Decision Support System for The Selection of XYZ School Head Candidates Using Topsis Method

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Article Info	ABSTRACT
	The school principal must be an integral part of the improvement of education quality, collaborating with teachers and other school staff to foster and enhance the educational quality in the school as optimally as possible according to established standards. The decision-making process for selecting a school head at the Education Office of Serdang Bedagai Regency is relatively challenging due to various criteria that influence the decision (both subjective and objective criteria). With a Decision Support System (DSS), humans can obtain information to support decision-making. The decision support system currently being developed includes the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) methods. TOPSIS is used in ranking to determine the best school head alternative. From the research results, it can be concluded, among other things: TOPSIS methods in the built decision support system is capable of providing final results that meet the criteria for the candidates for the State High School Head. The accuracy level of the testing results is 100%.

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1. INTRODUCTION

The progress of a school is closely tied to the influence of the school principal's ability to manage all available resources in the school. The position of a school principal represents career advancement for a teacher. A school principal is a teacher who meets specific qualifications and is assigned additional tasks to lead and manage the school. In such situations, individuals are required to make quick and accurate decisions to provide solutions for themselves and others.

The school principal must be an integral part of the education quality improvement, collaborating with teachers and other school staff to foster and enhance educational quality in the respective school as optimally as possible according to established standards. With the implementation of regional autonomy, the appointment of school principals becomes the authority of the Education Office in each region. The decision-making process for selecting a school head at the Education Office of Serdang Bedagai Regency is relatively challenging due to various criteria that influence the decision (both subjective and objective criteria). Therefore, qualified human resources are required, particularly teachers who have the potential and achievements to become school principals, to realize quality education.

An expert system is a computer-based system that utilizes knowledge, facts, and reasoning techniques to solve problems typically addressed by an expert in a specific field [1]. Decision-making systems greatly assist human life, such as identifying and predicting cancer, classifying images, and finding the shortest routes. These are some of the problems that can be addressed by decision-making technology [2]. A decision support system provides semi-structured decisions, where no one knows exactly how the decision should be made. The role of decision support systems in the overall context of information systems is to enhance performance through the application of information technology and determine the approach used in the decision-making process, up to evaluating interactive selections [3].

To achieve this, a Decision Support System (DSS) is required. With a Decision Support System (DSS), humans can obtain information to support decision-making. There are several stages in the DSS, namely defining the problem, collecting relevant and appropriate data, processing data into information, and determining alternative solutions. This system assists in decision-making for individuals and organizations, both in companies and institutions [4].

The decision support system currently evolving includes various methods, one of which is the TOPSIS method. The author chose this method because TOPSIS is used in ranking to determine the best School Head alternative.

From previous research, the TOPSIS method has been widely used but has never been applied in the selection of school principals. Therefore, in this study, the author will implement the TOPSIS method for the decision support system in selecting potential school principals. The objective of this research is to determine whether the TOPSIS method can be used to provide final results that align with the criteria and alternatives defined by the author in the decision-making process for selecting the best school principal.

2. METHOD

It is a method of data collection by studying literature, module packages and guides, handbook books, library books, and any other relevant literature indicated in Figure 1.
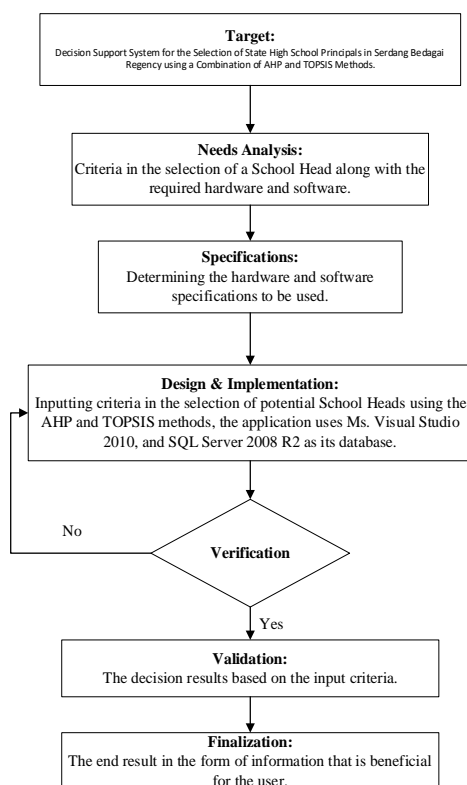
Figure 1. Design Procedure

1. Needs Analysis

   In this stage, a needs analysis is conducted, which includes the necessary elements for system design such as Microsoft Visual Studio 2010 software, SQL Server 2008 R2, Microsoft Visio 2013, and the criteria data that are prioritized in the selection of the XYZ School Head candidates.

2. Specifications

   In this stage, the specification and design of the software to be implemented are carried out. This involves designing the decision support system application to determine employee allowances using the Visual Basic .NET programming language with a SQL Server database. The hardware specifications needed to build this decision support system application for selecting potential State School Heads are:

   a) *Processor Intel ® Core ^{IM} i3-350M, 2.26 GHz*

   b) *LCD Monitor* minimum *14.0"*

   c) *Memory/RAM* minimum 4 GB

   d) *Harddisk* minimum 320 GB

   e) *Keyboard* and *Mouse*

   f) *Printer*

   The software used in designing the decision support system for the selection of State High School Principals is:
   a) *Microsoft Visual Studio 2022*
   b) *Microsoft SQL Server 2020 R2*
   c) *Crystal Report 13.0.2*
   d) *Microsoft Office 2019*
   e) *Microsoft Visio 2019*

3. Design and Implementation

   In this stage, the design and implementation of the software will be carried out to test whether the software is running according to expectations or plans, along with its database connection. The design of the decision support system for determining employee allowances is done using the Unified Modeling Language (UML).

4. Verify

   In this stage, software verification will be conducted to test whether the software is running as expected or planned, along with its database connection.

5. Validation

   This stage is necessary to evaluate the performance and reliability of the software designed to determine decisions based on existing criteria. In this stage, efforts will be made to improve and refine the built application if there are any shortcomings.

6. Finalize

   Finalization is the end result for implementing the decision support system application for selecting the prospective Headmaster of XYZ School.

2.1. Decision Support Systems

The concept of decision support is marked by an interactive computer-based system that helps decision-makers utilize data and models to solve unstructured problems. Essentially, Decision Support Systems (DSS) are designed to support all stages of decision-making, from identifying problems, selecting relevant data, determining the approach used in the decision-making process, to evaluating the selection of alternatives.

The model depicting the decision-making process. This process consists of three phases, as follows:

a. Intelligence

   This phase involves the exploration and detection of the scope of the problem as well as the problem recognition process. Input data is obtained, processed, and tested to identify the problem.

b. Design

This phase is the process of finding, developing, and analyzing alternative actions that can be taken. It includes processes to understand the problem, derive solutions, and test the feasibility of the solutions.

c. Choice

In this stage, the process of selection among various possible alternative actions is carried out. The results of this selection are then implemented in the decision-making process [5].

2.2. TOPSIS Method

According to Tzeng and Huang, TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) is one of the multicriteria decision-making methods first introduced by Yoon and Hwang in 1981. TOPSIS provides a solution from a number of possible alternatives by comparing each alternative with the best and worst alternatives among the problem alternatives. This method uses distance to make these comparisons. In this system, the TOPSIS method is used to rank alternative school principals as alternative solutions for users.

3. RESULTS AND DISCUSSION
3.1. Application of the TOPSIS Method

After obtaining the weights for each criterion, the next step is to perform calculations for the selection of school principal candidates using the TOPSIS method. In general, the TOPSIS procedure follows the steps outlined below:

a. Determine the normalized decision matrix

b. Calculate the weighted normalized decision matrix

c. Calculate the positive ideal solution matrix and the negative ideal solution matrix

d. Calculate the distance between the values of each alternative and the positive and negative ideal solution matrices

e. Calculate the preference value for each alternative

The criteria for selecting school principal candidates are shown in the following Table 1.

Code	Criteria
C1	Education
C2	Portfolio
C3	Experience
C4	Rank
C5	Exam
C6	Percentage

Table 1. Criteria Table

The preference weights assigned to each criterion in the selection of school principal candidates are shown in the following Table 2.

Code	Criteria	Weight
C1	Education	0.33
C2	Portfolio	0.23
C3	Experience	0.17
C4	Rank	0.12
C5	Exam	0.09
C6	Percentage	0.06

Table 2. Criteria Weight Table

The assessment process based on the existing criteria is shown in the following Table 2.

ID	Education	Portofolio	Experience	Rank	Exam	Percentage
A000	5	5	5	10	5	5

A001	1	5	3	9	3	3
A002	1	3	3	10	3	3

Table 3 Assessment Table

Completion:

1. Determine the normalized decision matrix.

$X1 = \sqrt{5^2+1^2+1^2} = 5.196$

$$r_{11} = \frac{X_{11}}{X1} = \frac{5}{5.196} = 0.962$$

$$r_{21} = \frac{X_{21}}{X1} = \frac{1}{5.196} = 0.192$$

$$r_{31} = \frac{X_{31}}{X1} = \frac{1}{5.196} = 0.192$$

$X2 = \sqrt{5^2+5^2+3^2} = 7.681$

$$r_{12} = \frac{X_{12}}{X1} = \frac{5}{7.681} = 0.651$$

$$r_{22} = \frac{X_{22}}{X1} = \frac{5}{7.681} = 0.651$$

$$r_{32} = \frac{X_{32}}{X1} = \frac{3}{7.681} = 0.391$$

$X3 = \sqrt{5^2+3^2+3^2} = 6.558$

$$r_{13} = \frac{X_{13}}{X1} = \frac{5}{6.558} = 0.762$$

$$r_{23} = \frac{X_{23}}{X1} = \frac{3}{6.558} = 0.458$$

$$r_{33} = \frac{X_{33}}{X1} = \frac{3}{6.558} = 0.458$$

$X4 = \sqrt{10^2+9^2+10^2} = 16.763$

$$r_{14} = \frac{X_{14}}{X1} = \frac{10}{16.763} = 0.597$$

$$r_{24} = \frac{X_{24}}{X1} = \frac{9}{16.763} = 0.537$$

$$r_{34} = \frac{X_{34}}{X1} = \frac{10}{16.763} = 0.597$$

$X5 = \sqrt{5^2+3^2+3^2} = 6.558$

$$r_{15} = \frac{X_{15}}{X1} = \frac{5}{6.558} = 0.762$$

$$r_{25} = \frac{X_{25}}{X1} = \frac{3}{6.558} = 0.458$$

$$r_{35} = \frac{X_{35}}{X1} = \frac{3}{6.558} = 0.458$$

$X6 = \sqrt{5^2+3^2+3^2} = 6.558$

$$r_{16} = \frac{X_{16}}{X1} = \frac{5}{6.558} = 0.762$$

$$r_{26} = \frac{X_{26}}{X1} = \frac{3}{6.558} = 0.458$$

$$r_{36} = \frac{X_{36}}{X1} = \frac{3}{6.558} = 0.458$$

$$R = \begin{bmatrix} 0.962 & 0.651 & 0.762 & 0.597 & 0.762 & 0.762 \\ 0.192 & 0.651 & 0.458 & 0.537 & 0.458 & 0.458 \\ 0.192 & 0.391 & 0.458 & 0.597 & 0.458 & 0.458 \end{bmatrix}$$

2. Calculate the weighted normalized decision matrix values:

$y_{11} = w_1 r_{11} = (0.33)(0.962) = 0.318$

$y_{12} = w_2 r_{12} = (0.23)(0.651) = 0.150$

$$y_{13} = w_3 r_{13} = (0.17)(0.762) = 0.130$$
$$y_{14} = w_4 r_{14} = (0.12)(0.597) = 0.072$$
$$y_{15} = w_5 r_{15} = (0.09)(0.762) = 0.069$$
$$y_{16} = w_6 r_{16} = (0.06)(0.762) = 0.046$$
$$y_{21} = w_1 r_{21} = (0.33)(0.192) = 0.064$$
$$y_{22} = w_2 r_{22} = (0.23)(0.651) = 0.150$$
$$y_{23} = w_3 r_{23} = (0.17)(0.458) = 0.078$$
$$y_{24} = w_4 r_{24} = (0.12)(0.537) = 0.064$$
$$y_{25} = w_5 r_{25} = (0.09)(0.458) = 0.041$$
$$y_{26} = w_6 r_{26} = (0.06)(0.458) = 0.027$$
$$y_{31} = w_1 r_{31} = (0.33)(0.192) = 0.064$$
$$y_{32} = w_2 r_{32} = (0.23)(0.651) = 0.090$$
$$y_{33} = w_3 r_{33} = (0.17)(0.458) = 0.078$$
$$y_{34} = w_4 r_{34} = (0.12)(0.597) = 0.072$$
$$y_{35} = w_5 r_{35} = (0.09)(0.458) = 0.041$$
$$y_{36} = w_6 r_{36} = (0.06)(0.458) = 0.027$$

$$R = \begin{bmatrix} 0.318 & 0.150 & 0.130 & 0.072 & 0.069 & 0.046 \\ 0.064 & 0.150 & 0.078 & 0.064 & 0.041 & 0.027 \\ 0.064 & 0.090 & 0.078 & 0.072 & 0.041 & 0.027 \end{bmatrix}$$

3. Calculate the positive ideal solution matrix and negative ideal solution matrix:

$$y_1^+ = \max\{0.318; 0.064; 0.064\} = 0.318$$
$$y_2^+ = \max\{0.150; 0.150; 0.090\} = 0.150$$
$$y_3^+ = \max\{0.130; 0.078; 0.078\} = 0.130$$
$$y_4^+ = \max\{0.072; 0.064; 0.072\} = 0.762$$
$$y_5^+ = \max\{0.069; 0.041; 0.041\} = 0.069$$
$$y_6^+ = \max\{0.046; 0.027; 0.027\} = 0.046$$
$$A^+ = \{0.318; 0.150; 0.130; 0.072; 0.069; 0.046\}$$
$$y_1^- = \min\{0.318; 0.064; 0.064\} = 0.064$$
$$y_2^- = \min\{0.150; 0.150; 0.090\} = 0.090$$
$$y_3^- = \min\{0.130; 0.078; 0.078\} = 0.078$$
$$y_4^- = \min\{0.072; 0.064; 0.072\} = 0.064$$
$$y_5^- = \min\{0.069; 0.041; 0.041\} = 0.041$$
$$y_6^- = \min\{0.046; 0.027; 0.027\} = 0.027$$
$$A^- = \{0.064; 0.090; 0.078; 0.046; 0.041; 0.027\}$$

4. Calculate the preference value for each alternative

$$V1 = \frac{0.268}{0.000 + 0.268} = 1.000$$
$$V2 = \frac{0.060}{0.262 + 0.000} = 0.187$$
$$V3 = \frac{0.008}{0.268 + 0.008} = 0.029$$

From the above calculations, it can be seen that V3 or Alternative A001 has the highest alternative value, making Alternative A001 suitable for becoming the School Principal.

4. CONCLUSION

Conclusion from the research titled " Decision Support System for The Selection of XYZ School Head Candidates Using Topsis Method" is as follows:

1. The application is built using Visual Basic 2022 programming language and SQL Server 2020 R2 database, making it user-friendly.

2. The decision support system application built provides convenience and minimizes potential errors in the selection process of XYZ School Principal Candidates.

3. The decision support system application built is dynamic in determining the criteria weight. Thus, it can be adjusted according to the needs in the selection process of XYZ School Principal Candidates.

4. The TOPSIS method in the decision support system application built can deliver final results in accordance with the criteria required for XYZ School Principal Candidates. The accuracy level from testing results is 100%.

Regarding the research titled "Decision Support System for the Selection of XYZ School Principal Candidates Using a Combination of TOPSIS Method," the author suggests potential future developments:

1. The author hopes that in the future, this application can be developed into a client-server-based application or using internet networks.

2. The system should be designed for multi-user access, making it more convenient for processing XYZ School Principal Candidate selection data on multiple computers.

3. To maintain data accuracy, a continuous update process is recommended for information in the XYZ School Principal Candidate selection process.

4. The application is expected to be further developed, not limited to the XYZ School Principal Candidate selection process alone.

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