the weighted normalized value and w_j is the weight of criterion j.

4. Determine the ideal and negative ideal solutions:
   a. Ideal solution: A^+={max((v_{ij}) for benefit criteria,min((v_{ij}) for cost criteria}
   b. Negative ideal solution: A^-={min((v_{ij}) for benefit criteria,max((v_{ij}) for cost criteria}

5. Calculate the Euclidean distance of each alternative from the ideal and negative ideal solutions:

$$S_i^+ = \sqrt{\sum_{j=1}^{n} (v_{ij} - A_j^+)^2}, \quad S_i^- = \sqrt{\sum_{j=1}^{n} (v_{ij} - A_j^-)^2} \quad (3)$$

where S_i^+ and S_i^- are the distances to the ideal and negative ideal solutions, respectively.

6. Calculate the relative closeness to the ideal solution:

$$C_i = \frac{S_i^-}{S_i^+ + S_i^-} \quad (4)$$

where C_i is the closeness coefficient, indicating how close the alternative is to the ideal solution.

7. Rank the alternatives: The alternative with the highest C_i is considered the best choice.

3. RESULTS AND DISCUSSION

Table 1 shows the results of calculating the relative closeness to the ideal solution using equation (4).

Table 1 - The closeness coefficient

Preference	Coefficient	Rank
V1	0.637367819	1
V2	0.597565406	4
V3	0.523536353	6
V4	0.58284708	5
V5	0.357561327	13
V6	0.391702784	11
V7	0.139295032	15
V8	0.385077965	12
V9	0.329665988	14
V10	0.48288769	7
V11	0.48288769	7
V12	0.608630429	3
V13	0.401505755	10
V14	0.432812679	9
V15	0.609588235	2

The closeness coefficient calculated for each household provides a measure of how close they are to the ideal solution (the most underprivileged), enabling the government to prioritize aid distribution objectively. The table shows the closeness coefficients for different preferences (households), with higher coefficients indicating a closer alignment to the criteria for underprivileged status. From the provided table, preference V1 ranks first with a closeness coefficient of 0.637367819, suggesting that this household is the most in need of assistance. Similarly, V15 and V12 follow closely with coefficients of 0.609588235 and 0.608630429, respectively, indicating their high priority for aid. On the other hand, preferences like V7, V9, and V5, which have the lowest coefficients, rank towards the bottom, indicating they are less likely to be classified as underprivileged based on the established criteria. This ranking system allows the government to efficiently allocate resources and ensure that PKH assistance reaches the households that need it the most.

The system interface design is shown in Figure 1 and Figure 2. Figure 1 contains the interface of calculation results of the TOPSIS method, starting from weighting, normalized decision matrix, normalized and weighted decision matrix, ideal solution value, and preference results.

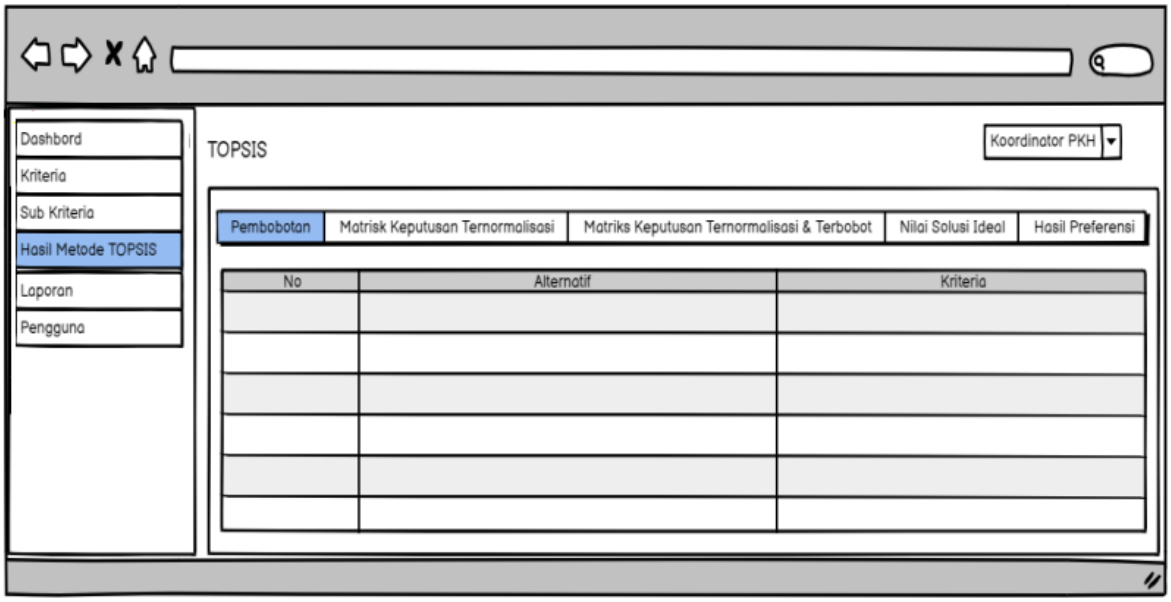

Figure 1 - The interface of calculation results

Figure 2 shows the Report page interface that can be accessed and viewed by management.

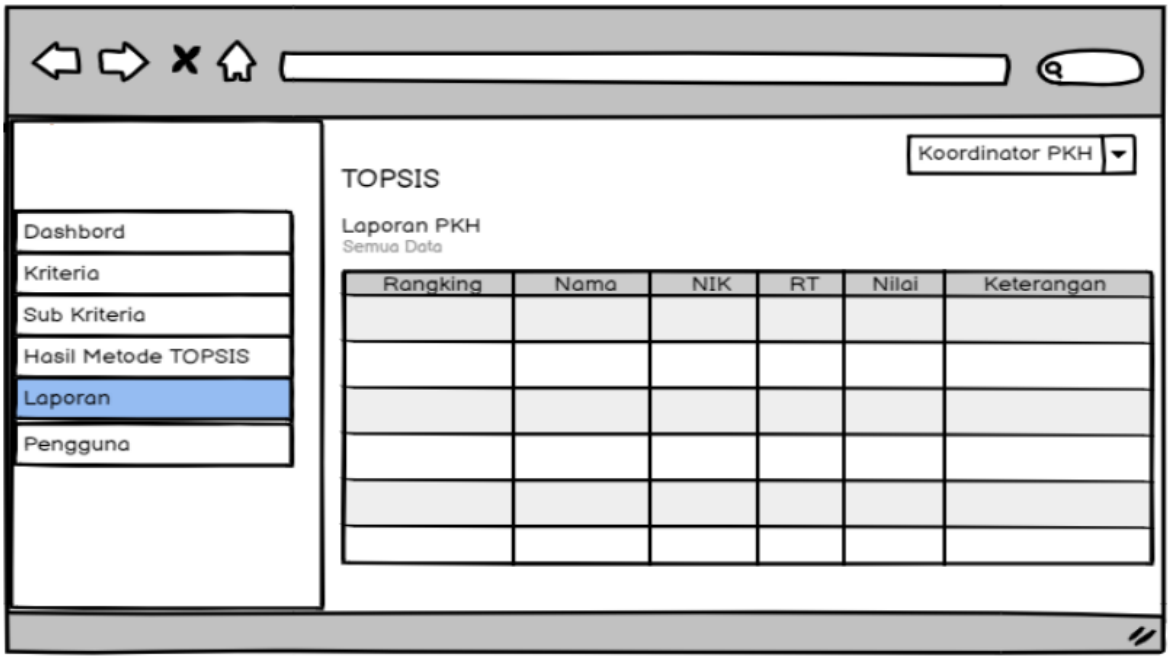

Figure 2 - The report page interface

4. CONCLUSION

The implementation of a Decision Support System (DSS) utilizing the TOPSIS method offers an effective and objective solution for determining underprivileged households eligible for government assistance through the Family Hope Program (PKH). By evaluating various criteria related to household welfare, the TOPSIS method ranks households based on their closeness to an ideal solution, ensuring that aid is directed to those most in need. The results of the ranking system, as demonstrated in Table 1, highlight the efficiency of the method in identifying households for priority assistance. With the integration of this system, the government can allocate resources more effectively, reducing inefficiencies and potential fraud in the manual selection process while ensuring that the PKH program reaches its intended beneficiaries.

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