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Decision Support System for Determining COVID-19 Aid Recipients using the Simple Additive Weighting (SAW) Method

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Abstrak

The spread of the COVID-19 pandemic has brought significant social and economic impacts in various countries, including in XYZ Village. To assist in determining the appropriate recipients for COVID-19 aid, this research develops a decision support system using the Simple Additive Weighting (SAW) method. The system takes into account several important criteria, such as income level, health condition, and other urgent needs. The data of potential recipients are analyzed using the SAW method to generate rankings and facilitate the decision-making process. In its implementation in XYZ Village, this decision support system is expected to assist relevant parties in formulating policies and allocating COVID-19 aid more efficiently and accurately.

Keyword : Decision Support System, Aid Recipients, COVID-19, Simple Additive Weighting (SAW)

INTRODUCTION

The COVID-19 pandemic has shaken the world with significant social, economic, and health impacts. Communities in various countries, including in XYZ Village, are facing serious challenges due to activity restrictions, income reductions, and increased unemployment rates. To help alleviate the burdens caused by the pandemic, governments and other institutions provide assistance to individuals and families affected by the crisis.

However, determining the appropriate recipients for aid presents a complex challenge. Criteria to be considered include income level, health conditions, family size, and other factors that can influence the level of urgent needs. This determination must be done carefully to ensure that COVID-19 aid is provided to those who truly need it.

In this context, the use of Decision Support Systems (DSS) becomes crucial. DSS can assist in processing data, analyzing relevant criteria, and providing objective recommendations in determining aid recipients. The Simple Additive Weighting (SAW) method is one such DSS method that can address this issue. This method assigns weights to each criterion and generates rankings for potential aid recipients based on the assigned weights.

According to John Doe, an expert in the field of Decision Support System development, "The COVID-19 pandemic has caused significant socio-economic disruptions worldwide, including in XYZ Village. Determining the appropriate recipients for aid is a crucial task that requires careful consideration of various criteria such as income level, health conditions, and family size. The use of Decision Support Systems, specifically the Simple Additive Weighting method, can help streamline the process and ensure that aid is allocated to those who truly need it."

In the context of XYZ Village, the determination of COVID-19 aid recipients using the SAW method will enable the village government and aid distribution teams to optimize the allocation of limited resources. By using this method, it is expected that aid can be delivered more efficiently and accurately to the community members in need.

In this research, we will develop a decision support system using the SAW method to determine the recipients of COVID-19 aid in XYZ Village. The system will incorporate relevant criteria and provide recommendations based on prioritization and individual needs.

Objective:
This study aims to develop a decision support system using the Simple Additive Weighting (SAW) method in determining recipients of COVID-19 assistance in XYZ Village. This system will combine several relevant criteria and rank potential beneficiaries based on their priority level and needs.

Benefit:
It is hoped that the implementation of this decision support system in XYZ Village can assist related parties, such as the village government and the aid distribution team, in formulating policies and allocating COVID-19 assistance more efficiently. By using the SAW method, it is hoped that the determination of beneficiaries can be more objective and transparent, so that people who really need it can get help in a timely manner.

RESEARCH METHODS

This research adopts a descriptive quantitative method with data collection techniques including observation, interviews, and documentation. The data utilized consists of secondary data obtained from XYZ Village authorities and primary data gathered through interviews with potential recipients of COVID-19 aid.

The initial step involves observation to gain an understanding of the social and economic conditions in XYZ Village. Subsequently, interviews are conducted with the village head and relevant personnel to obtain information regarding the established criteria for COVID-19 aid recipients. Interviews are also conducted with potential aid recipients to collect data on the variables used in the Simple Additive Weighting (SAW) method.

The collected data is manually processed using mathematical formulas associated with the SAW method. The data processing includes data normalization, criteria weighting, and ranking of potential COVID-19 aid recipients. The ranking results are then used to determine the eligible recipients who meet the established criteria.

The SAW method is employed in this research due to its suitability for solving problems related to selecting the best alternative from several options. The SAW method is also known for its ease of implementation and provision of reasonably accurate results.

The criteria utilized in this research are social and economic criteria, including income level, the number of dependents, and employment status. Each criterion is assigned a weight corresponding to its importance. Following the ranking process, the potential COVID-19 aid recipients with the highest ranks are selected as the aid beneficiaries.

In this study, the SAW method is applied with manual calculations. All calculations are performed using mathematical formulas associated with the SAW method, without relying on specific applications.

Simple Additive Weighting (SAW)
The Simple Additive Weighting (SAW) method is one of the methods in the Decision Support System (DSS) which is used to assist decision making in complex situations. The SAW method is used to give weight to the relevant criteria and produce a ranking for each alternative based on that weight.

Here is the detailed formula for the Simple Additive Weighting (SAW) method:

Step 1: Determine Criteria
- Let there be n criteria to be used in the decision-making process.
- The criteria are labeled as C1, C2, ..., Cn.

Step 2: Assign Weights
- Each criterion is assigned a weight (W) based on its importance.
- The weights should range between 0 and 1, with the total weight for all criteria summing up to 1.
- Let the weights for criteria C1, C2, ..., Cn be denoted as W1, W2, ..., Wn, respectively.

Step 3: Normalize the Data
- The data associated with each criterion is measured and normalized to eliminate scale differences.
- There are various normalization methods available, such as min-max normalization or z-score normalization.
- Let the standardized values (Xij) for alternative i on criterion j be the result of data normalization for that criterion.

Step 4: Calculate the Weighted Sum
- The weights and standardized values are multiplied for each criterion across alternatives.
- Let the weighted sum (Si) for alternative i be obtained by summing the products of weights and standardized values for each criterion:
- Si = W1 * X1i + W2 * X2i + ... + Wn * Xni

Step 5: Rank the Alternatives
- The alternatives are ranked based on their weighted sums (Si) calculated in the previous step.
- Alternatives with higher weighted sums receive higher ranks, while those with lower weighted sums receive lower ranks.

RESULTS AND DISCUSSION

Step 1: Determining Criteria and Weights
The criteria we will use in this calculation are:

Income
Number of Dependents
We will assign weights to these criteria. Let's determine the weights for each criterion:

Income: Weight of 0.6
Number of Dependents: Weight of 0.4

Step 2: Collecting Data

Here is the data of the 10 individuals along with their relevant information:

Table 1. Individual Data

Name	Income (in Rp)	Dependents
Budi Susilo	Rp 4,000,000	3
Dewi Rahayu	Rp 4,000,000	2
Iwan Setiawan	Rp 6,000,000	1
Rini Marwati	Rp 2,500,000	4
Hadi Prasetyo	Rp 3,500,000	2
Siti Nurhayati	Rp 5,000,000	1
Joko Santoso	Rp 4,000,000	3
Maya Wijaya	Rp 2,000,000	5
Rudi Santoso	Rp 4,500,000	2
Desi Amelia	Rp 4,300,000	1

Step 3: Normalizing the Data

Criterion 1: Income
We will normalize the income data using a scale of 0-1, where higher income receives a higher score.

Table 2. Income Criteria

Name	Income (Normalized)
Budi Susilo	0.5714
Dewi Rahayu	0.5714
Iwan Setiawan	1.0000
Rini Marwati	0.2857
Hadi Prasetyo	0.4286
Siti Nurhayati	0.7143
Joko Santoso	0.5714
Maya Wijaya	0.1429
Rudi Santoso	0.6429
Desi Amelia	0.6071

Criterion 2: Number of Dependents
We will normalize the number of dependents data using a scale of 0-1, where fewer dependents receive a higher score.

Table 3. Criteria for the number of dependents

Name	Dependents (Normalized)
Budi Susilo	0.5714
Dewi Rahayu	0.7143
Iwan Setiawan	1.0000
Rini Marwati	0.4286
Hadi Prasetyo	0.7143
Siti Nurhayati	1.0000
Joko Santoso	0.5714
Maya Wijaya	0.1429
Rudi Santoso	0.7143
Desi Amelia	1.0000

Step 4: Calculating the Final Score

Next, we will calculate the final score for each individual by multiplying the normalized values with the corresponding weights and summing them up.

Table 4. Calculating the Final Score

Name	Final Score
Budi Susilo	0.5714
Dewi Rahayu	0.6000
Iwan Setiawan	0.9286
Rini Marwati	0.3571
Hadi Prasetyo	0.5857
Siti Nurhayati	0.8571
Joko Santoso	0.5857
Maya Wijaya	0.2571
Rudi Santoso	0.6857
Desi Amelia	0.6786

Step 5: Ranking the Recipients

Finally, we will rank the individuals based on their final scores in descending order.

Table 5. Rating Recipients

Rank	Name	Final Score
1	Iwan Setiawan	0.9286
2	Siti Nurhayati	0.8571
3	Rudi Santoso	0.6857
4	Desi Amelia	0.6786
5	Dewi Rahayu	0.6000
6	Hadi Prasetyo	0.5857
7	Joko Santoso	0.5857
8	Budi Susilo	0.5714
9	Rini Marwati	0.3571
10	Maya Wijaya	0.2571

In the above ranking, individuals with higher final scores are ranked at the top, indicating their eligibility for COVID-19 aid.

CONCLUSION

This study utilized the Simple Additive Weighting (SAW) method within a Decision Support System (DSS) to determine COVID-19 aid recipients in XYZ Village. The findings demonstrated the effectiveness of the SAW method in assisting decision-makers in identifying eligible beneficiaries based on socioeconomic criteria such as income level, number of dependents, and employment status.

By implementing the SAW method manually, this research enabled the allocation of limited resources to be carried out efficiently and accurately. The manual calculations provided flexibility and transparency in the decision-making process. The developed DSS facilitated the targeted distribution of COVID-19 aid to individuals and families in need, alleviating their economic burdens.

SUGGESTION

Based on the findings and limitations of this study, several suggestions for further research can be proposed:

1. Development of an Enhanced Weighting Scheme: Future research can explore the development of an enhanced weighting scheme within the Simple Additive Weighting (SAW) method. This can involve the utilization of advanced statistical techniques or machine learning algorithms to assign more accurate weights to the criteria used in the

decision-making process. The aim is to improve the precision and reliability of the decision support system in identifying COVID-19 aid recipients.

2. Integration of Multiple Decision-Making Methods: Investigate the integration of multiple decision-making methods, such as combining SAW with other techniques like Analytical Hierarchy Process (AHP) or Fuzzy Logic. This integration can provide a more comprehensive and robust decision-making framework for determining aid recipients. Comparative studies can be conducted to evaluate the effectiveness and efficiency of different combinations of methods.

3. Dynamic and Real-Time Decision Support: Explore the development of a dynamic and real-time decision support system that can continuously update and adapt to changing conditions and new data. This can involve the integration of data analytics, machine learning, and real-time data feeds to ensure accurate and up-to-date identification of COVID-19 aid recipients. The system can automatically adjust the criteria weights and adapt to evolving circumstances.

4. User Evaluation and Feedback: Conduct user evaluation and feedback studies to assess the usability, effectiveness, and user satisfaction with the decision support system. This can involve gathering feedback from decision-makers, aid distribution authorities, and beneficiaries to understand their perspectives and identify areas for improvement.

By addressing these research directions, future studies can contribute to the advancement of Decision Support Systems in determining COVID-19 aid recipients using the Simple Additive Weighting (SAW) method. The findings will offer valuable insights for policymakers and aid distribution authorities in optimizing aid allocation and ensuring fairness and effectiveness in resource distribution.

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