Decision Support System for Determining Critical Land in Klaten Regency

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Abstract. Critical land has become a problem in the world. Critical land is very detrimental to the health of the land. Several factors cause the land to become critical. One of them is the use of land that is not by the capabilities of the land. If no repairs made, the land will be physically, chemically, and biologically damaged. Klaten Regency is one of the regencies in Central Java Province, which has quite extensive critical land. It is necessary to monitor and improve land quality regularly to avoid critical land problems. Data and information on critical land obtained from Klaten Regency processed into a decision support system. Decision Support System uses a combination of Analytical Hierarchy Process (AHP) and Technique For Order Preference by Similarity to Ideal Solution (TOPSIS) methods. In this research, a Web-based Decision Support System created to determine the critical land area in Klaten Regency. The information system created has an alternative menu and criteria that determine the potential of critical land in Klaten Regency, making it easier for users to obtain information.

Keywords. Critical Land, Data, Information, and Decision Support System

1. Introduction

Critical land becomes a problem in data processing in the environmental field[1, 2]. Regional Development Planning Agency Klaten Regency has difficulty in determining critical land. This is due to various parameter values and criteria. So we need a system that can provide information about critical land in Klaten Regency accurately, effectively and
efficiently. Therefore, the system created can assist the Regional Development Planning Agency Klaten Regency in making decisions to determine the potential for critical land in accordance with existing criteria. This study uses 6 criteria in determining Critical Land. These criteria include slope, land use, geology, rainfall, hidrogeology and soil types. Alternatively there are 26 subdistricts including Pedan, Karangdowo, Karanganom, Jatinom, Ngawen, Juwiring, Manisrenggo, Kalikotes, Ceper, Trucuk, Prambanan, Jogonalan, Bayat, Cawas, Delanggu, Kemalang, Tulung, Polanharjo, Wonosari, Karangnongko, Gantiwarno, Klaten Utara, Klaten Tengah, Klaten Selatan, Kebonarum, Wedi. The implementation of Analytic Hierarchy Process (AHP) and Technique For Order Preference by Similarity to Ideal Solution (TOPSIS) methods as a Decision Support System will provide more effective and efficient processing of this data and can be used as a mapping illustration in an area to determine critical land.

2. Literature Review

Utilizing AHP method was previously used to rank options according to the relevance of the criteria weights for delineation of groundwater potential zones [3]. AHP method is a decision making method to calculate priority criteria that meet the requirements of several alternatives based on the judgment of the decision maker [4, 5]. Although the AHP method has several advantages, it cannot be separated from the shortcomings, the method is less effective if it is used in cases that have a large number of criteria and alternatives. Other methods are needed to be combined in order to obtain more effective results [6-8]. AHP when used to rank requires a relatively longer time and only compares between criteria, there is no normalization process and calculation of its costs and benefits [9, 10, 12]. The AHP method is also used to choosing the optimal technology to rehabilitate the pipes in water distribution systems [13]. TOPSIS is a multi-criteria method used to identify solutions from alternative sets based on simultaneous minimization of ideal point distances and maximizing distances from low points [14-17].

3. Research Methodology

In this study using the Analytic Hierarchy Process (AHP) method, will be calculated from the criteria weight value to obtain a total priority value (tpv), which will then be used in calculations with the Technique For Order Preference by Similarity to Ideal Solution (TOPSIS) method.

3.1 Criteria Weights

First we need criteria data which contains the weights which in this case are 6 influential criteria obtained from the Klaten Regency field. These data are shown in the table 1.
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Alternatively there are 26 subdistricts including Pedan, Karangdowo, Karanganom, Jatinom, Ngawen, Juwiring, Manisrenggo, Kalikotes, Ceper, Trucuk, Prambanan, Jogonalan, Bayat, Cawas, Delanggu, Kemalang, Tulung, Polanharjo, Wonosari, Karangnongko, Gantiwarno, Klaten Utara, Klaten Tengah, Klaten Selatan, Kebonarum, Wedi. The implementation of Analytic Hierarchy Process (AHP) and Technique For Order Preference by Similarity to Ideal Solution (TOPSIS) methods as a Decision Support System will provide more effective and efficient processing of this data and can be used as a mapping illustration in an area to determine critical land.

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3.1 Criteria Weights

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| Criteria      | Value | Explanation |
|---------------|-------|-------------|
| Slope         | 5     | Benefit     |
| Land Use      | 7     | Benefit     |
| Geology       | 3     | Benefit     |
| Rainfall      | 5     | Cost        |
| Hydrogeology  | 7     | Benefit     |
| Soil Types    | 7     | Cost        |

From the data above will be made one by one comparison for each criterion so that the data obtained as shown in table 2.

| Criteria | C1 | C2 | C3 | C4 | C5 | C6 |
|----------|----|----|----|----|----|----|
| C1       | 1  | 1.4| 0.6| 1  | 1.4| 1.4|
| C2       | 0.71| 1  | 0.43| 0.71| 1  | 1  |
| C3       | 1.67| 2.33| 1  | 1.67| 2.33| 2.33|
| C4       | 1  | 1.4| 0.6| 1  | 1.4| 1.4|
| C5       | 0.71| 1  | 0.43| 0.71| 1  | 1  |
| C6       | 0.72| 1  | 0.43| 0.71| 1  | 1  |
| Jumlah   | 5.81| 8.13| 3.49| 5.81| 8.13| 8.13|

Explanation:
- C1: Slope
- C2: Land Use
- C3: Geology
- C4: Rainfall
- C5: Hydrogeology
- C6: Soil Types

3.2 Normalization of Criteria Weights

The next stage is the weighted criteria that have been compared normalized by dividing by the number of values in one row. Following is the acquisition of normalization values shown in table 3.

| Criteria | C1 | C2 | C3 | C4 | C5 | C6 | Total |
|----------|----|----|----|----|----|----|-------|
| C1       | 0.1721| 0.1721| 0.1721| 0.1721| 0.1721| 0.1721| 1.0328|
| C2       | 0.123| 0.123| 0.123| 0.123| 0.123| 0.123| 0.7377|
| C3       | 0.2869| 0.2869| 0.2869| 0.2869| 0.2869| 0.2869| 1.7213|
| C4       | 0.1721| 0.1721| 0.1721| 0.1721| 0.1721| 0.1721| 1.0328|
| C5       | 0.123| 0.123| 0.123| 0.123| 0.123| 0.123| 0.7377|
| C6       | 0.123| 0.123| 0.123| 0.123| 0.123| 0.123| 0.7377|
3.3 Determination of Priority Weight Value Criteria

At this stage the processing has been carried out using the formula weight criteria or total priority value, namely:

\[
TPV = \frac{\sum w_{ij}}{n}
\]

Explanation:
- \(TPV\) : Priority weights criteria value
- \(\sum w_{ij}\) : Total normalization sum of weights criteria
- \(n\) : Number of criteria

Samples of processing the criteria weights from the slope parameters can be obtained with the formula for priority weights criteria, namely:

\[
TPV = \frac{1.0328}{6} = 0.1721
\]

Likewise with other criteria will be done the same way with the formula of the priority value of criteria weights. The results of data processing the priority value of criteria weights can be shown in table 4.

Table 4. Table of Relative Weights

| Parameter       | Relative Weights |
|-----------------|------------------|
| Slope (C1)      | 0.1721           |
| Land Use (C2)   | 0.123            |
| Geology (C3)    | 0.2868           |
| Rainfall (C4)   | 0.1721           |
| Hidrogeology (C5)| 0.123           |
| Soil Types (C6) | 0.123            |

In the Topsis method, a calculation that takes the tpv value from the results of the previous method is AHP to obtain the final value from each of its districts.

3.4 Determination of Parameters and Values

First, the required criteria or parameter data and alternative data and their values are determined from the field, namely the Geodetic Department, in this case in the form of subdistrict data in Klaten Regency. These data are shown in table 5.

Table 5. Parameter and Values

| Area     | C1 | C2 | C3 | C4 | C5 | C6 |
|----------|----|----|----|----|----|----|
| Pedan    | 0  | 1  | 0  | 1  | 1  | 0  |
| Karangdowo| 0  | 1  | 4  | 1  | 1  | 0  |
| Karanganom| 0  | 1  | 0  | 0  | 0  | 0  |
| Jatinom  | 1  | 1  | 0  | 0  | 0  | 0  |
| Ngawen   | 0  | 1  | 0  | 0  | 0  | 0  |
3.3 Determination of Priority Weight Value Criteria

At this stage the processing has been carried out using the formula weight criteria or total priority value, namely:

\[ TPV = \frac{1}{n} \sum_{i=1}^{n} w_i \]

Explanation:
- \( TPV \): Priority weights criteria value
- \( \sum_{i=1}^{n} w_i \): Total normalization sum of weights criteria
- \( n \): Number of criteria

Samples of processing the criteria weights from the slope parameters can be obtained with the formula for priority weights criteria, namely:

\[ TPV = \frac{1}{n} \sum_{i=1}^{n} w_i \]

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| Parameter   | Relative Weights |
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| Land Use (C2) | 0.123            |
| Geology (C3) | 0.2868           |
| Rainfall (C4) | 0.1721           |
| Hydrogeology (C5) | 0.1023         |
| Soil Types (C6) | 0.123            |

In the Topsis method, a calculation that takes the \( TPV \) value from the results of the previous method is AHP to obtain the final value from each of its districts.

3.4 Determination of Parameters and Values

First, the required criteria or parameter data and alternative data and their values are determined from the field, namely the Geodetic Department, in this case in the form of subdistrict data in Klaten Regency. These data are shown in Table 5.

Table 5. Parameter and Values

| Subdistrict     | C1 | C2 | C3 | C4 | C5 | C6 |
|-----------------|----|----|----|----|----|----|
| Juwiring        | 0  | 1  | 2  | 2  | 1  | 0  |
| Manisrenggo    | 1  | 1  | 0  | 1  | 0  | 1  |
| Kalikotes       | 0  | 1  | 3  | 1  | 0  | 0  |
| Ceper           | 0  | 1  | 0  | 1  | 0  | 0  |
| Trucuk          | 1  | 3  | 0  | 1  | 0  | 0  |
| Prambanan       | 1  | 3  | 0  | 1  | 0  | 1  |
| Jogorangan      | 0  | 1  | 0  | 1  | 0  | 1  |
| Bayat           | 2  | 3  | 1  | 1  | 2  | 1  |
| Cawas           | 1  | 1  | 0  | 1  | 2  | 1  |
| Delanggu        | 0  | 1  | 0  | 2  | 0  | 0  |
| Kemalang        | 2  | 0  | 0  | 1  | 1  | 1  |
| Tulung          | 1  | 1  | 0  | 0  | 0  | 0  |
| Polanharjo      | 0  | 1  | 0  | 2  | 0  | 0  |
| Wonosari        | 0  | 1  | 2  | 2  | 0  | 0  |
| Karangnongko    | 1  | 1  | 0  | 1  | 0  | 0  |
| Gantiwarno      | 1  | 1  | 2  | 1  | 2  | 1  |
| Klaten Utara    | 0  | 3  | 0  | 0  | 0  | 0  |
| Klaten Tengah   | 0  | 3  | 3  | 0  | 0  | 0  |
| Klaten Selatan  | 0  | 4  | 0  | 0  | 0  | 0  |
| Kebonarum       | 0  | 1  | 0  | 1  | 0  | 0  |
| Wedi            | 2  | 1  | 0  | 1  | 2  | 1  |

Explanation:
- C1: Slope
- C2: Land Use
- C3: Geology
- C4: Rainfall
- C5: Hydrogeology
- C6: Soil Types

3.5 Determination The Value Divisor

The next step is to determine the value of the divisor by using the following formula:

\[ y = \sqrt[5]{\sum_{j=1}^{n} x_{ij}} \]

Explanation:
- \( y \): Divider Value
- \( x_{ij} \): i-alternative performance rating for the j-criterion

Samples determining the value of the divider from the slope parameter can be obtained by the formula of the divider value:

\[ y = \sqrt[5]{0^2 + 0^2 + 0^2 + 1^2 + 1^2 + 0^2 + 0^2 + 1^2 + 0^2 + 0^2 + 1^2 + 1^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 0^2 + 2^2 + 2^2 + 2^2 + 2^2 + 2^2 + 2^2} \]

\[ = 4.4721 \]
Likewise with other criteria will be done in the same way with the divisor value formula. The results of processing the divider value data can be shown in table 6.

**Table 6. Divider Value Table**

| Parameter       | Relative Weight |
|-----------------|-----------------|
| Slope (C1)      | 4.4721          |
| Land Use (C2)   | 8.9442          |
| Geology (C3)    | 6.8556          |
| Rainfall (C4)   | 5.5677          |
| Hidrogeology (C5)| 4.5825         |
| Soil Types (C6) | 2.6457          |

### 3.6 Determination The Normalization Value

At this stage the processing has been carried out using the normalization formula

\[ r_{ij} = \frac{x_{ij}}{y} \]

**Explanation:**
- \( r_{ij} \): Normalized Element Value
- \( x_{ij} \): Alternative performance rating i to the j criterion
- \( y \): Divider Value

Normalization processing samples from Pedan Subdistrict slope parameters can be obtained with the normalization formula:

\[ r_{ij} = \frac{0}{4.4721} = 0 \]

Likewise with other parameters and sub-districts carried out with the same normalization formula. Normalization data processing results can be shown in table 7.

**Table 7. Normalization Table**

| Subdistrict   | Criteria |
|---------------|----------|
|               | C1  | C2  | C3   | C4   | C5   | C6   |
| Pedan         | 0   | 0.1118 | 0   | 0.1796 | 0.2182 | 0   |
| Karangdowo    | 0   | 0.1118 | 0.5835 | 0.1796 | 0.2182 | 0   |
| Karanganom    | 0   | 0.1118 | 0   | 0   | 0   | 0   |
| Jatinom       | 0.2236 | 0.1118 | 0   | 0   | 0   | 0   |
| Ngawen        | 0   | 0.1118 | 0   | 0   | 0   | 0   |
| Juwiring      | 0   | 0.1118 | 0.2917 | 0.3592 | 0.2182 | 0   |
| Manisrenggo   | 0.2236 | 0.1118 | 0   | 0.1796 | 0   | 0.3536 |
| Kalikotes     | 0   | 0.1118 | 0.4376 | 0.1796 | 0   | 0   |
| Ceper         | 0   | 0.1118 | 0   | 0.1796 | 0   | 0   |
| Trucuk        | 0.2236 | 0.3354 | 0   | 0.1796 | 0.2182 | 0   |
| Prambanan     | 0.2236 | 0.3354 | 0   | 0.1796 | 0   | 0.3536 |
| Jogonalan     | 0   | 0.1118 | 0   | 0.1796 | 0   | 0.3536 |
3.6 Determination The Normalization Value

At this stage the processing has been carried out using the normalization formula obtained with the normalization formula:

\[ \text{Normalized Element Value} = \frac{\text{Alternative performance rating i to the j criterion}}{\sum \text{Alternative performance rating i to the j criterion}} \]

Likewise with other parameters and sub-districts carried out with the same.

### Table 7. Normalization Table

| Subdistrict   | C1  | C2  | C3  | C4  | C5  | C6  |
|---------------|-----|-----|-----|-----|-----|-----|
| Bayat         | 0.4472 | 0.3354 | 0.1459 | 0.1796 | 0.4364 | 0.3536 |
| Cawas         | 0.2236 | 0.1118 | 0    | 0.1796 | 0.4364 | 0.3536 |
| Delanggu      | 0   | 0.1118 | 0    | 0.3592 | 0    | 0    |
| Kemalang      | 0.4472 | 0    | 0    | 0.1796 | 0.2182 | 0.3536 |
| Tulung        | 0.2236 | 0.1118 | 0    | 0    | 0    | 0    |
| Polanharjo    | 0   | 0.1118 | 0    | 0.3592 | 0    | 0    |
| Wonosari      | 0   | 0.1118 | 0.2917 | 0.3592 | 0    | 0    |
| Karangnongko  | 0.2236 | 0.1118 | 0    | 0.1796 | 0    | 0    |
| Gantiwarno    | 0.2236 | 0.1118 | 0.2917 | 0.1796 | 0.4364 | 0.3536 |
| Klaten Utara  | 0   | 0.3354 | 0    | 0    | 0    | 0    |
| Klaten Tengah | 0   | 0.3354 | 0.4376 | 0    | 0    | 0    |
| Klaten Selatan | 0   | 0.4472 | 0    | 0    | 0    | 0    |
| Kebonarum     | 0   | 0.1118 | 0    | 0.1796 | 0    | 0    |
| Wedi          | 0.4472 | 0.1118 | 0    | 0.1796 | 0.4364 | 0.3536 |

3.7 Determination of Weighted Normalization

At this stage a multiplication is made between the normalized value and the priority value of the criteria weights. Samples of normalization values & priority values for criteria weights are shown as follows:

Pedan Subdistrict with the slope criteria has a normalization value of 0 based on table 7. With the priority value of the slope criteria weight is 0.1721 based on table 4. Then, the weighted normalization value is obtained in the ampelgading area with the slope parameter is 0. The results of weighted normalization data processing are shown in table 8.

Table 8. Weighted Normalization Table

| Subdistrict   | Criteria  |
|---------------|-----------|
|               | C1  | C2  | C3  | C4  | C5  | C6  |
| Pedan         | 0   | 0.0137 | 0   | 0.0309 | 0.0268 | 0    |
| Karangdowo    | 0   | 0.0137 | 0.1674 | 0.0309 | 0.0268 | 0    |
| Karanganom    | 0   | 0.0137 | 0    | 0    | 0    | 0    |
| Jatinom       | 0.0385 | 0.0137 | 0    | 0    | 0    | 0    |
| Ngawen        | 0   | 0.0137 | 0    | 0    | 0    | 0    |
| Juwiring      | 0   | 0.0137 | 0.2917 | 0.0618 | 0.0268 | 0    |
| Manisrenggo   | 0.0385 | 0.0137 | 0    | 0.0309 | 0    | 0.0435 |
| Kalikotes     | 0   | 0.0137 | 0.4376 | 0.0309 | 0    | 0    |
| Ceper         | 0   | 0.0137 | 0    | 0.0309 | 0    | 0    |
| Trucuk        | 0.0385 | 0.0412 | 0    | 0.0309 | 0.0268 | 0    |
| Prambanan     | 0.0385 | 0.0412 | 0    | 0.0309 | 0    | 0.0435 |
| Jogonalan     | 0   | 0.0137 | 0    | 0.0309 | 0    | 0.0435 |
| Bayat         | 0.077 | 0.0412 | 0.1459 | 0.0309 | 0.0537 | 0.0435 |
| Cawas         | 0.0385 | 0.0137 | 0    | 0.0309 | 0.0537 | 0.0435 |
| Delanggu      | 0   | 0.0137 | 0    | 0.3592 | 0    | 0    |
3.8 Determination of The Value of the Ideal Solution

There are two types of ideal solution values, namely the positive ideal solution (+) and the negative ideal solution (-), performed data processing using the ideal solution formula, namely:

\[ y_j^+ = \begin{cases} \max_{i \in j} y_{ij} & \text{if } j = \text{benefit} \\ \min_{i \in j} y_{ij} & \text{if } j = \text{cost} \end{cases} \]

\[ y_j^- = \begin{cases} \max_{i \in j} y_{ij} & \text{if } j = \text{benefit} \\ \min_{i \in j} y_{ij} & \text{if } j = \text{cost} \end{cases} \]

Explanation:
- \( y_j^+ \): Value of Positive Ideal Solution Elements
- \( y_j^- \): Value of Negative Ideal Solution Elements

Sample processing the value of an ideal solution with the criteria for slope which is a benefit by looking at table 8 and table 1 obtained by the evaluation factor formula, namely:

\[ y_j^+ = 0.118 \]
\[ y_j^- = 0 \]

Likewise with other parameters and sub-districts carried out with the same normalization formula. Normalization data processing results can be shown in table 9.

Table 9. Weighted Normalization Table

| Criteria Value | C1      | C2      | C3       | C4      | C5      | C6      |
|---------------|---------|---------|----------|---------|---------|---------|
| \( y^+ \)     | 0.0769  | 0.0549  | 0.1673   | 0       | 0.0536  | 0       |
| \( y^- \)     | 0       | 0       | 0.0618   | 0       | 0       | 0.0434  |
3.9 Determination of The Value of the Ideal Solution

At this stage there are two types of alternative value distances, namely the distance of the positive ideal solution value \(d^+\) and the distance of the negative ideal solution value \(d^-\), performed data processing using the alternative value distance formula:

\[
d^+_i = \sqrt{\sum_{j=1}^{n} (v_{ij} - v^+_j)^2}
\]

\[
d^-_i = \sqrt{\sum_{j=1}^{n} (v_{ij} - v^-_j)^2}
\]

Explanation:
- \(v^+_j\): Value of Positive Ideal Solution Elements
- \(v^-_j\): Value of Negative Ideal Solution Elements
- \(d^+_i\): Positive Alternative Distance Value
- \(d^-_i\): Negative Alternative Distance Value

Likewise with other sub-districts carried out with the same alternative value distance formula. The results of distance data processing of alternative values can be shown in table 10.

| Sub-district      | \(D^+\) | \(D^-\) |
|-------------------|---------|---------|
| Pedan             | 0.19318437015576984 | 0.0612715705063838 |
| Karangdowo        | 0.09644744253328615 | 0.17824785287231013 |
| Karanganom        | 0.196275266275092  | 0.0768224455477994 |
| Jatinom           | 0.18460663675661443 | 0.08592522764319772 |
| Ngawen            | 0.196275266275092  | 0.0768224455477994 |
| Juwiring          | 0.13847009591311363 | 0.09900984709824051 |
| Manisrenggo       | 0.19215879320796622 | 0.0512462780275117 |
| Kalikotes         | 0.11494693400276913 | 0.1370931411714353 |
| Ceper             | 0.19869513986652404 | 0.05508495960138976 |
| Trueuk            | 0.17709923952926668 | 0.08214226909317697 |
| Prambanan         | 0.18818424852594512 | 0.06432640807949584 |
| Jogonalan         | 0.20339462043995069 | 0.0338340296968558 |
| Bayat             | 0.1370931411714353 | 0.11494693400276912 |
| Cawas             | 0.1845144750284211  | 0.07419977543544633 |
| Delanggu          | 0.2057840955278989  | 0.045591384263558556 |
| Kemalang          | 0.18602880577907768 | 0.0871863375130954 |
| Tulung            | 0.18460663675661443 | 0.08592522764319277 |
| Polanharjo        | 0.2057840955278989  | 0.045591384263558556 |
| Wonosari          | 0.14606000546447664 | 0.09530258445151898 |
| Karangnongko      | 0.1871774259621279  | 0.06719977217131497 |
| Gantiwarno        | 0.11415788504987891 | 0.1118486906494133 |
| Klaten Utara      | 0.19238578361586565 | 0.08610097882028894 |
3.10 Determination of The Rank

At this stage it is the final stage of the TOPSIS method by making calculations with the formula:

\[ c_i = \frac{d_i^{-}}{d_j^{-} + d_i^{+}} \]

Explanation:
- \( c_i \): End Value
- \( d_i^{+} \): Positive Alternative Distance Value
- \( d_j^{-} \): Negative Alternative Distance Value

Samples of ranking processing with alternative Pedan Subdistricts by looking at table 11 obtained with the final result formula, namely:

\[ c_i = \frac{0.0612715705063838}{0.0612715705063838 + 0.19318437015576984} = 0.2408 \]

The final results of the Topsis method are shown in table 11.

| Peringkat | Sub-district       | Hasil  |
|-----------|--------------------|--------|
| 1         | Karangdowo        | 0.6489 |
| 2         | Klaten Tengah     | 0.5949 |
| 3         | Kalikotes         | 0.5439 |
| 4         | Gantiwarno        | 0.4949 |
| 5         | Bayat             | 0.4561 |
| 6         | Juwiring          | 0.4169 |
| 7         | Wonosari          | 0.3949 |
| 8         | Wedi              | 0.356  |
| 9         | Klaten Selatan    | 0.3275 |
| 10        | Kemalang          | 0.3191 |
| 11        | Jatinom           | 0.3176 |
| 12        | Tulung            | 0.3176 |
| 13        | Trucuk            | 0.3169 |
| 14        | Klaten Utara      | 0.3092 |
| 15        | Cawas             | 0.2868 |
| 16        | Ngawen            | 0.2813 |
| 17        | Karanganom        | 0.2813 |
| 18        | Karangnongko      | 0.2642 |
A Web-based Decision Support System created to determine the critical land area in Klaten Regency. The information system created has an alternative menu and criteria that determine the potential of critical land in Klaten Regency, making it easier for users to obtain information. The results of ranking the decision support system using the web-based AHP-TOPSIS method are shown in Figure 1.

![Fig. 1. A Web-based Decision Support System for Critical Land.](image)

### 4. Result

The implementation of Analytic Hierarchy Process and Topsis methods for this Critical Land Decision Support Support System was built using web-based. Alternative data and criteria data can be accessed on the sub-district and data pages. After the data is ready to be processed, the system will dynamically perform the processing using the AHP and TOPSIS methods and the results will be displayed on the system at each step. The use of the combination of AHP and TOPSIS is because the AHP method is less effective when used in cases that have a large number of criteria and alternatives, in this case there are quite a number of alternatives namely 26 alternatives, so combined with the TOPSIS method used to determine the priority level of alternatives to be more effective and efficient in the calculation process. The system that has been made can recommend the Regional Development Planning Agency of Klaten (Bappeda) in determining the priority of critical land in the Klaten Regency. The Supporting System for Critical Land Determination
Decisions in Klaten District using the Analytic Hierarchy Process and TOPSIS methods built on a web-based result shows that the Karangdowo District area has the highest final yield value of 0.6489 and Jogonalan District with the lowest value of 0.1426.

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