Decision Support System for Village Head Election Using the Weighted Product Method: Case Study in Lumar Village

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Abstract — The election of the village head is an important process in determining leaders who can manage the village government effectively and meet the needs of the community. Election leader of village is very important to determine the direction of the region and the importance of the capabilities of the chosen leader based on real data. This study discusses the application of the Weighted Product (WP) method in the decision-making support system for the election of village heads in Lumar Village. The WP method is used because it is able to handle various criteria by giving weight to each criterion according to its level of importance. The criteria used include work experience, education, integrity, and community support. This system is designed to process data in a structured and transparent manner, generating a preference value for each prospective village head. The candidate with the highest score is considered the most qualified. The results of the study show that the WP method improves the accuracy, objectivity, and efficiency of the village head election process, resulting in accountable decisions.

Keywords—Decision Support System, Government, Information Systems, Weighted Product.

I. INTRODUCTION

The election of candidates for village heads is one of the important processes in maintaining social, economic, and political stability at the village level. Village heads play a strategic role as local leaders who are responsible for managing various aspects of community life, including development, community empowerment, and administrative services. According to government regulations Village Head (Kades) The Village Head is responsible for the implementation of village government, the implementation of village development, village community development, and village community empowerment [1] [2].Therefore, the selection of a qualified village head is very crucial to ensure the sustainability of village development and the welfare of its community.

In Lumar Village, the selection of candidates for village heads is carried out through methods that prioritize transparency and objectivity. This is based on challenges that often arise in the process of selecting village heads, such as nepotism, politicization, and lack of community participation, because the wrong methods are used in the selection process and take time to collect data [3] [4] [5] To help solve these problems, it is necessary to have a Decision Making System so that every work related to decision-making in the selection of village head candidates can be helped in making a good decision that is in accordance with the level of eligibility of participants to be made as village head candidates [6] [7] [8]. In the Weighted Product (WP) method used as an approach to select prospective village heads based on predetermined criteria [9] [10], the Weighted Product Method has a basic concept, namely connecting attribute ratings using multiplication techniques, where the

rating of each attribute is first ranked with the weight of relevant attributes [11] The Weighted Product method is one of the multicriteria decision-making methods that has the advantage of giving weight to relevant criteria, according to relevant research apply the Weighted Product (WP) method to simplify the calculation process, so that the process of determining the best village can be carried out quickly, accurately [12]. In the context of Lumar Village, criteria such as work experience, education, integrity, and communication skills are considered the main factors that affect the leadership quality of a village head. By giving appropriate weight to each criterion, it is hoped that the assessment results will be more accurate and reflect the needs and aspirations of the village community.

Various studies have been conducted to examine a more objective method of selecting village heads [13] or another case [14]. Highlighting the importance of using technology-based decision-making systems to improve efficiency and fairness in village head elections. Their research shows that technology-based methods can reduce subjectivity and potential conflicts in the electoral process. Implement the Weighted Product method in the election of the chairman of community organizations [15]. The results of their research show that this method is able to provide more transparent and measurable results, as well as increase public trust in election results. Another study by discussing the application of the Weighted Product method in leadership selection at the local level, focusing on its ability to prioritize candidates based on defined criteria. Decision support system it aims to provide information, guide, provide predictions and direct information users so that they can make better decisions. Decision Support System is a solution that can be used to assist related parties in assessing and selecting village head candidates based on the criteria that have been set. The Composite Performance Index (CPI) method was chosen because of its ability to combine various assessment criteria into one comprehensive index [16] [17].The Weighted Product (WP) method is to determine the criterion factor as a benefit or cost by looking for a multiplication of the value of the alternative criterion to the criterion weight. WP method is a decision-making technique that allows the selection of the best options from the available alternatives, with different weights for each related variable [11]. Based on the results of the tests carried out from the new student admission selection system at SMP Negeri 1 Sumberpucung using the Weighted Product method, which can provide results that are in accordance with what is expected so as to avoid inefficient decision-making. A decision support system is an interactive alternative system to help make decisions through the use of data and decision models to solve semi-structured and unstructured problems.

This study has some significant differences compared to previous research. While previous studies have focused more on the application of the Weighted Product method in a broader field such as community organizations or other formal sectors, this study specifically examines the application of the Weighted Product method in the context of village head selection in Lumar Village. This makes a unique contribution because it highlights the local and specific needs of the village community in determining the appropriate leader. In addition, this study also adds the dimension of community participation in the election process. The proposed approach not only focuses on processing criterion data, but also involves the community in setting the weight of each criterion, so that the results obtained better reflect collective aspirations. This research seeks to integrate technology with participatory democratic values to create a more inclusive and equitable electoral process.

The purpose of this study is to develop a structured and transparent Weighted Product method selection system for village head candidates, identify the main criteria that are priorities in the selection of village head candidates in Lumar Village, involve the community in the process of giving weight to criteria to create results that reflect local needs and aspirations, and analyze the effectiveness of the Weighted Product method in increasing objectivity and accuracy Results of the selection of candidates for village heads. With this approach, it is hoped that the elected village head really has the best qualifications in accordance with the needs and expectations of the people of Lumar Village, and is able to carry out their duties and responsibilities effectively.

II. METHODOLOGY

A. Research Methology

The research method that uses Weighted Product (WP) in the decision support system aims to help determine the best village head based on predetermined criteria. The Weighted Product (WP) method is selected over other methods such as Simple Additive Weighting (SAW), Analytic Hierarchy Process (AHP), and Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) due to its capability to handle normalized values and multiplicative aggregation, which better reflects proportional differences among candidates. Compared to SAW, which uses additive scores, WP penalizes low scores more strongly, making it more sensitive to weak performance in any critical criterion. In the case of the village head election in Lumar, the Weighed Product method is applied to process the data of village head candidates by considering various relevant criteria, such as work experience, education, vision and mission, and community support. Each criterion is weighted according to its level of importance, which reflects priorities in decision-making. The Weighted Product process begins with the normalization of the weights of the criteria to ensure that the total weight is worth 1. Furthermore, each alternative value (candidate for village head) is ranked with the weight of the criteria, both for the benefit criteria (the higher the value, the better) and the cost (the lower the value, the better). The results of this process are calculated to obtain the final preference value of each alternative. The candidate with the

highest preference score is considered the most deserving to be elected as the village head. The WP method was chosen because it is able to handle many criteria while providing objective and measurable results, thus helping to increase transparency and accuracy in the village head election process in Lumar. The flow show on Fig 1
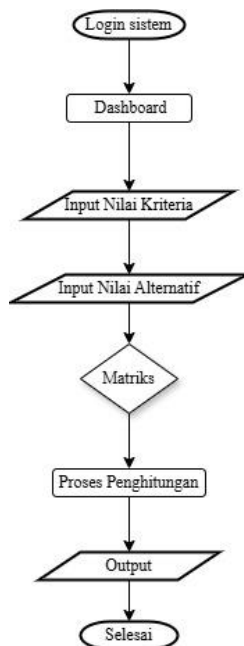

Fig 1. Flowchart Decision Support System

Based on Fig 1 flowchart starting from logging into the system by entering the username and password. After successfully logging in, users will be redirected to the dashboard page. The user enters the criteria data that will be used in the decision-making process. Users enter alternative data that will be evaluated based on predetermined criteria. The program will form a matrix containing the values, criteria, and alternatives. The program will perform calculations based on the matrix that has been formed. The calculation results will be displayed in the form of outputs. The process ends after the calculation results are displayed.

Use case is a technique in system analysis that is used to describe the interaction between users and systems to achieve a goal that serves to identify the functional system from the user's point of view, thus helping to understand the needs and expectations of users for the system being built. Use case on Fig 2.
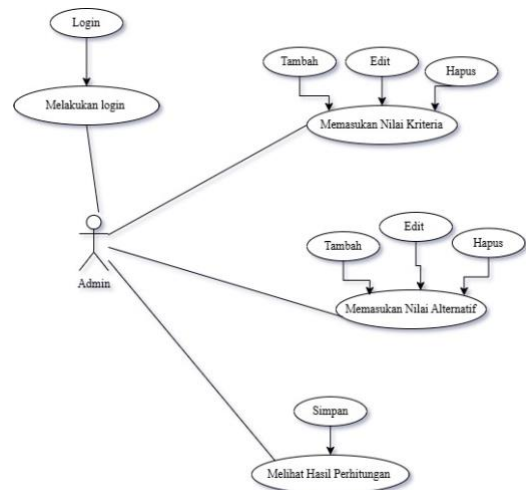

Fig 2. Use Case Decision Support System

Use Case indicates that the Admin starts by logging into the system. Next, the Admin successfully enters the system. Then the Admin can add, edit, or remove the criteria used in the decision-making. After the Admin enters the values for each criterion, the Admin can add, edit, or remove the alternatives to be evaluated. Admins enter values for each alternative based on predefined criteria. Finally, the Admin saves the data on the criteria and alternatives that have been entered and the Admin sees the calculation results based on the data that has been entered.

III. RESULT AND DISCUSSION

Flow resarch using the village head decision-making system in Lumar village. The User Registration Process is systematically designed to provide controlled access to the parties involved in the system, the admin and the election committee have access rights to the system indicated in the Fig 3.

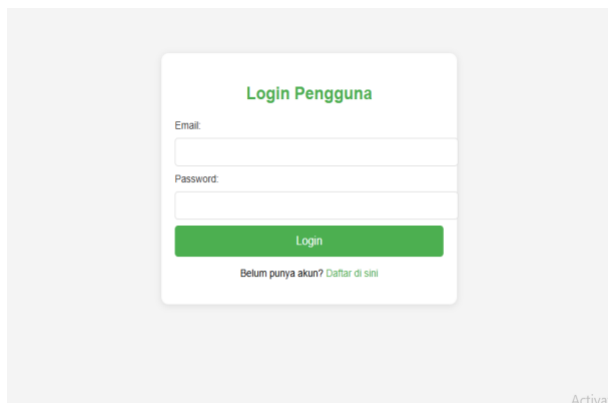
Fig 3. User Registration

Fig 4. Login Page

Login menu at Fig *4* used by users to enter their credentials (username and password) to access a specific application or system.
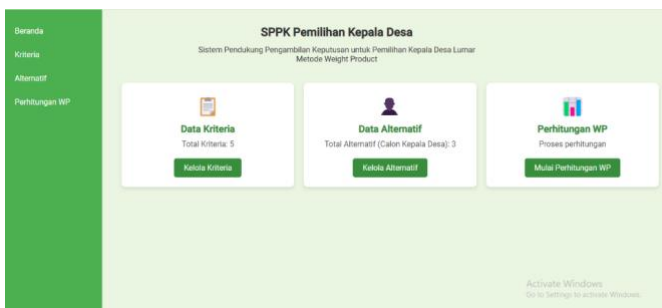

Fig 5. Dashboard System

Fig *5* show dashboard serves as a control center that visually presents data and analysis, making it easier for users to make informed decisions. Users can access the latest information about village head candidates, assessment results, and voter statistics. This information is updated automatically, so users always have the latest data.

Fig 6. Input Menu

Fig *6* input menu criteria management process is designed to allow users, especially admins or election committees, to manage the criteria used in the assessment process of village head candidates. Users can add new criteria that are considered relevant for the assessment of village head candidates. For example, criteria such as work experience, education, community support, and work program plans can be added as needed.

Fig 7. Alternative Data

Alternative data on Fig *7* Keeps complete information about each prospective village head, including name, age, education, work experience, proposed work program, and community support. This information becomes the basis for the assessment to be made.

Fig 8. Result Alternative

The results of the calculation on *Fig 8* is used to rank each candidate for village head based on the calculated preference value. These rankings assist users in identifying the most deserving candidates to choose from. Each candidate will have a preference value calculated using a predetermined method, such as Weighted Product (WP). This value reflects how well each candidate meets the criteria that have been set. By presenting the results of the calculation clearly, the system provides transparency to the public about how decisions are made. This is important to build public trust in the electoral process. In the image above, the calculation results using the intended system are in the alternative ranking where in the alternative ranking section determines the most and largest points are the ones that determine the winning rate obtained. With ranking 1 being alternative B, the second is alternative A, and the third is alternative C, so the conclusion is that the winner as a candidate for village head is candidate B.

Once each candidate's preference score has been calculated, the final step is to do a ranking. The candidate with the highest preference score will be considered the candidate who best meets the criteria overall and becomes a recommended candidate. By using the Weighted Product method, the process of selecting village heads becomes more objective and systematic. This method ensures that all important aspects of the candidate's assessment are taken into account proportionately according to their level of importance, so that the resulting decision results can be more accurate and accountable.

Application of Methods

The following is an example of the application of the Weighted Product (WP) method for the decision-making system for the election of village heads:

Alternative Data and Criteria

Alternatives to the election of village head candidates

A1 = Candidate 1

A2 = Candidate 2

A3 = Candidate 3

Criteria for Selecting Village Head Candidates

- a. Education (C1) – Benefit (Weight = 0.30)
- b. Work Experience (C2) – Benefit = (0.25)
- c. Behavior (C3) –(Benefit = 0.20)
- d. Age (C4) – (Cost = 0,15)
- e. Resident Status (C5) – (Benefit = 0.10)

From the selection process for the election of village head candidates, there are 5 (five) criteria and each criterion has sub criteria that are considered in the calculation, which are as follows:

1. Minimum junior high school education.
2. Work experience is seen from how long the period in serving as the village head.
3. Be at least 25 years old at the time of registration.
4. Behaviors that can be taken from SKCK are not having a criminal history record and having a criminal history record.
5. Resident status is permanent resident, temporary resident and non-permanent resident.

Result of alternative show on Table *I*, and the normalization result show on Table *II*.

Table I. Alternative Result

Alternative	Education	Work Experience	Behavior	Age	Population Status
A	3	3	4	4	5
B	4	4	5	5	3
C	3	2	3	3	1

Table II. Normalization

Alternative	Education	Work Experience	Behavior	Age	Population Status
A	3/4 = 0,75	3/4 = 0,75	4/5 = 0,80	3/4 = 0,75	5/5 = 1,00
B	4/4 = 1,00	4/4 = 1,00	5/5 = 1,00	5/5 = 0,60	3/5 = 0,60
C	3/4 = 0,75	2/4 = 0,50	3/5 = 0,60	3/3 = 1,00	1/5 = 0,20

Value Vektor S

$S_1 = (0,75^{0,30}) \times (0,75^{0,25}) \times (0,80^{0,20}) \times (0,75^{-0,15}) \times (1.00^{0,10})$
$= 0.9129 \times 0.9306 \times 0.9520 \times 1.0506 \times 1.0000 = 0.844$

$S_2 = (1.00^{0,30}) \times (1,00^{0,25}) \times (1,00^{0,20}) \times (0,60^{-0,15}) \times (0,60^{0,10})$
$= 1.0000 \times 1.000 \times 1.0000 \times 1.0672 \times 0.9564 = 1.021$

$S_3 = (0,75^{0,30}) \times (0,50^{0,25}) \times (0,60^{0,20}) \times (1,00^{-0,15}) \times (0,20^{0,10})$
$= 0.9129 \times 0.8409 \times 0.8885 \times 1.0000 \times 0.7943 = 0.551$

Value Vektor V

Total $S = S_1 + S_2 + S_3 = 0.844 + 1.021 + 0.551 = 2.416$

A value of V for each alternative

$A = \frac{0,844}{2,416} = 0,349$

$B = \frac{1,021}{2,416} = 0,423$

$C = \frac{0,551}{2,416} = 0,228$

The largest value is at B = 0.423

In the process of evaluating the alternatives carried out, the author calculates a value of V for each available alternative. The calculation results show that the value of V for alternative A is 0.349, for alternative B it is 0.423, and for alternative C it is 0.228. From these results, it can be seen that alternative B has the highest value of V, which is 0.423. This indicates that alternative B is the most optimal choice among the three alternatives. This calculation is done manually and also compared with the results obtained through the system, and both produce consistent values. This gives more confidence in the results obtained, showing that the methods used for this evaluation are valid and reliable. Thus, based on

the analysis that has been carried out, alternative B is the best option to consider in subsequent decision-making.

IV. CONCLUSION

Decision support system for the election of village heads based on the Weighted Product (WP) method has been proven effective in assisting the selection process of prospective village heads. Through the application of the WP method, each alternative or candidate for village head is evaluated objectively by considering various predetermined criteria, such as leadership experience, education, community support, and work program plans. Based on the results of the calculation using taxpayers, the candidate for village head A2 (Candidate 3) obtained the highest preference score (0.423) and was considered the best alternative, followed by A1 (Candidate 1) and A3 (Candidate 2). The taxpayer method provides an advantage in terms of objectivity and transparency in decision-making because it considers the weight of criteria that are in accordance with the level of importance. The results obtained can be accounted for and provide a strong basis for related parties in selecting candidates who best meet the criteria desired by the community.

Suggestions :

a. Improved Criteria and Alternatives

In order for the system to be more comprehensive, it is necessary to consider if there are additional criteria relevant to the election of village heads, such as the integrity of the candidate or communication skills. It can be added to enrich the evaluation.

b. Implementation of the System in Lumar Village

The implementation of this system in Lumar Village can help the community in determining the most appropriate candidate for the village head, based on an objective assessment. This system should be socialized to the community so that they better understand and support the decision-making process carried out.

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