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IMPLEMENTATION OF TOPSIS METHOD SELECTION OF STUDENT ACHIEVEMENT LANE STMIK PRINGSEWU

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Abstract
New admissions is a routine activity carried out by all universities in Indonesia each year. These activities may be regarded as the starting point of the search process for new students STMIK Pringsewu quality. At this time the data processing for selecting new students achievement lane STMIK Pringsewu still using Microsoft Excel. The processing of value requires a long time, especially in the process of selection and ranking process. Decision support system is the right system to be implemented, because the decision support system can help make decisions based on the same criteria. The method used in this research is the method of TOPSIS (Technique for Order Preference by Similarity to Ideal Solution). Selection of new students STMIK Pringsewu using TOPSIS method. results of a decision support system using the method of TOPSIS (Technique for Order Preference by Similarity to Ideal Solution)to assist and facilitate Universities in determining which students are competent or not get into college STMIK Pringsewu use the path of achievement.

Keywords: **Selection of new student achievement lane, Decision Support Systems, TOPSIS**

1.0 INTRODUCTION

At this time the education is a very important thing in our lives, because of technological advances and the development of human resources are also constantly evolving. According to Article 31 of Law 1945 "Every citizen of the Republic of Indonesia a entitled to teaching", thus STMIK Pringsewu requires qualified human resources that many of the criteria that must be fulfilled students who wish to be received in college STMIK Pringsewu. In 2016 STMIK Pringsewu accept 345 students (153 male students and 192 student female) and in 2017 STMIK Pringsewu receives as many as 252 students (132 male students and 120 female students).

Research undertaken by Safrizal Barus, Vera Meikana Sitorus, Darmawan Napitupulu, Mesran, Supiyandi (2018) contains about WASPAS (Weighted Aggregated Sum Product Assessment) could help decision makers in deciding on one or more of several options that must be taken to serve as Teacher Stay with the criteria taken into consideration[1].[2] According to Otto Fajarianto, Muchammad Iqbal, Jaka Tubagus Cahya in a study of the year (2017) which contains the Application of WP (Weighting product) reception system proved to be better employees[3]. Meanwhile, according to Titis Handayni in his research (2012) the results of the research that has been done AHP (Analytical Hierarchy Process) as a model in the Decision Support System Selection of Student Achievement through multiple criteria weighting process[4].

New admissions achievement path selected based on the requirements and criteria that have been determined. To build a decision support system for the determination of new admissions achievement path. STMIK Pringsewu using TOPSIS method for decision-making that is able to select the best decision of a number of decisions that resulted with a more efficient, so the decisions in question are students who are eligible to enter the path of achievement based on the criteria that have been determined by STMIK Pringsewu. Based on the above, the purpose of use TOPSIS method in the new student path STMIK Pringsewu determine

student achievement are eligible to enter and whether in college STMIK Pringsewu. The criteria on which the decision by the committee new admissions Pringsewu STMIK achievement lane. Although the selection of students who will go remain to be determined entirely by the committee of new admissions track achievements STMIK Pringsewu but TOPSIS method will display the highest priorities to the lowest of prospective students, that will facilitate and assist the committee of new admissions in make decisions.

2.0 LITERATURE RIVIEW

2.1. Decision Support Systems

Decision Support Systems as a computer-based information system that is adaptive, interactive, flexible, which was specifically developed to support the solution of unstructured the problem management to improve the quality of decision making. Decision Support System is a system built to solve various problems managerial company designed to develop the effectiveness and productivity of managers to resolve problems with the help of computer technology[5][6].

2.2. TOPSIS

TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) principle is simply that the alternatives selected must have the shortest distance from the ideal solution positive and furthest from the ideal solution negatives from a geometrical point by using the Euclidean distance to determine the relative proximity of an alternative to the solution optimal[7], [8]. According to in his research Generally, procedures or steps in the method of TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) includes:

1. Make a decision matrix that is normalized.
2. Make the weighted normalized decision matrix.
3. Determine the ideal solution matrix of positive and negative ideal solution matrix.
4. Determine the distance between the value of each alternative with a matrix of positive ideal solution and negative ideal solution matrix.
5. Determine preference value for each alternative[9], [10].

There are several stages in the resolution of problems with TOPSIS method:

a. Make a decision matrix that is normalized.

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \qquad (1)$$

explanation
Rij = value decision matrix normalization
Xij = original value decision matrix

a. Make weighted normalized decision matrix W = (W1,W2, ... Wn), the normalization of weight matrix V is

$$V_{ij} = \begin{bmatrix} W_{11}^{V_{ij}=W_i r_{ij}} r_{11} & \cdots & W_{1n} r_{1n} \\ \vdots & \ddots & \vdots \\ W_{m1} r_{m1} & \cdots & W_{mn} r_{nm} \end{bmatrix} \qquad (2)$$

explanation
STX = weighted normalized decision matrix
wi = weighting of the criteria i

b. Determine the ideal solution matrix of positive and negative ideal solution matrix

$$A^+ = y_1^+, y_2^+, \ldots, y_n^+ \qquad (3)$$

$$A^- = y_1^-, y_2^-, \ldots, y_n^- \quad (4)$$

explanation
Y1 + = max, if j is an attribute of the advantages (benefits)

Y1- = min, if j is an attribute of the cost (cost)

c. Determine the distance between the value of each alternative with a matrix of positive ideal solution and negative ideal solution matrix. Distance alternative with positive ideal solution formulated:

$$D_i^+ = \sqrt{\sum_{j=1}^{n}(V_{ij} - V_j^+)^2} \quad (5)$$

d. Determine preference value for each alternative:

$$V_i = \frac{D_i^-}{D_i^- + D_i^+} \quad (6)$$

2.3. Student Achievement

Achievement (www.gurupendidikan.co.id) By Siti Pratini, (2005) Achievement is the result of someone in the learning activities. Meanwhile, according to Bukhari M, (1983) The achievement can we interpret as the results achieved or the results which have been achieved. [8] So Achieving Students are students who achieved high achievements in both academic and non-academic, able to communicate with Indonesian and English, to be positive, as well as the spirit of Pancasila.

2.4. Scolarship

Scholarship is a gift in the form of financial assistance granted to individuals, college students or students who are used for the sake of education to pursue. By Erny Murniasih (2009) defined as a form of scholarship awards given to individuals in order to continue their education to a higher level. The award may be limited access to an institution or the award of financial aid. [9]

2.5. Determination Rules Student Achievement In Act

Selection of the best students has started since 1986 which in practice have ups and downs including change of names or terms and acronyms. In the book RISTEKDIKTI (2017) Selection of the best students has been set in the legislation.

1. Law No. Republic of Indonesia Number 20 Year 2003 on National Education System.
2. Law of the Republic of Indonesia Number 12 of 2012 on Higher Education.
3. Indonesian Government Regulation No. 4 of 2014 on the Implementation of Higher Education and Higher Education Management.
4. Indonesian Presidential Regulation Number 8 Year 2012 on Indonesian National Qualifications Framework.
5. Regulation of the Minister of Education and Culture No. 44 Year 2015 on National Standards for Higher Education.
6. Regulation of the Minister of Education and Culture No. 154 of 2014 on Cluster Science and Technology as well as graduate degree collage.
7. National Education Minister Regulation No. 17 of 2010 on the Prevention and Combating Plagiarism in Higher Education [10]

3.0 METHODOLOGY

3.1. Data Colection

Methods of data collection based on the type of data the collected in this study are:

a. Study Literature
   A method of collecting data through books, magazines, modules, e-books, journals and other literature that is still associated with the discussion and support in the

completion of the research report in hand. The author uses the method of Literature in order to become a more complete data collection and to find out more about what it selection outstanding students.

b. Interview
   At this stage of the process of collecting data through interviews with the STMIK Pringsewu in this case the stakeholders in decision making for selection. Furthermore, the interview process raw data, to be analyzed premises TOPSIS Method.
c. Observation
   An observation method used is by way of research directly by visiting STMIK Pringsewu.

3.2. TOPSIS

Method of TOPSIS (Technique for Others Reference by Similarity to Ideal Solution) TOPSIS method is a method by category MCDM (Multi-Criteria Decision Making) is a technique of decision-making of some alternative options exist, especially MADC (Multi Attribute Decision Making). TOPSIS (Technique for Order Preference by Similarity Ideal) Solution TOPSIS is a basic concept that provides alternative MADM the shortest distance from the positive ideal solution and the longest distance from the negative ideal solution. For MADM problem with m alternatives evaluated by the n attribute or the so-called criteria. In selecting students by using MADM (Multi Attribute Decision Making) required criteria and weights to perform calculations that will get the best alternative[7], [9], [11].

MADM (Multi-Attribute Decision Makin) criteria and weighting are needed to determine who will be eligible to go to college STMIK Pringsewu. According to MADM (Analysis System Multi-Attribute Decision Makin) is the method used to find alternatives to optimal from a number of alternatives with certain criteria In MADM there are criteria and weighting are needed to determine the students are eligible STMIK Pringsewu college entrance[12], [13]. The criteria are as follows:

Table 1: Criteria

Criteria	Information
C1	Average Value diploma
C2	Average Value of Mathematics
C3	Average Rating English
C4	Average Value Indonesian
C5	Non Academic Achievement
C6	IT skills

Selection of new students STMIK Pringsewu path using the achievements of the value judgments of diplomas and IT skills in the value of the interview by the committee new admissions STMIK achievement lane Pringsewu:

Table 2: Average Rating Certificate (C1)

Average Value diploma	Weight	Value
6.0-7.4	Enough	3
7.5-8.9	High	4
9.0-10	Very high	5

Table 3: Average Value of Mathematics (C2)

Value Certificate Mathematics	Weight	Value
6.0-7.0	Enough	3
7.1-8.9	High	4
9.0-10	Very high	5

Table 4: Average Rating English (C3)

Value diploma English	Weight	Value
6.5-7.5	Enough	3
7.6-8.9	High	4
9.0-10	Very high	5

Table 5: Average Value Indonesian (C4)

Value diploma Indonesian	Weight	Value
6.0-7.0	Enough	3
7.1-8.9	High	4
9.0-10	Very high	5

Table 6: Value of Non-Academic (C5)

Non Academic Achievement Level	Weight	Value
School	Very low	1
sub-district	Low	2
districts	Enough	3
Province	High	4
National	Very high	5

Table 7: IT Skills (C6)

IT skills	Weight	Value
MS. office	Enough	3
assemble computer	High	4
Basic programming language	Very high	5

The weights in each criteria the selection committee determined the new admissions STMIK achievement lane Pringsewu namely:

Table 8. Criteria and Weights

Criteria	Information	Weight
C1	Average Value diploma	20%
C2	Average Value of Mathematics	15%
C3	Average Rating English	15%
C4	Average Value Indonesian	10%
C5	Non Academic Achievement	15%
C6	IT skills	25%

4.0 RESULANTS AND DISCUSSION

4.1. Calculation

Manual testing requires the necessary skills. Manual testing is used to find errors as much as possible Identify all errors. STMIK Pringsewu opens new student registration lines achievements, there are three students who will participate in the selection of new admissions Pringsewu STMIK achievement lane. And for consideration by the committee selecting the new students choose STMIK Pringsewu lane 6 criteria used. Rating matches each alternative on each criterion assessed by 1 to 5, namely:

Table 9: Weight Value

Weight	Value
Very low	1
Low	2
Enough	3
High	4
Very high	5

Rating the value of each alternative criteria:

Table 10: Criteria

Alternative	CRITERIA					
	C1	C2	C3	C4	C5	C6

A1	4	5	5	3	4	3
A2	5	3	4	3	4	5
A3	4	3	4	5	2	3

Normalization equation attribute values to form a normalized matrix (R) and multiplying the weight with the value of each attribute to form matrix (Y), is done by using the following equation:

$$\underline{d}=\frac{\sum_{k=1}^{m}\sum_{k=1}^{m} d_{kl}}{m\,(m-1)}$$

$|x1| = \sqrt{4^2 + 5^2 + 4^2}$ = 7549

$r_{11} = \frac{x_{11}}{|x_1|} = \frac{4}{7.549} = 0{,}529$

$r_{21} = \frac{x_{21}}{|x_1|} = \frac{5}{7.549} = 0{,}662$

$r_{31} = \frac{x_{31}}{|x_1|} = \frac{4}{7.549} = 0{,}529$

$|x2| = \sqrt{5^2 + 3^2 + 3^2}$ = 6557

$r_{12} = \frac{x_{12}}{|x_2|} = \frac{5}{6.557}$ = 0,762

$r_{22} = \frac{x_{22}}{|x_2|} = \frac{3}{6.557}$ = 0,457

$r_{32} = \frac{x_{32}}{|x_2|} = \frac{3}{6.557}$ = 0,457

$|x3| = \sqrt{5^2 + 4^2 + 4^2}$ = 7549

$r_{13} = \frac{x_{13}}{|x_3|} = \frac{5}{7.549}$ = 0,662

$r_{23} = \frac{x_{23}}{|x_3|} = \frac{4}{7.549}$ = 0,529

$r_{33} = \frac{x_{33}}{|x_3|} = \frac{4}{7.549}$ = 0,529

$|x4| = \sqrt{3^2 + 3^2 + 5^2}$ = 6557

$r_{14} = \frac{x_{14}}{|x_4|} = \frac{3}{6.557} = 0{,}457$

$r_{14} = \frac{x_{24}}{|x_4|} = \frac{3}{6.557} = 0{,}457$

$r_{14} = \frac{x_{34}}{|x_4|} = \frac{5}{6.557} = 0{,}762$

$|x5| = \sqrt{4^2 + 4^2 + 2^2}$ = 6

$r_{15} = \frac{x_{15}}{|x_5|} = \frac{4}{6} = 0{,}666$

$r_{25} = \frac{x_{25}}{|x_5|} = \frac{3}{6} = 0{,}666$

$r_{35} = \frac{x_{35}}{|x_5|} = \frac{2}{6} = 0{,}333$

$|x6| = \sqrt{3^2 + 5^2 + 3^2}$ = 6557

$r_{16} = \frac{x_{16}}{|x_6|} = \frac{4}{6.557} = 0457$

$r_{26} = \frac{x_{26}}{|x_6|} = \frac{5}{6.557} = 0762$

$r_{36} = \frac{x_{36}}{|x_6|} = \frac{4}{6.557} = 0457$

From the above calculation results obtained normalized matrix (R):

$$R = \begin{bmatrix} 0.529 & 0.762 & 0.662 & 0.457 & 0.666 & 0.457 \\ 0.662 & 0.457 & 0.529 & 0.457 & 0.666 & 0.762 \\ 0.529 & 0.457 & 0.529 & 0.762 & 0.333 & 0.457 \end{bmatrix}$$

Having obtained the normalized matrix (R), then look for the matrix V by the equation:

$$V_{ij} = W_j X_{ij}$$

$V_{11} = W_1 R_{11} =$ (0.20) (0529) = 0105
$V_{12} = W_2 R_{12} =$ (0:15) (0762) = 0114
$V_{13} = W_3 R_{13} =$ (0:15) (0662) = 0099
$V_{14} = W_4 R_{14} =$ (0.10) (0457) = 0045
$V_{15} = W_5 R_{15} =$ (0:15) (0666) = 0.1
$V_{16} = W_6 R_{16} =$ (0.25) (0457) = 0114

$V_{21} = W_1 R_{21} =$ (0.20)(0662) = 0132
$V_{22} = W_2 R_{22} =$ (0:15) (0457) = 0068
$V_{23} = W_3 R_{23} =$ (0:15) (0529) = 0079
$V_{24} = W_4 R_{24} =$ (0.10) (0457) = 0045

$V_{25} = W_5R_{25}$ = (0:15) (0666) = 0.1
$V_{26} = W_6R_{26}$ = (0.25) (0762) = 0190

$V_{31} = W_1R_{31}$ = (0.20) (0529) = 0105
$V_{32} = W_2R_{32}$ = (0:15) (0457) = 0068
$V_{33} = W_3R_{33}$ = (0.15) (0,529) = 0,079
$V_{34} = W_4R_{34}$ = (0.10) (0762) = 0076
$V_{35} = W_5R_{35}$ = (0:15) (0333) = 0:05
$V_{36} = W_6R_{36}$ = (0.25) (0,457) = 0,114

From the above calculation of the obtained matrix (Y)

$$Y = \begin{bmatrix} 0.105 & 0.114 & 0.099 & 0.045 & 0.1 & 0.114 \\ 0.132 & 0.068 & 0.079 & 0.045 & 0.1 & 0.190 \\ 0.105 & 0.068 & 0.079 & 0.076 & 0.05 & 0.114 \end{bmatrix}$$

The ideal solution is positive () Counted by the equation:A^+

$$A^+ = (y_1^+, y_2^+, \ldots . y_n^+)$$

y_1^+ =max {0105; 0132; 0105} = 0132
y_2^+ = max {0.114; 0.068; 0068} = 0.114
y_3^+ =max {0099; 0.079; 0079} = 0.099
y_4^+ =max {0045; 0.045; 0076} =0076
y_5^+ =max {0.1; 0:01; 0:05} = 0.1
y_6^+ =max {0.114; 0.190; 0.114} =0190

The ideal solution Negative ()Counted by equationA^-

$$A^- = (y_1^-, y_2^-, \ldots . y_n^-)$$

y_1^- =max {0105; 0132; 0105} = 0105
y_2^- = max {0.114; 0.068; 0068} = 0.068
y_3^- =max {0099; 0.079; 0079} = 0.079
y_4^- =max {0045; 0.045; 0076} =0045
y_5^- =max {0.1; 0:01; 0:05} = 0:05
y_6^- =max {0.114; 0.190; 0.114} =0114

Distance between weighted value of each alternative against positive alternative to the ideal solution is calculated based on the equation:

$$D_i^+ = \sqrt{\sum_{j=1}^{n}(y_i^- - y_{ij})^2} \; ; \qquad \text{i = 1,2, ...m.}$$

$$D_1^+ = \sqrt{\begin{matrix}(0.105-0.123)^2+(0.114-0.114)^2+\\(0.099-0.099)^2+(0.045-0.045)^2+\\(0.1-0.1)^2+(0.114-0.190)^2\end{matrix}} = 0086$$

$$D_2^+ = \sqrt{\begin{matrix}(0.132-0.123)^2+(0.068-0.114)^2+\\(0.079-0.099)^2+(0.045-0.045)^2+\\(0.1-0.1)^2+(0.190-0.190)^2\end{matrix}} = 0058$$

$$D_2^+ = \sqrt{\begin{matrix}(0.105-0.123)^2+(0.068-0.114)^2+\\(0.079-0.099)^2+(0.076-0.045)^2+\\(0.05-0.1)^2+(0.114-0.190)^2\end{matrix}} = 0107$$

$$D_i^- = \sqrt{\sum_{j=1}^{n}(y_{ij} - y_i^-)^2} \; ; \qquad \text{i = 1,2, ...m.}$$

$$D_1^- = \sqrt{\begin{matrix}(0.105-0.105)^2+(0.114-0.068)^2+\\(0.099-0.079)^2+(0.045-0.045)^2+\\(0.1-0.05)^2+(0.114-0.114)^2\end{matrix}} = 0.070$$

$$D_2^- = \sqrt{\begin{matrix}(0.132-0.105)^2+(0.068-0.068)^2+\\(0.079-0.079)^2+(0.045-0.045)^2+\\(0.1-0.05)^2+(0.190-0.114)^2\end{matrix}} = 0094$$

$$D_3^- = \sqrt{\begin{matrix}(0.105-0.105)^2+(0.068-0.068)^2+\\(0.079-0.079)^2+(0.076-0.045)^2+\\(0.05-0.05)^2+(0.114-0.114)^2\end{matrix}} = 0.030$$

The proximity of each alternative against the ideal solution is calculated based on the equation

$$V_i = \frac{D_i^-}{D_i^- + D_i^+}$$

$$V_1 = \frac{0.070}{0.070+0.086} = 0450$$

$$V_2 = \frac{0.094}{0.094+0.058} = 0618$$

$$V_3 = \frac{0.030}{0.030+0.107} = 0221$$

The order of the value of V can see which ones have the greatest value as the largest value.V_1

4.3 Analysis of Results

Based on the research results TOPSIS method for the determination of decision support systems STMIK Pringsewu Admissions Achievement Paths can be concluded as follows:

1. System used in TOPSIS method is able to overcome the weaknesses found in the old system and provide accurate results in determining the best students with the criteria determined by the campus.
2. TOPSIS method for decision support systems can provide maximum results in terms of decision which I sort students who excel and complied with.

5.0 CONCLUSION

5.1 Conclusion

Decision Support System to determine the new admissions Pringsewu STMIK achievement lane to assist and facilitate Universities in determining which students are competent or not get into college STMIK Pringsewu use the path of achievement.

5.2 Suggestions

Based on the above conclusions is expected that this information system can be developed further with new admissions data processing path of achievement. Hopefully, this system can be used as one of the new admissions decisions STMIK Pringsewu achievement lane.

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