

# Decision Support System in Village Head Election Using AHP Method

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## Abstract

*The Village Head Election System so far has not been accurate, causing the elected village head candidates to not meet the expectations of the community. This study aims to design a decision support system (DSS) to select a web-based village head that calculates the criteria elements and alternatives using the Analytical Hierarchy Process (AHP) method. The system that is built is only up to the design of the system interface. The results of the study determined 5 elements of the criteria that the community wanted and 4 alternative elements as sample samples for prospective village heads. The criteria and alternative elements that have a consistency ratio (CR) value of <10% can be used in the designed DSS. This web-based Village head election DSS design provides information on a list of criteria and names of Village Head candidates that can be chosen by the community. Besides, it can display the results of AHP calculations.*

**Keywords:** AHP, Criteria, Decision Support System, Village Head Election, Website

## 1. INTRODUCTION

The village head is the highest leader of the village government system. As the highest leader, the Village Head is authorized to lead the administration of village administration [1], appoint and dismiss Village apparatus, holds the power to manage Village Finances and Assets, establish Village Regulations, and carry out his authority in accordance with statutory provisions. Thus, the Village Head must be a person who is truly responsible, wise, fair, honest, and transparent in carrying out his authority [2]. Such a village head is certainly born from a village head election system that is free from the influence of the personal, group, or class interests. The village head election system that runs is still manual, causing many problems to occur during the election, such as long queues, crowds during a pandemic, costs can be minimized and there may be commotion at polling locations.

The web-based village head election is seen as effective and on target. One example of the goal of a web-based system would be to support an open and non-interested democracy. [3]. It is said that because the times have begun to require people to use information technology. Moreover, in a modern society that has made information technology a

primary need, the election of a web-based village head is certainly a priority choice [4].

The election of village heads using a web-based method can fulfill the principles of general elections in Indonesia, including: First, directly, voters who have the right to vote, have an account to activate one electronic vote. Second, the election can be followed by all villagers who already have the right to vote. Third, voters can cast their votes without coercion from any party. The system can accommodate voter choices based on available options and allows voters to confirm as they wish. Fourth, honest, namely the election is carried out in accordance with the rules to ensure that every citizen who has the right to vote according to his will and every voter's vote has the same value to determine the candidate to be elected. Fifth, namely Fair with equal treatment of citizens who will vote with an electronic system, namely web-based.

Web-based Village Head elections can also reduce the role of certain parties in winning candidates for village heads and can also guarantee the confidentiality of community choices so that the elected Village Head is free from debt and can carry out his authority according to the mandate of the law. In addition [5], the web-based Village Head election can eliminate queues that usually occur at polling stations

because the election can be carried out from anywhere as long as it is within the reach of the system [6].

The web-based Village Head election becomes more effective and on target again when implementing a Decision Support System (DSS) which is modeled through the Analytical Hierarchy Process (AHP) method. Through the AHP method, the community can choose the Village Head according to the desired criteria without intervention or influence from stakeholders. The SPK modeled through the AHP method on a web-based Village Head election system can help get a Village Head who really fits the criteria desired by the community because this method has been tested and is widely used in DSS [7]. There are still many studies that discuss DSS and have been tested and can solve problems in decision making [8].

### LITERATURE REVIEW

Decision support systems are specifically designed to support someone who has to make certain decisions [9]. The following are some of the criteria for a decision support system. (1) Interactive, The decision support system has a communicative user interface so that users can access data quickly and obtain the required information. (2) Flexible, Decision support systems have as many input variables as possible, the ability to process and provide output that presents decision alternatives to users. (3) Quality Data, Decision support systems have the ability to receive quantitative quality data that are subjective in nature from their users, as input data for data processing. For example, quality beauty can be quantified by assigning a weighting value such as 75 or 90. (4) Expert Procedure, The decision support system contains a procedure designed based on a formal formulation or also in the form of a person or group's expertise procedure in solving a problem area with a certain phenomenon.

A village is the smallest and lowest government structure that is directly related to citizens. The village is the oldest original legal community institution and identity. The authenticity of the village lies in its autonomy and governance authority, which is regulated and managed based on the rights of origin and local customs. The village in the regional government system is the spearhead of the success of regional autonomy because in the village government system there is a right and obligation of the village to run the wheels of government in order to create welfare for the community [10].

The village head is a village government official who has the authority, duties, and obligations to organize his village household and carry out the duties

of the government and local government. The village head is the leader of the village administrator based on policies established with the BPD (Village Consultative Body), the village apparatus is tasked with developing the village and improving community welfare also developing human resources and natural resources in the village. The village head is also tasked with developing the potential of the community in the village. The village head is the highest leader in the village. Therefore, the village head is fully responsible for the wheels of government in the village [11].

AHP is a model for decision-making that can help the human frame of mind. The rationale of the AHP method is the process of forming a numerical score to rank each decision alternative based on how best the alternative is matched with the decision maker's criteria. AHP is a method to help develop a priority from various options using various criteria. This decision support model will describe multi-problem complex factors or multiple criteria into a hierarchy. Hierarchy is defined as a representation of a complex problem in a multi-level structure where the first level is the goal, followed by the level of factors, criteria, sub-criteria, and so on down to the last level of alternatives [12]. There is a priority scale in the AHP method, which can be seen in Table 1 below.

TABEL I. PRIORITY SCALE IN AHP

Level	Definition	Description
1	Both elements are equally important	The two elements have the same effect.
3	One element is slightly more important than the other	Experience and judgment slightly support one element.
5	One element is more important than the other	Experience and judgment strongly favor one element over another.
7	One element is clearly more important than the other elements	One element that is strongly supported and dominant is seen in reality.
9	One element is absolutely more important than the other elements	Evidence that supports one element against another has the highest level of corroboration.
2,4,6,8	Values between two adjacent considerations	This value is given when there are two components

		between the two choices.
<b>Opposite</b>	If the i-th activity gets a number when compared to the j-th activity, then j has the opposite value compared to i.	

Microsoft Office Word 2010 Application	To design, report and design the system interface.
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There are principles in the Analytical Hierarchy Process (AHP), namely:

- 1) Decomposition is creating a hierarchy. So complex systems are broken down into simpler ones.
- 2) Comparative judgment is the assessment of criteria and alternatives. Criteria and alternatives are often represented by paired matrices.
- 3) Synthesis of priority, determines the priority of the criteria elements. This is often seen as a weight or contribution to the decision-making objectives.
- 4) Logical consistency Consistency has two meanings. The first is that similar objects can be grouped according to uniformity and relevance. The second concerns the level of relationship between objects based on certain criteria.

## 2. RESEARCH METHODS

The method used in this research is the AHP (Analytical Hierarchy Process) method and the system development model adopts the SDLC and Prototype models. Case study of Bantik Lama Village in the Talaud Islands Regency.

The data used in this study is primary data in the form of the opinion of 5 respondents about the importance of the criteria for selecting the village head and the opinion of the informants about the system design. The tools in this study are as shown in Table II:

TABEL II. TOOLS AND FUNCTION

Tools	Function
Questionnaire	Used to retrieve primary data in the form of respondents' opinions. The questionnaire was made in the form of a pairwise comparison matrix on a scale of 1-9.
Microsoft Office Excel Applications	To combine expert opinion and find out the value generated at each stage of the AHP method.
Microsoft Office Visio Application	To design system flow and data flow diagrams.

The data used in this study is primary data. Primary data is the source of data obtained directly from the community in the form of criteria data and questionnaires filled out by respondents.

Several data collection techniques were used in conducting research in Bantik Lama Village, namely:

- 1) Observation was made directly in the village of Bantik Lama.
- 2) Interviews were conducted directly with the community to find out the criteria for the desired village head candidate.
- 3) The questionnaire was filled in by 5 expert respondents who knew about the problems that often occurred when determining their regional leaders. The 5 respondents are representatives of religious leaders, traditional leaders, educational leaders, community leaders, and village government leaders.
- 4) Literature Study is collecting data through literature books and other data sources, complemented by the opinions of experts related to the problems discussed to obtain theoretical data that will be used as comparison material in the discussion of the problem. All data that has been obtained through this method is secondary data which is presented by quoting and re-expressing existing theories.

Research activities at the analysis stage of Figure 1 are data requirements analysis, user needs analysis, and functional requirements analysis. Activities carried out at this stage include weighting criteria and alternative elements, ranking elements through matrix manipulation, combining respondents' opinions, calculating CR values, and determining the functions that will exist in the system. The weighting of elements is carried out by 5 experts who have been described at the planning stage.

In this study, analysis of user needs is shown by the answer from the questions of the system, the desired functions, and what data or information must be processed. Furthermore, functional requirements analysis is shown to

describe the necessary function to be provided by the system. Analysis of user requirements and functional requirements are further defined in the context diagram.

Research activities at the design stage are data management design, decision-making models, system architecture and system interface design.

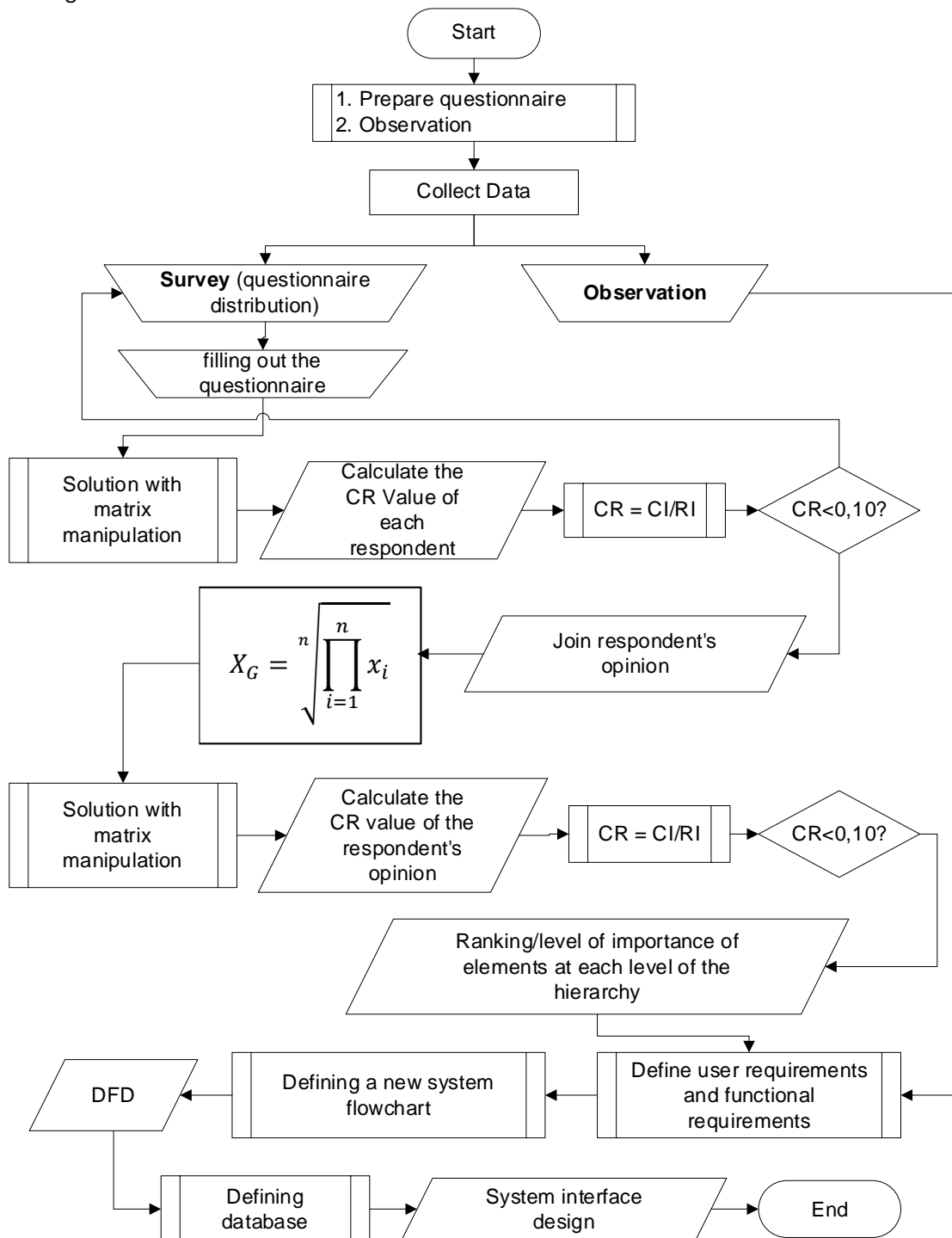


Figure 1. Stage of data analysis, user requirements, and functional system

### 3. RESULTS AND DISCUSSION

#### A. RESULTS

The method used in data collection is observation. Observations were carried out in depth to determine the perception of the village community regarding the desired criteria for the Village Head. After that,

interviews and questionnaires were conducted, to obtain information and measure the extent to which the role of the criteria was to be able to support the decision-making process in the election of the village head.

The results of the survey and observations that the research team carried out obtained the following results Bantik Lama Village, Beo District, Talud Islands Regency, North Sulawesi Province, has a population of 573 people. In 2006, Bantik Village was further divided into two villages, namely; Bantik Village and Old Bantik Village. Bantik Village is led by Mr. R. Barudapa, while Bantik Lama Village is under the leadership of Mr. Yohanis Raras. In 2007 Bantik Lama Village held a village head election, and the elected village head was Mr. Yulianus Mangante, he led Bantik Lama Village until November 2013.

After Mr. Yulianus Mangante finished his term of office, from then until September 2014 Bantik Lama was led by Mr. Marthin Rongkonusa as a temporary official. In 2014 Bantik Lama Village again held village head elections. The elected village head at that time was Mr. Jhon Bonte for the 2014-2020 period. In 2020, precisely in November, Bantik Lama held a village head election for the 2020-2026 period, and Mr. Jhon Bonte was re-elected as the head of Bantik Lama Village.

The results of the assessment points in the AHP calculation are in accordance with the criteria asked in the observation. AHP determines the Village Head based on data obtained from the sample villages, it is found that the desired criteria are (1) Transparency, (2) Education, (3) Fair, (4) Wise, (5) Responsible. The following table shows the AHP process for determining the Criteria (Table 3) and Alternatives (Table 4) for the Village Head.

The criteria for education, such as the minimum education requirements for a village head are high school and even undergraduate level. Criteria for Responsible, for example, all of their work programs can be carried out well. The Transparency Criteria mean open access for the entire community to all information related to all activities that cover the entire process through a public information system management. While in fair and wise as follows: Wisdom is firm when making decisions. While fair is a firm attitude.

TABEL III. CRITERIA DATA

Code	Criteria
K01	Transparency
K02	Education

K03	Fair
K04	Wise
K05	Responsible

TABEL IV. ALTERNATIVE DATA

Code	Criteria
A01	John Bonte
A02	Rumein Larenggam
A03	Desy Ponda
A04	Irma Maariwuga

The criteria above are the criteria for the village head that the community wants, while the alternative above is an example of a sample of village heads that will be compared in the AHP calculation process. In the AHP method, we compare two criteria, namely (1) comparison of criteria with criteria and (2) comparison between alternatives with alternatives on each criterion. The value of the weight of the criteria is obtained from the results of combining respondents' opinions from the comparison table, by adding up the values of each element of the matrix column and dividing by the number of respondents.

## B. DISCUSSION

A decision support system for web-based village head elections requires the active role of the community in generating and ranking criteria elements. Before ranking the criteria elements, the community first selects the criteria that will be used to generate the criteria elements.

Basically, DSS or decision support system is a knowledge management system that has a role in supporting the decision-making process for a member's perception of the organization. In this research is the perception of the community on the selection of village heads according to the criteria.

The community selects the criteria that will be used in the DSS, then the 5 most selected criteria will be determined as elements of the criteria for determining the Village Head. After obtaining the criteria, the community then filled out the questionnaire for the 2nd day, after that the community was asked again to choose the Village Head on the 3rd day. From the description, we can see that there are 3 interactions that occur in the system.

Context diagrams describe the input/output relationship between the system and the outside world. A context diagram contains one process, which represents the entire system. In this study, the context diagram has two entities, namely system managers and decision-makers (Figure 2).

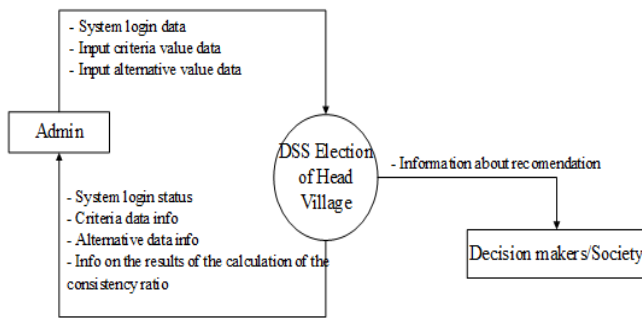


Figure 2. Village head election DSS context diagram

The Figure 2 above describes the form of DSS interaction that will be built. In this context diagram there are two entities that have interaction with this DSS, namely Admin as system manager and decision-maker as recipient or decision-maker in this DSS. Admin performs data entry of criteria and alternative values, then receives the results of the process in the form of information on criteria, alternatives and calculation data. The decision-maker/community will receive the recommendation of the candidate for the village head which will be considered at a later stage (Figure 3).

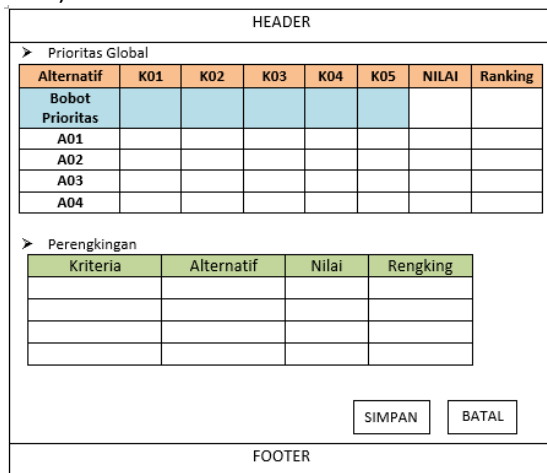


Figure 3. Priority weight calculation page design

For example, on this page the public can make their choice by clicking on the circle next to the criteria, when the community has made their choice, the circle next to the selection criteria will change color as shown in figure 4. After the community has made their choice, the community will continue by clicking the process button, the system will automatically display a page that has finished selecting and continue to see the results as shown in the picture.



Figure 4. Select criteria page design

In the results, the first aspect was chosen, this can be seen in the Priority Weight (Figure 5).

Criteria	Transparency	Education	Fair	Wise	Responsible	priority weight	CM
Transparency	0,08	0,31	0,31	0,21	0,04	0,1904	2,0773
Education	0,09	0,06	0,11	0,13	0,06	0,0871	1,6385
Fair	0,18	0,21	0,09	0,32	0,29	0,2186	3,3113
Wise	0,29	0,26	0,22	0,18	0,44	0,2751	4,0686
Responsible	0,36	0,17	0,28	0,17	0,17	0,2289	3,0821
<b>TOTAL</b>	<b>1,00</b>	<b>1,00</b>	<b>1,00</b>	<b>1,00</b>	<b>1,00</b>	<b>1,0000</b>	<b>14,1778</b>

Figure 5. Matrix Normalization Based on Main Criteria

#### 4. CONCLUSION AND RECOMMENDATION

From the results of designing a decision support system for the election of a web-based village head, it can be concluded that the following conclusions can be drawn:

- 1) The DSS for web-based village head elections, can help the community determine the best village head according to the desired criteria.
- 2) By using the AHP method in the DSS in this trial, the calculation results obtained sequentially desired by the community are Wise (4,06), Fair (3,31), Responsible (3,08), Transparency (2,07), and Education (1,63)
- 3) The Criteria Assesment System that is currently being built is only at the initial trial stage in the form of a prototype.
- 4) This Criteria Assessment System is very important, so that the Community and the Village Head can prepare for what potential they want for the progress of the Village.

The various suggestions (recommendations) to complete the conclusions drawn are as follows:

- 1) To avoid crowds, minimize costs, and more importantly to get a quality village head in

accordance with the criteria desired by the community, a decision support system using the AHP method can be used for web-based village head elections.

- 2) The system that was built only reached the design or design stage, it is highly expected for further development of the design of the village head election SPK which is made to become an integrated and better system.

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