# COMPARISON OF TOPSIS AND VIKTOR METHODS IN SCHOLARSHIP SELECTION OF AISYAH UNIVERSITY

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## Abstract

Higher education institutions, especially private-level universities, offer many scholarships to prospective students. Scholarships are sourced from universities, and the requirements for obtaining scholarships for prospective students will be selected and meet the specified requirements, for example, the hafiz/hafidzah must meet one of the requirements of having a certificate or certificate of hafiz/hafidzah . The scholarship program aims to realize the expectations of the underprivileged and have good academic potential in pursuing higher education.This study examines the comparison of TOPSIS and VIKTOR methods in the selection of scholarships at Aisyah University. The TOPSIS method has a simple and easy-to-understand concept, besides that the TOPSIS method can measure the relative performance of decision alternatives in a simple mathematical form. The Vise Kriterijumska Optimizacija I Kompromisno Resenje (Vikor) method makes multi-criteria decisions or what is often known as Multi-Criteria Decision Making (MCDM). MCDM is used to solve problems based on conflicting and disproportionate criteria. The TOPSIS method has the highest accuracy rate of 80% in 12 trials, while the VIKOR method only has the highest accuracy rate of 60%. Based on these results, it can be concluded that the TOPSIS method can be used to select outstanding student scholarships for the underprivileged at Aisyah University.

Keywords: Topsis, vikor, Scholarship Selection

## 1. Introduction

Scholarships given to underprivileged students who have achievements are a form of concern and appreciation from educational institutions for students who have financial deficiencies, so that students can still continue and complete their education. Aisyah University is a private university that has more than 1000 students and participates in organizing scholarship programs for prospective students who excel in the fields of religion, academics and sports. Meanwhile, the system for determining scholarship receipts is still done manually by employees of the Aisyah University which is strongly influenced by factors such as the condition of the employee at that time, limited time, employees who concurrently with other jobs and subjective factors.

Based on the existing problems, it is necessary to build a decision support system to support the process of selecting underprivileged students for scholarship recipients at Aisyah University. Decision Support System (DSS) is a computer-based system that presents and processes information that enables decision making to be more productive, dynamic, and innovative (Pranoto, Muslim, & Hasanah, 2013) (Hanifah, 2014) (Fardani, Wuryanto, & Werdiningsih, 2015). Multiple Criteria Decision Making (MCDM) is the selection of the best alternative from several mutually beneficial exclusive alternatives on the basis of general performance in various criteria or attributes determined by decision makers (Chiou, Tzeng, & Cheng, 2005). MCDM has various methods used to solve problems in the fields of science, business, and government.

One of the MCDM methods is the Analytical Hierarchy Process ( AHP) (Turskis & Zavadskas, 2010). This decision support system will be built using the Analytical Hierarchy Process (AHP) method for weighting the criteria, as well as the VlseKriterijumska Optimizacija I Kompromisno Resenje (VIKOR) method and the Technique for Order Preferences by Similarity to an Ideal Solution (TOPSIS) for alternative rankings. The AHP

method has advantages in determining the weights and hierarchy of criteria, and can guarantee consistency when determining the weight of criteria (Lemantara, Setiawan, & Aji, 2013).

The results of research by Bambang Supriyanto (2014) indicate that in learning there is an increase in learning activities and outcomes in VI B grade of State Elementary School Tanggul Wetan 02 by using discovery learning. This was indicated by the increase in student learning outcomes by 30.30%, namely from cycle 1 it reached 60.60% and in cycle 2 it reached 90.90%. While, results of research by Rosarina, et al (2016) indicate that in learning there is an increase in the percentage of completeness in each cycle, where the first cycle of students who complete based on the test results are 7 students ( 26.92%), the second cycle to 17 students (65.38%) and the third cycle to 23 students (88.46%).

The VIKOR method has advantages in compromising existing alternatives, and can complete discrete decision making on conflicting and non-commensurable criteria, namely the difference in units between criteria (Opricovic & Tzeng, 2007). The TOPSIS method has several advantages, including the concept is simple and easy to understand, computationally efficient, and has the ability to measure the relative performance of alternative decisions in a simple mathematical form. The compromise solution can be considered as choosing the solution with the closest Euclidean distance from the positive ideal solution and the farthest Euclidean distance from the negative ideal solution (Tzeng & Huang, 2011). With the application of this method, it is hoped that the process of selecting students who receive scholarship assistance for underprivileged students can be more objective, accurate, and faster.

Based on the description that the author wrote, the author wants to examine "Comparison between TOPSIS and VIKTOR methods with case studies of scholarships for outstanding students who are less able to continue their education to Aisyah University "

## 2. Literatur Riview
### 2.1 System

In general, the notion of the system is a unity, either real or abstract objects consisting of various components or elements that are interrelated, interdependent, mutually supportive, and as a whole unite in one unit to achieve certain goals effectively and efficiently. Etymologically, the term "system" comes from Latin (systēma) and Greek (sustēma) which are often used to make it easier to describe interactions within an entity. M according to ( Williams and Sawyer, 2003) say "System is a collection of interrelated components that interact with each other to perform a task to achieve a goal" .

### 2.1.1 Multicriteria Decision Making

Multicriteria taking decision (MCDM) (Pedrycz, Fuzzy Multicriteria Decision Making, Model, Method and Application, 2011) related by taking decision in front a number of and criteria which each other contradictory. Multicriteria Decision-making problems can range from everyday decision problems, such as the purchase of a car, for people who affect the whole country, as in wise use money for maintain security national (Lu et al., 2007).

### 2.1.2 Decision Support System

Decision Support System (DSS) is part of a computer-based information system including a knowledge-based system to support decision making in an organization or company (Asfi, 2010: 2).

### 2.1.3 Students

A student is a person who studies at a college, whether at a university, institute or academy. Those who are registered as students in colleges can be called students. But basically the meaning of a student in a college is only an administrative requirement to be a student, but being a student contains a broader understanding than just the administrative problem itself.

### 2.1.4 Scholarship

Scholarships are grants in the form of financial assistance given to individuals that aim to be used for the continuation of the education taken. Scholarships can be awarded by government agencies, companies or foundations. According to Agus Lahinta (2009), the definition of scholarship is a

provision in the form of financial assistance given to individuals that aims to be used for the continuation of the education taken.

### 2.1.5 Analytical Hierarchy Process (AHP)

AHP is an appropriate approach method to deal with complex systems related to making decisions from several alternatives and providing options that can be considered. The hierarchical model stated by Saaty is a functional hierarchy model with the main input being human perception. The AHP principles that must be understood include the following:

1. Decomposition

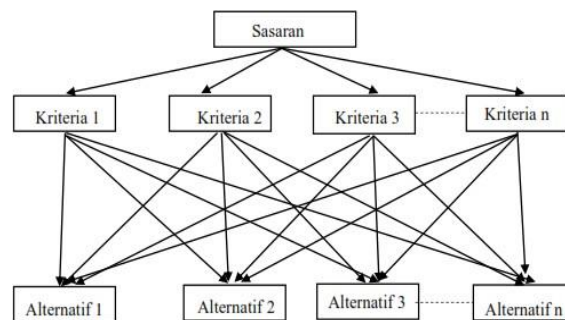Complex systems can be understood by breaking them down into smaller and easier-to-understand elements.


Figure 1. AHP Models

2. Rating Comparative ( *Comparative judgment* ) .

According to Saaty (2008: 86), for various issues, a scale of 1 to 9 is the best scale for expressing opinions.

Table 1. Pairwise Comparison Rating Scale

| Intensity Interest | Information |
|---|---|
| 1 | Second element same importance |
| 3 | Element which one a little more important thanelement which other |
| 5 | Element which one more important than whichother |
| 7 | One element very strong important than elementother |
| 9 | One element very very important from on elementother |
| 2,4,6,8 | When in doubt between two mutually exclusive values close by |

3. Synthesis Priority ( *Synthesis of priority* )

AHP, performs element priority analysis with pairwise comparison method between two elements so that all existing elements are covered.

4. Consistency Logical ( *Logical Consistency* )

Consistency has two meanings. First, similar objects can be grouped according to uniformity and relevance. Second, it concerns the level of relationship between objects based on certain criteria (Kosasi, 2002: 89).

### 2.1.6 Technique For Order Preferences by Similarity to Ideal Solution (TOPSIS)

TOPSIS considers the distance to the positive ideal solution and the negative ideal solution by taking the close relationship to the ideal solution.

### 2.1.7 Vlse Kriterijumska Optimizacija I Kompromisno Resenje (VIKOR)

VIKOR is a very helpful tool in multi-criteria decision making, especially in situations where the decision maker is unable, or does not know, to express preferences early in the system design. This method focuses on ranking and selection from a set of alternatives in the presence of conflicting criteria.

### 2.1.8 Prototyping

One of the most widely used software development methods is prototyping. In order for the prototyping model to be successful, it is necessary to define the rules that must be agreed upon by the client and the developer, namely the agreement that the prototype is built to define all the client's needs.

### 2.2 Application Software

### 2.2.1 PHP

PHP stands for Personal Hypertext Preprocessor, is a scripting language that is integrated into HTML and runs on the server side.

### 2.2.2 MySQL

MySQL is an RDBMS (Relational Data Base Management System) application that is very fast and powerful in handling databases. MySQL is a database server that can handle multiple users and multiple tasks at the same time. MySQL uses the SQL (Structured Query Language) language, which is a world standard database query language.

### 2.2.3 Web programming

The web was originally an information space on the Internet, using hypertext technology, users were led to find information by following the links provided in web documents displayed in a web browser. Internet is synonymous with the web, because of its popularity as a provider of information and display interfaces (interfaces) needed by Internet users from information problems to communication.
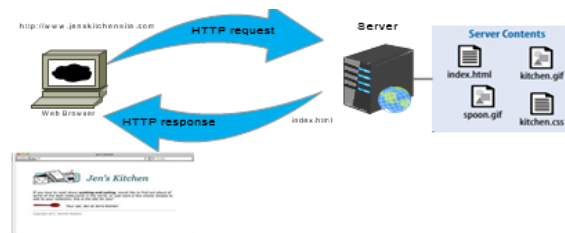


Figure 2. Web Work Schematic (Robbins, 2012)

### 2.3 Object Oriented Design and Analysis with Unified Modeling Language

### 2.3.1 The basic concepts of object-oriented analysis and design .

The concept of object-oriented or object-oriented focuses on creating a class which is a blueprint for an object. This concept divides software into several objects that interact with each other.

### 2.3.2    Unified Modeling Language (UML)

Unified Modeling Language (UML) is a modeling language used to analyze, define, and design software systems. There are several main diagrams in UML that can be used, namely:

### a. Use Case Diagrams

Use Case also describes the interactions that occur in the system, the interaction between the system inside and outside the system and the user or actor, which gives an overview of the user or actor associated with the system and matters relating to the user in the system . ( Dennis et al . al. 2009).

Table 2. Use Case Diagram elements

| Nama Elemen | Fungsi | Notasi |
|---|---|---|
| *Actor* | Menggambarkan orang atau sistem yang berhubungan dengan sistem dan dengan subyek di luarnya, diletakkan di luar pembatas subyek, dan dapat diasosiasikan dengan *actor* lain dengan menggunakan *specialization* atau *superclass association*. | Actor/Role |
| *Use Case* | Mewakili sebuah bagian dari fungsionalitas sistem dan ditempatkan dalam *system boundary*. | Use Case |
| *Subject boundary* | Menggambarkan lingkup subyek. | Subject |
| *Assocation Relationship* | Menggambarkan hubungan antara *actor* dengan *use case*. | * * |
| *Include Relationship* | Menggambarkan hubungan ke dalam sistem. Arah panah dari *base use case* ke *included use case*. | <<include>> |
| *Extend relationship* | Menggambarkan hubungan dengan pilihan *optional*. Arah panah dari *extension use case* ke *base use case*. | <<extend>> |
| *Generalization Relationship* | Menggambarkan hubungan dalam sistem, antara satu *use case* dengan *use case* lain. | |

### 2.3.3   Testing Software

*Software testing* is software that is tested to uncover errors created by accident at the time the software was designed or built. (Roger Pressman, 2012) .

### 2.3.3.1  Testing Techniques

There are two types of test case approaches, namely white-box and black-box, white-box approach is a test to show the workings of a product in detail according to its specifications. The black-box approach is a test to find out whether all software functions have been running properly in accordance with defined functional requirements.

### 2.3.3.2 ISO 9126

ISO 9126 defines software product quality, models, quality characteristics, and related metrics used to evaluate and define the quality of a software product.

### 2.4 Overview of Research Objects

Aisyah University is a private campus that was established on June 20, 2019 as a result of the merger of three higher education institutions, namely: STIKES Aisyah Pringsewu, STT Aisyah and Akbid Medica Bakti Nusantara (Akbid MBN). For STIKES Aisyah was established on August 20, 2009 as the Aisyah Pringsewu College of Health Sciences (STIKes) based on the Decree of the Director General of Higher Education, Ministry of Education and Culture Number 131/D/O/2009.

After the merger of the three institutions became Aisyah University and the first faculties were formed at Aisyah University, namely the Faculty of Health Sciences, the Faculty of Information Technology and the Faculty of Social Business.

### 2.5 IT Infrastructure

**Network Topology**

The following is the network topology of Aisyah University
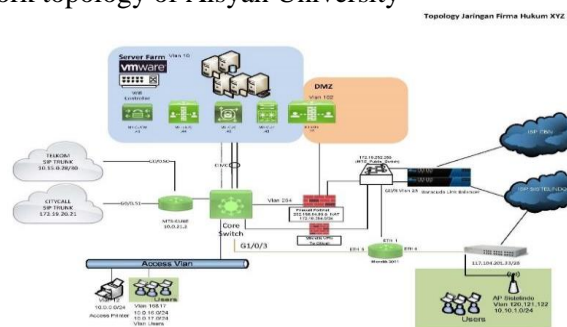
Figure 3. Steam Network Topology

### 3.   Method

### 3.1 Research Method

The research method used is descriptive analysis method with a quantitative approach, meaning that the research carried out is to emphasize the analysis on numerical data (numbers), which aims to get a clear picture of a situation based on the data obtained by presenting , collecting and analyzing the

data. so that it becomes new information that can be used to analyze the problem being studied.

Sampling is a process of selecting a portion of the population to be able to represent the population (Sugiyono 2003). The research method is a set of rules, activities, and procedures used to organize this research.

**3.2 Data Collection Techniques**

Data collection methods used to conduct research are:
a. Field Study
b. Literature review
c. Interview

**3.3 Scholarship Criteria**
a. Number of Parent Dependents
b. Academic and Non-Academic Achievement Data
c. Last month's electricity bill
d. Year-end Land and Building Tax Value

**3.4 Alternative Ranking with VIKOR Method**
1. Determine the criteria that will be used as a reference in decision making, namely the value of report cards, activity values, achievement values, and attitude values.
2. Weighting the criteria to distinguish the level of importance between criteria
3. Determine positive and negative values as the ideal solution for each criterion
4. Calculate the utility measure of each alternative.
5. Calculating VIKOR indeks index value
6. Ranking Alternatives

**3.5 Alternative Ranking with TOPSIS Method**
1. Determine the criteria that will be used as a reference in decision making.
2. Weighting the criteria to distinguish the level of importance between criteria.
3. Normalize the decision matrix. The normalization used is vector normalization.
4. Carry out normalization weighting by multiplying the results of the normalization of the decision matrix by the weight of the criteria
5. Determine the positive ideal solution and the negative ideal solution for each criterion.
6. Calculating the value of relative proximity and sorting alternatives starting from the largest value as a result of ranking students with achievements.
7. Calculating the value of relative closeness and sorting alternatives starting from the largest value as a result of ranking students with achievements.

**3.6 AHP Method**

The AHP (Analitycal Hierarchy Process) method has a concept that makes broad and unstructured problems into a flexible and easy-to-understand model, solves complex problems through a systems approach and deductive integration and AHP also provides measurement scales and methods to get priorities.

**3.7 TOPSIS Method**

The TOPSIS method has a simple and easy-to-understand concept, besides that the TOPSIS method has the ability to measure the relative performance of decision alternatives in a simple mathematical form.

The TOPSIS method is used for the alternative ranking process of each alternative student scholarship recipients for underprivileged students by calculating the closeness between the solutions and each alternative using the weighted criteria that have been calculated using AHP.

**3.8 VIKTOR Method**

The Vise Kriterijumska Optimizacija I Kompromisno Resenje (VIKTOR) method is a method in making multi-criteria decisions or what is often known as Multi Criteria Decision Making (MCDM). MCDM is used to solve problems based on conflicting and disproportionate criteria.

**4. Results And Discussion**

**4.1 Results**

### 4.1.1 Problem analysis

The problems in this research are outlined in the making of the system model. The system model to be made has the following limitations:

a. The design is made using the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) and Vlse Kriterijumska Optimizacija I Kompromisno Resenje (VIKOR) reasoning methods.

b. The making of rules in the knowledge base is assisted by the academic section of Aisyah University

### 4.2 Calculation of AHP Method

In calculating the weight of the criteria using the AHP method, the first step is to calculate the level of importance of pairwise comparisons of each criterion, namely: Number of Parent Dependents (C01), Academic and Non-Academic Achievement Data (C02), Last Month's Electricity Bill (C03), Tax Value Earth and Building last year (C04).

### 4.2.1 Criteria comparison matrix

For each criterion used, a value of X is given which represents the comparison between one criterion and another. So that after a comparison is made between all existing criteria, a pairwise comparison matrix is obtained.

Table 3. Criteria Comparison Matrix

| X | C01 | C02 | C03 | C04 | C05 | C06 | C07 |
|---|---|---|---|---|---|---|---|
| C01 | 1 | 3 | 2 | 1 | 1 | 2 | 1 |
| C02 | 0.3333 | 1 | 2 | 3 | 1 | 1 | 1 |
| C03 | 0.5 | 0.5 | 1 | 2 | 2 | 1 | 1 |
| C04 | 1 | 0.3333 | 0.5 | 1 | 1 | 2 | 1 |

### 4.2.2 Pairwise fuzzy comparison matrix

The Intensity of Criteria Comparison Matrix is then converted into a triangular fuzzy scale.

Table 4. AHP Fu Fuzzy Comparison Matrix

| X | C01 L | C01 M | C01 U | C02 L | C02 M | C02 U | C03 L | C03 M | C03 U | C04 L | C04 M | C04 U |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C01 | 1 | 1 | 1 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 |
| C02 | 0.3333 | 0.3333 | 0.3333 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| C03 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 1 | 1 | 1 | 2 | 2 | 2 |
| C04 | 1 | 1 | 1 | 0.3333 | 0.3333 | 0.3333 | 0.5 | 0.5 | 0.5 | 1 | 1 | 1 |

Table 5. Paired AHP Fuzzy Comparison Matrix

| X | C01 L | C01 M | C01 U | C02 L | C02 M | C02 U | C03 L | C03 M | C03 U | C04 L | C04 M | C04 U |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C01 | 1 | 1 | 1 | 1 | 1.5 | 2 | 1 | 1 | 1.5 | 1 | 1 | 1 |
| C02 | 0.5 | 0.6667 | 1 | 1 | 1 | 1 | 1 | 1 | 1.5 | 1 | 1.5 | 2 |
| C03 | 0.6667 | 1 | 1 | 0.6667 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.5 |
| C04 | 1 | 1 | 1 | 0.5 | 0.6667 | 1 | 0.6667 | 1 | 1 | 1 | 1 | 1 |

### 4.2.3 Value *fuzzy synthetic extent*

From the comparison value between the predetermined criteria, calculations are carried out to find the value of fuzzy synthetic extent (Si) using equation (1), so that a matrix is obtained.

Table6. Weight Normalization Matrix with AHP

| X2 | X1 | l2 | m2 | u2 | l1 | m1 | u1 | a l1-u2 | b m2-u2 | c m1-l1 | d b-c | e a/d | d' |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| C01 | C02 | 0.128 | 0.152 | 0.197 | 0.119 | 0.145 | 0.186 | -0.078 | -0.045 | 0.026 | -0.071 | 1.095 | 1.000 |
| C01 | C03 | 0.128 | 0.152 | 0.197 | 0.116 | 0.142 | 0.175 | -0.081 | -0.045 | 0.026 | -0.071 | 1.143 | 1.000 |
| C01 | C04 | 0.128 | 0.152 | 0.197 | 0.113 | 0.135 | 0.164 | -0.084 | -0.045 | 0.022 | -0.067 | 1.252 | 1.000 |
| C01 | C05 | 0.128 | 0.152 | 0.197 | 0.122 | 0.142 | 0.164 | -0.075 | -0.045 | 0.020 | -0.065 | 1.157 | 1.000 |
| C01 | C06 | 0.128 | 0.152 | 0.197 | 0.116 | 0.142 | 0.153 | -0.081 | -0.045 | 0.026 | -0.071 | 1.143 | 1.000 |
| C01 | C07 | 0.128 | 0.152 | 0.197 | 0.122 | 0.142 | 0.153 | -0.075 | -0.045 | 0.020 | -0.065 | 1.157 | 1.000 |
| C02 | C01 | 0.119 | 0.145 | 0.186 | 0.128 | 0.152 | 0.197 | -0.058 | -0.041 | 0.024 | -0.064 | 0.895 | 0.895 |
| C02 | C03 | 0.119 | 0.145 | 0.186 | 0.116 | 0.142 | 0.175 | -0.070 | -0.041 | 0.026 | -0.067 | 1.051 | 1.000 |
| C02 | C04 | 0.119 | 0.145 | 0.186 | 0.113 | 0.135 | 0.164 | -0.073 | -0.041 | 0.022 | -0.063 | 1.161 | 1.000 |
| C02 | C05 | 0.119 | 0.145 | 0.186 | 0.122 | 0.142 | 0.164 | -0.064 | -0.041 | 0.020 | -0.060 | 1.056 | 1.000 |
| C02 | C06 | 0.119 | 0.145 | 0.186 | 0.116 | 0.142 | 0.153 | -0.070 | -0.041 | 0.026 | -0.067 | 1.051 | 1.000 |
| C02 | C07 | 0.119 | 0.145 | 0.186 | 0.122 | 0.142 | 0.153 | -0.064 | -0.041 | 0.020 | -0.060 | 1.056 | 1.000 |
| C03 | C01 | 0.116 | 0.142 | 0.175 | 0.128 | 0.152 | 0.197 | -0.047 | -0.033 | 0.024 | -0.057 | 0.822 | 0.822 |
| C03 | C02 | 0.116 | 0.142 | 0.175 | 0.119 | 0.145 | 0.186 | -0.056 | -0.033 | 0.026 | -0.059 | 0.943 | 0.943 |
| C03 | C04 | 0.116 | 0.142 | 0.175 | 0.113 | 0.135 | 0.164 | -0.062 | -0.033 | 0.022 | -0.055 | 1.122 | 1.000 |
| C03 | C05 | 0.116 | 0.142 | 0.175 | 0.122 | 0.142 | 0.164 | -0.053 | -0.033 | 0.020 | -0.053 | 1.000 | 1.000 |
| C03 | C06 | 0.116 | 0.142 | 0.175 | 0.116 | 0.142 | 0.153 | -0.059 | -0.033 | 0.026 | -0.059 | 1.000 | 1.000 |
| C03 | C07 | 0.116 | 0.142 | 0.175 | 0.122 | 0.142 | 0.153 | -0.053 | -0.033 | 0.020 | -0.053 | 1.000 | 1.000 |
| C04 | C01 | 0.113 | 0.135 | 0.164 | 0.128 | 0.152 | 0.197 | -0.036 | -0.029 | 0.024 | -0.053 | 0.679 | 0.679 |
| C04 | C02 | 0.113 | 0.135 | 0.164 | 0.119 | 0.145 | 0.186 | -0.045 | -0.029 | 0.026 | -0.055 | 0.816 | 0.816 |
| C04 | C03 | 0.113 | 0.135 | 0.164 | 0.116 | 0.142 | 0.175 | -0.048 | -0.029 | 0.026 | -0.055 | 0.877 | 0.877 |
| C04 | C05 | 0.113 | 0.135 | 0.164 | 0.122 | 0.142 | 0.164 | -0.042 | -0.029 | 0.020 | -0.049 | 0.861 | 0.861 |
| C04 | C06 | 0.113 | 0.135 | 0.164 | 0.116 | 0.142 | 0.153 | -0.048 | -0.029 | 0.026 | -0.055 | 0.877 | 0.877 |
| C04 | C07 | 0.113 | 0.135 | 0.164 | 0.122 | 0.142 | 0.153 | -0.042 | -0.029 | 0.020 | -0.049 | 0.861 | 0.861 |

The result of the row sum is divided by the relative priority element concerned and then add up the quotient by the number of elements, the result is called max . The results can be shown in table 4.6

Table 7. Values of Weight, CI, and CR

| Kriteria | W | W Lokal | CI | IR | CR |
|----------|-----|---------|--------|------|-------|
| C01 | 1.000 | 0.179 | | | |
| C02 | 0.895 | 0.160 | | | |
| C03 | 0.822 | 0.147 | | | |
| C04 | 0.679 | 0.121 | 0.1468 | 1.32 | 0.111 |

The CR value obtained is 0.111. This CR value <= 0.20 then the assessment is acceptable, meaning that the preferences given are consistent from the above calculations so that the criteria.

## 4.3. Ranking alternative with Method TOPSIS

TOPSIS method is used for the alternative ranking process of each criterionby calculating the closeness between the solution and each alternative using weight criteria which has calculated use AHP.

### 4.3.1 Evaluation of alternative scholarship recipients

Alternative data selected for the selection of scholarship recipients for underprivileged students at Aisyah University.

Table 8. Evaluation of Alternatives

| Alternatif | C01 | C02 | C03 | C04 |
|------------|-----|-----|-----|-----|
| A01 | 3 | 3 | 4 | 3 |
| A02 | 5 | 4 | 4 | 2 |
| A03 | 3 | 3 | 2 | 4 |
| A04 | 3 | 4 | 4 | 2 |
| A05 | 3 | 4 | 3 | 2 |
| A06 | 2 | 3 | 3 | 3 |
| A07 | 1 | 3 | 2 | 4 |
| A08 | 4 | 4 | 3 | 1 |
| A09 | 4 | 2 | 2 | 3 |
| A10 | 4 | 3 | 1 | 1 |

Table 9. Matrix X Value Candidate

$$X = \begin{matrix} 3 & 3 & 4 & 3 \\ 5 & 4 & 4 & 2 \\ 3 & 3 & 2 & 4 \\ 3 & 4 & 4 & 2 \\ 3 & 4 & 3 & 2 \\ 2 & 3 & 3 & 3 \\ 1 & 3 & 2 & 4 \\ 4 & 4 & 3 & 1 \\ 4 & 2 & 2 & 3 \\ 4 & 3 & 1 & 1 \end{matrix}$$

Table 10.Normalized Weight Matrix

| Alternatif | C01 | C02 | C03 | C04 |
|------------|----------|----------|----------|----------|
| Bobot | 0.178693 | 0.159959 | 0.146851 | 0.121401 |
| A01 | 0.050208 | 0.045143 | 0.062618 | 0.042627 |
| A02 | 0.083681 | 0.060191 | 0.062618 | 0.028418 |
| A03 | 0.050208 | 0.045143 | 0.031309 | 0.056835 |
| A04 | 0.050208 | 0.060191 | 0.062618 | 0.028418 |
| A05 | 0.050208 | 0.060191 | 0.046963 | 0.028418 |
| A06 | 0.033472 | 0.045143 | 0.046963 | 0.042627 |
| A07 | 0.016736 | 0.045143 | 0.031309 | 0.056835 |
| A08 | 0.066945 | 0.060191 | 0.046963 | 0.014209 |
| A09 | 0.066945 | 0.030095 | 0.031309 | 0.042627 |
| A10 | 0.066945 | 0.045143 | 0.015654 | 0.014209 |
| Max | 0.083681 | 0.060191 | 0.062618 | 0.056835 |
| Min | 0.016736 | 0.030095 | 0.015654 | 0.014209 |

Table 11.Values of Negative and Positive Ideal Solutions

|  | C01 | C02 | C03 | C04 |
|---|---|---|---|---|
|  | benefit | cost | benefit | benefit |
| positif | 0.083681 | 0.030095 | 0.062618 | 0.056835 |
| negatif | 0.016736 | 0.060191 | 0.015654 | 0.014209 |

Table 12. Ranking Preference Values

| Alternatif | Positif | Negatif | Pref | Rank |
|---|---|---|---|---|
| A01 | 0.052 | 0.073 | 0.582 | 4 |
| A02 | 0.050 | 0.094 | 0.651 | 1 |
| A03 | 0.052 | 0.080 | 0.606 | 3 |
| A04 | 0.053 | 0.087 | 0.620 | 2 |
| A05 | 0.058 | 0.078 | 0.574 | 5 |
| A06 | 0.064 | 0.059 | 0.479 | 7 |
| A07 | 0.084 | 0.070 | 0.454 | 9 |
| A08 | 0.074 | 0.064 | 0.463 | 8 |
| A09 | 0.061 | 0.071 | 0.539 | 6 |
| A10 | 0.085 | 0.058 | 0.405 | 10 |

## 4.4 Alternative Ranking by VIKOR Method
### 4.1.1 Matrix Determination Decision Method VIKOR

VIKOR method decision matrix, where the existing alternatives will be tested based on the weights that have been determined by AHP

Table 13. Decision matrix of VIKOR method

| Z | Jumlah Tanggungan Orang tua | Jumlah semester | IPK Semester | Data Prestasi Akademik dan Non | Tagihan Listrik bulan terakhir | Nilai Pajak Bumi dan bangunan tahun | Keanggotaan dalam organisasi Kampus |
|---|---|---|---|---|---|---|---|
| Bobot | 0.178693 | 0.159959 | 0.146851 | 0.121401 | 0.139261 | 0.126918 | 0.126918 |
| A01 | 0.050208468 | 0.045143003 | 0.062617621 | 0.042626609 | 0.048484287 | 0.037425983 | 0.031484402 |
| A02 | 0.08368078 | 0.060190671 | 0.062617621 | 0.028417739 | 0.048484287 | 0.018712991 | 0.031484402 |
| A03 | 0.050208468 | 0.045143003 | 0.03130881 | 0.056835479 | 0.024242144 | 0.037425983 | 0.047226603 |
| A04 | 0.050208468 | 0.060190671 | 0.062617621 | 0.028417739 | 0.024242144 | 0.018712991 | 0.047226603 |
| A05 | 0.050208468 | 0.060190671 | 0.046963216 | 0.028417739 | 0.024242144 | 0.018712991 | 0.031484402 |
| A06 | 0.033472312 | 0.045143003 | 0.046963216 | 0.042626609 | 0.048484287 | 0.037425983 | 0.047226603 |
| A07 | 0.016736156 | 0.045143003 | 0.03130881 | 0.056835479 | 0.024242144 | 0.056138974 | 0.047226603 |
| A08 | 0.066944624 | 0.060190671 | 0.046963216 | 0.01420887 | 0.048484287 | 0.056138974 | 0.031484402 |
| A09 | 0.066944624 | 0.030095336 | 0.03130881 | 0.042626609 | 0.048484287 | 0.056138974 | 0.031484402 |
| A10 | 0.066944624 | 0.045143003 | 0.015654405 | 0.01420887 | 0.072726431 | 0.037425983 | 0.047226603 |
| maksimum | 0.083681 | 0.060191 | 0.062618 | 0.056835 | 0.072726 | 0.056139 | 0.047227 |
| minimum | 0.016736 | 0.030095 | 0.015654 | 0.014209 | 0.024242 | 0.018713 | 0.031484 |

Table 14. Normalization Matrix

| Alternatif | Jumlah Tanggungan Orang tua | Jumlah semester | IPK Semester | Data Prestasi Akademik dan Non | Tagihan Listrik bulan terakhir | Nilai Pajak Bumi dan bangunan tahun | Keanggotaan dalam organisasi Kampus |
|---|---|---|---|---|---|---|---|
| A01 | 0.500000 | 0.500000 | 1.000000 | 0.666667 | 0.500000 | 0.500000 | 0.000000 |
| A02 | 1.000000 | 0.000000 | 1.000000 | 0.333333 | 0.500000 | 1.000000 | 0.000000 |
| A03 | 0.500000 | 0.500000 | 0.333333 | 1.000000 | 1.000000 | 0.500000 | 1.000000 |
| A04 | 0.500000 | 0.000000 | 1.000000 | 0.333333 | 1.000000 | 1.000000 | 1.000000 |
| A05 | 0.500000 | 0.000000 | 0.666667 | 0.333333 | 1.000000 | 1.000000 | 0.000000 |
| A06 | 0.250000 | 0.500000 | 0.666667 | 0.666667 | 0.500000 | 0.500000 | 1.000000 |
| A07 | 0.000000 | 0.500000 | 0.333333 | 1.000000 | 1.000000 | 0.000000 | 1.000000 |
| A08 | 0.750000 | 0.000000 | 0.666667 | 0.000000 | 0.500000 | 0.000000 | 0.000000 |
| A09 | 0.750000 | 1.000000 | 0.333333 | 0.666667 | 0.500000 | 0.000000 | 0.000000 |
| A10 | 0.750000 | 0.500000 | 0.000000 | 0.000000 | 0.000000 | 0.500000 | 1.000000 |

Table 15.Weighted Normalization Matrix

| Alternatif | Jumlah Tanggungan Orang tua | Jumlah semester | IPK Semester | Data Prestasi Akademik dan Non | Tagihan Listrik bulan terakhir | Nilai Pajak Bumi dan bangunan tahun | Keanggotaan dalam organisasi Kampus |
|---|---|---|---|---|---|---|---|
| A01 | 0.089347 | 0.079979 | 0.146851 | 0.080934 | 0.069630 | 0.063459 | 0.000000 |
| A02 | 0.178693 | 0.000000 | 0.146851 | 0.040467 | 0.069630 | 0.126918 | 0.000000 |
| A03 | 0.089347 | 0.079979 | 0.048950 | 0.121401 | 0.139261 | 0.063459 | 0.126918 |
| A04 | 0.089347 | 0.000000 | 0.146851 | 0.040467 | 0.139261 | 0.126918 | 0.126918 |
| A05 | 0.089347 | 0.000000 | 0.097901 | 0.040467 | 0.139261 | 0.126918 | 0.000000 |
| A06 | 0.044673 | 0.079979 | 0.097901 | 0.080934 | 0.069630 | 0.063459 | 0.126918 |
| A07 | 0.000000 | 0.079979 | 0.048950 | 0.121401 | 0.139261 | 0.000000 | 0.126918 |
| A08 | 0.134020 | 0.000000 | 0.097901 | 0.000000 | 0.069630 | 0.000000 | 0.000000 |
| A09 | 0.134020 | 0.159959 | 0.048950 | 0.080934 | 0.069630 | 0.000000 | 0.000000 |
| A10 | 0.134020 | 0.079979 | 0.000000 | 0.000000 | 0.000000 | 0.063459 | 0.126918 |

Calculation next is determination score end which next bias sortedranking based on the highest final score. The following is a table of ranking results method VIKOR.

## 4.5 Graphical User Interface (GUI) Design

The GUI design is made using a web-based program with PHP and Mysql.

### 4.5.1 Use Case Diagrams

Based on the results of the analysis of the functional needs of the decision support system for the provision of scholarship assistance to underprivileged outstanding students at Aisyah University.



Figure 4. Proposed Use Case Diagram

## 4.6 Research Implications

The implications of the managerial aspect are related to organizations that may need to be improved, human resources that need to be improved in competence, strategies or policies and rules that need to be made to overcome problems or improve the management of research objects based on the findings and interpretation of research results.

## 4.7 Implementation Plan

The system implementation plan is the initial stage of system implementation and the purpose of its implementation activities is so that the new system can operate as expected. In the process of implementing the application system for the awarding of scholarships for underprivileged students using the TOPSIS and VIKOR methods.

## 5. Conclusions

Based on the discussion that has been described, regarding the comparison of TOPSIS and VIKTOR methods in the selection of Aisyah University scholarships, it can be concluded several things as follows The use of VIKOR and TOPSIS methods results in a calculation of scholarship assessment for outstanding students who are capable by entering 4 input criteria and 10 alternatives that are tested 20 times. The TOPSIS method has the highest accuracy rate of 80% in 12 trials, while the VIKOR method only has the highest accuracy rate of 60%. Based on these results, it can be concluded that the TOPSIS method can be used in the case of selecting outstanding student scholarships for the underprivileged at Aisyah University.

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