Application of Decision Support System using Composite Performance Index Algorithm

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Abstract. Every village has a site of leadership. The village head is the person who is entitled to manage the village. The person is the one that is elected to build and develop the village. The village heads will try to improve the situation of the village as well as its residents. People who have this rank have obligations and responsibilities for carrying out village activities. However, democracy is the way to accomplish the best outcomes in terms of peace, justice, and security. The decision support system using the Composite Performance Index (CPI) method functions to assess village head candidates and process them in order to get good ranking results. The most important result of the election is what the village head decides. The application of the Composite Performance Index (CPI) method is very good in determining the right person who will occupy the position of the village head.

1. Introduction

The village head is a person who is trusted in a certain village environment to advance the village or area held by the village head. As respected as he is, the village head is a person chosen from among the people, so that he can help advance business and activities in the village. Each village head has a specific length of time in office. There are a lot of village leaders in Indonesia. Each region has a chief of their own village. Each Indonesian federal territory has a village head, whom the local government appoints as the executor or village leader rather than the democratically elected governor.

Each head of a village has a certain term of office. The term of the village head's current office is approximately six years in each of these periods of election and appointment of the village head. The
village head should have the right to choose whomever they want to rerun their office. A village leader can carry out some activities to extend his term as mayor, or carry out some activities to lead the village again. The entire community elects the village office. The village head's duties and responsibilities are to regulate and manage work units, or any organizations in society. To be obligated to report the village's activity, your village head must be compelled to annually report periodically. The village head is not directly responsible to the village, but the village only coordinates the village head to do his/her job.

The person who goes to be the village head is generally the person whose domicile happens to be around the village. When the village head positions come up, there are requirements one must meet to be considered. There are several criteria in naming a village head, such as certain age and ability. It is not too uncommon for villagers who have duties to nominate themselves for village head position. Making it to be a village head is much harder, so this research requires a method in the form of a decision support system so that village head elections can be carried out transparently and fairly.

The technique used by this researcher in this experiment is the Composite Performance Index (CPI) method[1], [2]. This process's main goal is to create a variety of criteria that can be used to judge each candidate for village head. The CPS/CPI method will use this (unspecified) preference weight as the balance weight that will be utilized in determining a change in the CPI[3], [4]. There are numerous ways to do an election for the village head. The use of a decision support system that uses the CPI method is going to help calculate who is suitable to be elected as the village head.

2. Methodology
2.1 A Village Head
A Village Head is the leader of the village in Indonesia. The chief of the village government has a fancy title. For the term of office of the Superintendent/Chairman, his/her term is six years and can be extended for one further term. The village head is not directly controlled by the government but is instead carried out by the government. The position of Village Head can be referred to by other names, including nambakan diam (North Sumatra), klèkèn (South Maluku), gampang (West Sulawesi), tapis (North Sulawesi), tojung (South Kalimantan), kautu (Central Kalimantan), tugume (Bali) (Cirebon and Indramayu). The powers of the Village Head include:

1. Leads the administration of village governance based on policies established with the Consultative Body
2. Submit a draft village regulation
3. Establish Village Regulations that have received joint approval from the Consultative Body
4. Prepare and submit draft village regulations regarding the Village Budget to be discussed and stipulated with the Consultative Body

The Village Head is prohibited from being a political party administrator (an applicant or current). It is concurrently serving as Chairman or Member of the Board of Directors, and serving as a member of any social institutions, simultaneously serving as DPRD Member, playing a political role in the presidential election, the general election, and the regional head election [5].

The Village Head may be dismissed at the BPD leadership's suggestion to the Regent / Mayor through the Camat, based on a BPD deliberation decision. The term Lurah is often confused with the title of Village Head. Indeed, in Java, in general, the leader of a village was known as Lurah. However, in the context of the Indonesian government, a Kelurahan is led by a Lurah, while a Village Head leads a village. Of course, the two are different because the Lurah is a civil servant responsible to the Camat, while the Village Head can be held by anyone who meets the requirements (can vary between villages) whom the people directly elect through the Village Head Election (Pilkades).
2.2 Composite Performance Index

Composite Performance Index is a composite index (Composite Index) that can be used to determine the assessment or ranking of various alternatives \((i)\) based on several criteria \((j)\)[6]. The Composite Performance Index method is one of the calculation methods of performance index-based decision making; the Composite Performance Index method is used for assessment with non-uniform criteria [7]–[9].

The composite index can determine the determination or ranking of various alternatives based on several criteria. The procedure in the Composite Performance Index is stated as follows.

1. Identify the trend criteria, such as positive (the higher the score, the better) and negative (the lower the score, the better).
2. For the positive trend criterion, each criterion's minimum value is transformed to one hundred, while the other values are transformed proportionally higher.
3. For the negative trend criterion, each criterion's minimum value is transformed to one hundred, while the other values are transformed lower.
4. The alternative value calculation is the sum of the multiplication between the criteria value and the criterion weight.

CPI can be used to produce a determination or ranking of various alternatives based on several criteria after the formula is used to produce the CPI value [2].

\[
A_{ij} = \frac{x_{ij}^{(\text{min})}}{x_{ij}^{(\text{min})}} \times 100
\]

\[
A_{(i+1),j} = \frac{x_{(i+1),j}}{x_{ij}^{(\text{min})}} \times 100
\]

\[
I_{ij} = A_{ij} \times P_j
\]

\[
I_j = \sum_{j=1}^{n} I_{ij}
\]

Description:
- \(A_{ij}\) = alternative value of criterion \(i\) \((j)\)
- \(X_{ij}^{(\text{min})}\) = the alternative value at the minimum initial criterion \(j\)
- \(A_{(i+1),j}\) = the alternative value for \(i+1\) in criterion \(j\)
- \(X_{(i+1),j}\) = the alternative value for \(i+1\) at the start of criterion \(j\)
- \(P_j\) = the criteria for weight of importance \(j\)
- \(I_{ij}\) = alternative index \(i\)
- \(I_j\) = composite index on alternative criteria \(i\)
- \(i\) = 1,2,3,…, \(n\)
- \(j\) = 1,2,3, ..., \(m\)

Composite Performance Index can generate ratings or ratings of various alternatives \((i)\) based on several criteria \((j)\). The Composite Performance Index method is one of the calculation methods of performance index-based decision making. The Composite Performance Index method is used for assessment with non-uniform criteria.

The composite index (Composite Index) can produce a determination or ranking of various alternatives based on several criteria [10]. The Composite Performance Index procedure is described as follows:
1. Identification criteria: positive trend (the higher the score, the better)
2. For the criteria, the trend is positive. The minimum value is transformed into one hundred, while the other values change proportionally higher.
3. For negative trend criteria, each criterion's minimum value is transformed into one hundred, while the others change to a lower value.
4. The alternative value calculation is the sum of the criteria values with the weight criteria.
5. The alternative to the rank is determined based on the Bayes calculation model.

\[ N_{ki} = \sum_{j=1}^{n} V_{ij} B_j \]
\[ \sum_{j=1}^{n} B_j = 1.0 \]

Description:
\( N_{ki} \) = Total final value of alternative i
\( V_{ij} \) = alternative value i on criterion j
\( B_j \) = level of importance (weight) criteria j
\( I, j = 1,2,3, \ldots n \; \)
\( n \) = number of alternatives

3. Methodology
3.1 Criteria Reference Assessment
Criteria reference assessment is an assessment carried out to determine the weight of an alternative based on the criteria that have been made in advance. The assessment of the assumed criteria reference aims to provide a weighted value for each alternative. Criteria are assessed by weight. For various problems, an ordinal scale of 1 to 5 is the best scale for producing weights, as in table 1.

| Weight | Description   |
|--------|--------------|
| 1      | Very low     |
| 2      | Low          |
| 3      | Moderate     |
| 4      | Good         |
| 5      | Very good    |

3.2 Determination of Criteria
The author determines the criteria used by proposing five characteristics of the candidate village head. The village head's election requires unique characteristics to determine a person's suitability for holding the village head's position. Table 2 is the criteria used in selecting the village head.
### Table 2. Criteria for CPI

| Criteria               | Weight |
|------------------------|--------|
| Education              | 3      |
| Age                    | 5      |
| Domicile               | 5      |
| Academic Potential Test| 4      |
| Psychological Test     | 3      |

#### 3.3 Research Design

Several research designs in the form of diagrams were carried out to provide clear directions and images to obtain research results and programming application programs. In the following, the author's modeling will be explained.

Use Case Diagram is the description of the functions of a system from a user perspective. The way the use case works is by describing the typical interactions between a system's user and the system itself through a story or description of how a system is used. Figure 1 is a use case diagram design of a decision support system for determining the village head.

![Use Case Diagram](image)

**Figure 1. Use case diagram**

#### 4. Result and Discussion

##### 4.1 CPI Calculation Results

The CPI calculation will be carried out when the CPI button is pressed. Weighting must be carried out to simplify the criteria value, and then the CPI process is carried out. The data used is based on existing data in the database, such as ten pieces of data. Figure 2 is a display of the weighting results with predetermined criteria weights.
Figure 2. Criteria Weight

The criteria' weight is used to determine which criteria are more dominant in selecting candidates for village head. The next step is to determine the min-max value and normalized value for each criterion. Figure 3 is a display of the normalization results.

Figure 3. Normalization

The next process is to calculate the trend value to get the CPI ranking value. This value is used to get the final score to determine the eligibility of a village head. Figure 4 is the calculation result obtained.
The ranking results can be seen in the alternative table. The CPI value is a value that is used as a reference in determining the elected village head. Figure 5 shows the results of the last calculation in getting the ranking value. The values obtained have been sorted in descending order.

![Figure 4. Trend Value](image)

**Figure 4. Trend Value**

5. Conclusion
Several conclusions can be drawn based on the research results. The SPK Desa Kepala Desa application successfully determined the best candidate for village head using the CPI method. The selected criteria were the result of monitoring how to determine the village head. Preference weight is the determination of the dominant level of criteria. The CPI method can be applied by processing and calculating each criterion's value for prospective village heads.

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