DECISION SUPPORT SYSTEM SELECTION OF DEPARTMENT AT TELKOM VOCATIONAL SCHOOL, LAMPUNG USING THE TOPSIS METHOD

Arjuna Primanada[1], Siti Mukodimah[2]
Departement of Information Systems, Faculty of Technology and Computer Science,
Bakti Nusantara Institute, Lampung
Wisma Rini Street No.09 Pringsewu, Lampung, Indonesia
E- mail: primanadaarjuna@gmail.com, mukodimah97@gmail.com

Article Info

Abstract

In this era of technology, information technology is developing rapidly. The problem raised this time is how to determine the majors that match the abilities of new students at SMK Telkom Lampung. Because in the activity of determining the majors at SMK Telkom Lampung. The school has not implemented a computerized system optimally because the majority of majors are still using a manual system. On this occasion the method that will be used to assist in the selection of majors at SMK Telkom Lampung is the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method. The TOPSIS method is based on the concept that the best selected alternative not only has the shortest distance from the positive ideal solution, but also has the longest distance from the negative ideal solution. The TOPSIS method also has a simple and relatively easy-to-understand concept, is computationally efficient, and has the ability to measure the relative performance of each decision alternative in a simple mathematical form. In applying the selection of majors using the Decision Support System, it is hoped that it can really help facilitate and make the desired results in selecting majors more accurate, save time and get results faster. The decision support system for selecting majors at SMK Telkom Lampung can be further developed by creating a system where each test result that becomes a criterion is directly connected to the decision support system for selecting this major.

I. INTRODUCTION

At present Information Technology is developing rapidly. One of them is in the field of education, which we can see in the field of education for now there are many learning media that already use technology as a means to make it easier [1] .

Telkom Lampung Vocational School is a Vocational High School whose existence is under the auspices of the Telkom Education Foundation and is also the only Telkom School in Lampung. At Telkom Vocational School there are 4 majors including: Computer and Network Engineering (TKJ), Software Engineering (RPL), Telecommunications Access Network Engineering (TJAT), and Animation. According to data from the official website of SMK Telkom Lampung, currently there are 430 students, 43 teachers and students, and the number of alumni is 400 students [2] [3] [4] .

The decision support system at SMA Negeri Anggana focuses on providing recommendations for tertiary institutions that are in accordance with the abilities of students, therefore this SPK has criteria that can be changed as needed. [5]. In research at SMK Kertha Wisata Denpasar using the fuzzy method, the application built in this study was able to produce majors based on criteria and weights in a relatively short time. [6]. The third is the selection of majors at SMK Putra Nusantara Jakarta which uses the AHP method in which the results of the study show that the factors that influence prospective students in choosing majors have four criteria, namely among them are talent criteria, interests, quality of majors and career opportunities. [7]

The existence of fundamental changes in the field of information and communication technology has caused changes in several aspects, even now information has become a very valuable and decisive commodity to achieve success. Currently Telkom Lampung Vocational School has problems related to determining which majors are suitable for the abilities of new students. Because in the activity of determining the majors at SMK Telkom Lampung. The school has not implemented a computerized system optimally because the majority of majors are still using a manual system. Therefore, this research will focus on creating a system which can optimize the chances of success for new students in pursuing education in the majors at SMK Telkom Lampung based on the calculation of ability tests and supporting factors from the students themselves.

In making research at SMK Telkom Lampung using the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method. The TOPSIS method is based on the concept that the best selected alternative not only has the shortest distance from the positive ideal solution, but also has the longest distance from the negative ideal solution. The TOPSIS method also has a simple and relatively easy-to-understand concept, is computationally efficient, and has the ability to measure the relative performance of each decision alternative in a simple mathematical form.

I. LITERATURE REVIEW

2.1 Decision Support System

Decision Support System (DSS) is an interactive system that supports decisions in the decision-making process through alternatives obtained from the results of data processing, information and model design. Decision Support System (DSS) is also an information system that uses decision models, databases, as well as the manager's own thinking, an interactive modeling process with a computer. [8]

Table 1. Previous Research

Researcher	Study Results	Method Used	Advantages	Deficiency
Al Fath Riza Kholdani (2017)	This study analyzes and manufactures a major decision-making system software using a Decision Support System to obtain a weighting process in computerized decision-making. Calculations for weighting are based on the criteria for student scores, extracurriculars, crafts, test scores and behavior. The final score from SAW will later be converted according to the majors that will be determined, both Science, Social Studies and Language	SAW	making uses parameters which can provide accuracy, so that the decision results become more objective, not only based on the wishes of the teacher.	There is still a lack of detailed majors, criteria, and a combination of algorithmic methods used so that decision making is still limited and less flexible to use.
Ermadi satria wijay, et al (2018)	In this study the criteria used were Mathematics National Exam Scores, Indonesian Language National Examination Scores, English National Exam Scores, Science National Exam Scores, IPS UNBK Scores, Science Student Interests, Social Science Student Interests. The final results of this study found that the decision support system using the SAW method was able to overcome problems in the process of selecting majors and was in accordance with the interests and talents of prospective students.	SAW	In this study the system designed is in the form of a website that can be operated properly, which only requires a little time to wait for the desired results and the accuracy in this system has been able to adjust to the interests and talents of prospective students.	In this study, the criteria used are still too general, only focusing on the academic field, making it less flexible in making decisions.
Christian TP Sojow, et al (2021)	In this study, development was carried out by adding the criteria used to 15 criteria including: Mathematics test scores, Indonesian language test scores, English test scores, Mathematics report cards scores, Indonesian language report cards scores, English report cards scores, Science Report Scores, Report Card Scores Social Sciences, Psychological Test Scores, Science Student Interests, Social Science Student Interests, IB Student Interests, Science Parents' Suggestions, and IPS Parents' Suggestions, IB Parents' Suggestions.	SAW	In this study, it can be shown in detail the points that became the assessment and there was transparency in the selection of majors carried out by the user, supported and proven by the system.	It doesn't have its own domain yet so it can't be used online and can't add final results that are published on social media directly through the application.
Elisa Putri Br Sembiring (2021)	This system is implemented using the SMART method based on the criteria for each alternative. The result of this system is the value of knowledge for determining majors	SMART	The research uses a lightweight programming language,	The web appearance that is created is still very simple, so that it makes it

	based on predetermined criteria. This system uses the PHP programming language and uses a database from My SQL.		namely PHP, which makes it easy to access on non-renewable devices, and the alternatives provided can be added as needed.	less comfortable to use for interface purposes.
Bartulomius Harpad, et al (2021)	This research focuses on providing recommendations to students for suitable majors to take while in college. This system is designed using a simple programming language, namely PHP and the database used is phpMyAdmin. In this study, the selected colleges were only IT majors and the systems used were still offline. As well as the tools used for system development made using the Unified Modeling Language (UML) model.	TOPSIS	Has criteria that can be changed dynamically according to the needs needed by users where changing these criteria will not change the accuracy of the system	It can only be used for one selection in the search menu, and this system is still in the form of a website that hasn't been formed so it's not yet a mobile phone

2.2 Fuzzy Multi Attribute Decision Making (FMADM)

Fuzzy Multi Attribute Decision Making or commonly abbreviated as FMADM is a method used to find alternatives with optimal criteria. Fuzzy Multi Attribute Decision Making (FMADM) is a way in which we determine the weight value of each existing attribute, then it is processed by means of ranking which will select the existing alternatives. [9]

Basically, in FMADM there are three approaches that can be used to find attribute weight values, namely the first using a subjective approach, the second using an objective approach and the last with an integrity approach where the integrity approach itself is between the subjective approach and the objective approach. Each of these approaches has advantages and disadvantages. Where in the subjective approach, determining the weight value is based on the subjectivity of decision making, while for the objective approach, the weight value can be calculated mathematically so that it can ignore the subjectivity of decision making. There are several methods that can be used in solving Fuzzy Multi Attribute Decision Making (FMADM) problems, including the following:
1. Electre Technique For Order Preference By Similarity To Ideal Solution (TOPSIS)
2. Analytic Hierarchy Process (AHP)
3. Simple Additive Weighting (SAW)
4. Weighted Product (WP)

2.3 SMK Telkom Lampung

Telkom Lampung Vocational School is the only educational institution under the auspices of the Telkom education foundation and is also the only Telkom School in Lampung, at Telkom Vocational School there are 4 majors provided, including [4] :

1. TKJ (Computer and Network Engineering)
   Here students will learn how to assemble, install, and repair computers, be it Local Area Network (LAN) and Wide Area Network (WAN) network installations, or the internet of things (IoT).
2. Software Engineering (RPL)
   This department will study software creation, both for desktop, web and mobile-based applications, and here you will also learn how to do software design and develop the software itself.
3. Telecommunications Access Network Engineering (TJAT)
   Here students will learn about how to understand, operate and maintain various main equipment and also support telecommunications networks from various telecommunications operators or companies that use telecommunications facilities as supporting infrastructure for their core business.
4. Animation.
   This major will learn about how to make Videography, 2D Animation, 3D Animation, Digital Processing and others, in this animation major there are huge and many job opportunities in the current Industry 4.0 era.

II.   RESEARCH METHOD

In carrying out this research, the authors used several methods, as for the implementation method used in this research.

3.1   Data Types

The data in this study is data in the form of files of academic test results or it can also be in the form of written data from interviews with SMK Telkom Lampung, data brought by prospective students and other important data that can be used as a trigger in understanding the problems that arise when selection or determination of the majors of prospective students.

3.2 Research Flow

From this research, we can describe the research method in the form of a research flowchart below:
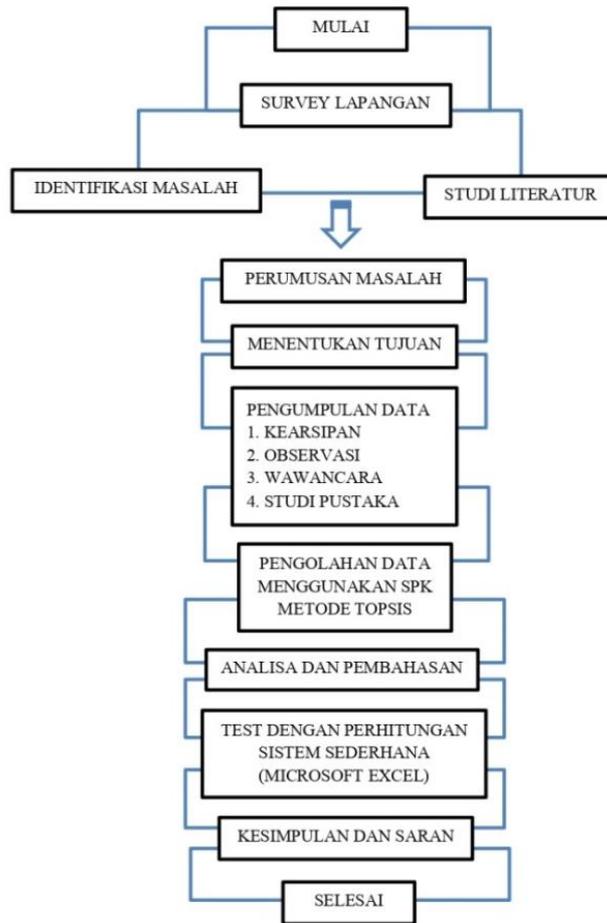
Figure 1. Research Flow

1) Field survey

In this activity we conduct a direct review of the research object which here is SMK Telkom Lampung, as well as asking permission from the school to conduct the research.

2) identification of problems

What is done at this stage is observing and determining the problem to be raised, then searching for related literature, determining the purpose of the problem to be obtained.

3) data collection

At this stage there are several methods of data collection, including:

1. Record management

This data collection method is in the form of evidence, notes that have been arranged in a document file from the results of students' academic tests.

2. Observation

This data collection method is carried out by making direct observations in the field, for managing data that will be stored in files and how to determine the majors for students is determined by taking into account the existing criteria in academic assessments such as psychological tests, verbal tests, Al-Qur' a test, and a computer comprehension test.

3. Interview

Data collection by conducting interviews was addressed to SMK Telkom Lampung where this interview was used to find and determine problems in choosing majors at SMK Telkom Lampung and ensure that the data obtained was truly accurate according to research needs. This interview was conducted with an informant named Mr. Tiara Pragaswara as a teacher at SMK Telkom Lampung, to inquire more deeply about the selection of majors at SMK Telkom Lampung so far.

4. Literature review

Here we study and record important things in scientific books and journals that have a relationship with the problem being discussed and also have a relationship with the research object which will be used as a basis for research.

4) Data processing

At this stage data processing will be carried out which consists of starting to group and sort the data obtained from the data collection process which will later be used in the process of discussing and implementing the selected method in solving the problem.

5) Analysis and discussion

As previously discussed here, we will begin to apply the chosen method in solving the problem that is taken based on the data obtained. In this research, the solution to the problem used is a decision support system using the TOPSIS method to solve the problem of selecting majors at SMK Telkom Lampung.

6) test with system

Here will be tested the results of the discussion using a simple calculation system Microsoft Excel.

7) conclusions and recommendations

A description of the results of the research that has been carried out in the previous process.

3.3 TOPSIS method

Technique For Others Reference By Similarity To Ideal Solution (TOPSIS) One of the multicriteria decision making methods first introduced by Yoon and Hwang (1981). TOPSIS uses the principle that the selected alternative must have the shortest distance from the positive ideal solution and the farthest from the negative ideal solution from a geometric point of view by using Euclidean distance to determine the relative proximity of an alternative to the optimal solution.

The positive ideal solution is defined as the sum of all the best values that can be achieved for each attribute, while the negative-ideal solution consists of all the worst values that can be achieved for each attribute.

TOPSIS considers both the distance to the positive ideal solution and the distance to the negative ideal solution by taking the relative proximity to the positive ideal solution. Based on a comparison of their relative distances, an alternative priority arrangement can be reached. [10]

Stages in the TOPSIS Method

1. Determine the criteria and properties

The criteria that will be used as a reference in making decisions, namely Ci and the nature of each criterion.

2. Defines a match rating
   The suitability rating of each alternative on each criterion.

3. Create a normalized decision matrix
   TOPSIS requires a performance rating for each alternative Ai on each normalized Cj criterion, namely:

$$r_{ij} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^{m} X_{ij}^2}}$$

4. Multiply between the weight with the value of each attribute
   This multiplication to form the Y matrix can be determined based on the normalized weight ranking (yij) as follows:

$$Y_{ij} = W_i r_{ij}$$

   with i=1,2,…,m and j=1,2,…,n

5. Determine the positive ideal solution matrix and the negative ideal solution matrix

6. Determine the distance between the values of each alternative and the positive and negative ideal solution matrices
   The distance between the alternative Ai and the positive ideal solution is formulated as:

$$D_i^+ = \sqrt{\sum_{j=1}^{n} \left(y_i^+ - y_{ij}\right)^2}$$

   The distance between the alternative Ai and the negative ideal solution is formulated as

$$D_i^- = \sqrt{\sum_{j=1}^{n} \left(y_{ij} - y_i^-\right)^2}$$

7. Determine the preference value for each alternative
   The preference value for each alternative (Vi) is given as:

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

   The larger Vi value indicates that the alternative Ai is preferred. [10]

III. RESULTS AND DISCUSSION

In the CHAPTER of this discussion, from the analysis of the problems that have been obtained during the research process, they include:

4.1 Registration process

process is carried out every new school year. Registration of new students is done manually or you can also visit the official website of SMK Telkom Lampung. After

completing registration and paying the registration fee, prospective new students will receive a new student admission form to fill out.

4.2 Academic Tests

After completing the form filling, prospective new students will go through a series of tests including a psychological test, Al-Qur'an test, verbal test and computer comprehension test. In recording the assessment of this test, the committee still records the assessment manually. So that the recording of this assessment has a considerable risk of writing and calculation errors which results in reduced data accuracy.

4.3 Calculation of test results and selection of majors

After a series of test processes are carried out by prospective new students, the admissions committee will carry out calculations from the test results to determine whether they are accepted or not and determine majors for prospective new students based on the results of the tests that have been carried out. The calculation of this test is carried out using Microsoft Excel so that it can be easier to calculate because there are supporting functions in it.

4.4 TOPSIS Calculation Methods and Results

From this process there are several obstacles in the process of recording test scores and calculating scores. Recording values that are still done manually has a high risk of recording errors. Calculation of the weight of this value also requires a longer time even though it has used the help of the Microsoft Excel application.

The solution offered by the author in this study is an alternative that is expected to solve the problem. The authors in this study built a system using the decision support system or SPK method, where the method chosen was Technique for Others Reference By Similarity To Ideal Solution (TOPSIS), where this method is the sum of the weights of several criteria. In supporting the decision-making process for the selection of majors at SMK Telkom Lampung. Telkom Lampung Vocational School has 4 skills competence majors which will be an alternative in the method used. These alternatives can be seen in the following table:

Table 2. Alternative Majors

Alternative	
A_1	Nito
A_2	Nayan
A_3	Rifki
A_4	Tisya
A_5	fine
A_6	Ijah
A_7	farhan
A_8	Sultan
A_9	Femas
A_{10}	Pen

From the alternatives above, there are limits/ranges from the results of processing the existing criteria to determine the most suitable majors or alternatives for new students who have passed the entrance test to SMK Telkom Lampung.

Table 3. Major Grade Limits

Major	Value Limitation	convert
Animation	>85.00	>0.75
Software engineering	>80.00 – 85.00	>0.50 – 0.75
Telecommunications Access Network Engineering	>75.00 – 80.00	>0.25 – 0.50
Computer network Engineering	>70.00 – 75.00	>0.01 – 0.25

There are 8 criteria used as the basis of reference in decision making. Which criteria are taken from calculating student test results and National exam scores on the prospective new student's Middle School Certificate. These criteria include:

Table 4. Major Criteria
(Source: Telkom Lampung Vocational School Teacher)

Symbol	Criteria
C_1	Psychotest Test Value
C_2	Al-Qur'an Test Scores
C_3	Verbal test scores
C_4	Computer comprehension test scores
C_5	Mathematics National Examination Scores
C_6	Science National Exam Score
C_7	English National Exam Scores
C_8	Indonesian National Exam Score
C_9	Economic Ability of Parents of Prospective Students

From the criteria above, then create sub-criteria from the existing criteria to determine the weight value of the results of the existing criteria, the intended sub-criteria are as follows:

Table 5. C_1 Psychological Test Scores

Score	Category
60 – 65	Very bad
66–71	Bad
72–77	Enough
78–83	Well
≥ 84	Very good

Table 6. C_2 Al-Qur'an test scores

Score	Category
65 – 70	Very bad
71–76	Bad
77–82	Enough
83–88	Well
≥ 89	Very good

Table 7. C_3 Verbal Test Scores

Score	Category
60 – 65	Very bad
66–71	Bad
72–77	Enough
78–83	Well
≥ 84	Very good

Table 8. C $_4$ Computer Comprehension Test Scores

Score	Category
62–67	Very bad
68–73	Bad
74–79	Enough
80 – 85	Well
≥ 86	Very good

Table 9. C $_5$ National Mathematics Exam Score

Score	Category
60 – 65	Very bad
66–71	Bad
72–77	Enough
78–83	Well
≥ 84	Very good

Table 10. C $_6$ Science National Exam Score

Score	Category
58–63	Very bad
64 – 69	Bad
70–75	Enough
76–81	Well
≥ 82	Very good

Table 11. C $_7$ Scores of the National English Language Examination

Score	Category
61–66	Very bad
67–72	Bad
73–78	Enough
79–84	Well
≥ 85	Very good

Table 12. C $_8$ Indonesian Language National Exam Score

Score	Category
61–66	Very bad
67–72	Bad
73–78	Enough
79–84	Well
≥ 85	Very good

Table 13. C $_9$ Economic Ability of Parents of Prospective Students

Income	Weight	Category
≥ 5,000,000	90	Very good

≥ 3,000,000 – 5,000,000	85	Well
≥ 1,500,000 – 3,000,000	80	Enough
≥ 500,000 – 1,500,000	70	Bad
≤ 500,000	65	Very bad

In this study, there were 10 registrants at SMK Telkom Lampung who became the sample. Including the following:

Table 14. Sample

A₁		
Nito	Psikotest test scores	75
	Al-Qur'an Test Scores	90
	Verbal test scores	70
	Computer comprehension test scores	75
	Mathematics National Examination Scores	65
	Science National Exam Score	80
	English National Exam Scores	75
	Indonesian National Exam Score	85
	Economic Capability of Students' Parents IDR 2,800,000	80
A₂		
Nayan	Psikotest test scores	78
	Al-Qur'an Test Scores	94
	Verbal test scores	68
	Computer comprehension test scores	79
	Mathematics National Examination Scores	70
	Science National Exam Score	67
	English National Exam Scores	72
	Indonesian National Exam Score	80
	Economic Capability of Students' Parents IDR 3,200,000	85

After all the value data from each alternative 1, 2, 3,….. 10 in can then determine the suitability rating of each alternative to each criterion, the suitability rating can be seen in the following table.

W	5	4	5	3	4	3	5	3	4
AL	Criteria								
	C₁	C₂	C₃	C₄	C₅	C₆	C₇	C₈	C₉
A₁	75	90	70	75	65	80	75	85	80
A₂	78	94	68	79	70	67	72	80	85
A₃	80	77	75	68	82	79	83	73	90
A₄	82	81	85	79	68	82	76	85	90
A₅	77	80	82	85	80	73	65	78	80
A₆	81	84	85	82	86	85	83	85	70
A₇	70	75	73	81	75	80	77	76	90
A₈	85	80	70	82	84	76	85	78	85
A₉	90	83	69	78	80	75	83	80	80
A₁₀	85	90	76	75	87	90	85	88	80

From the criterion data from each of the alternatives above then enter the normalization stage which at this stage is carried out by using the following calculations :

$$r_{ij} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^{m} X_{ij}^2}}$$

$x_1 = \sqrt{75^2+78^2+80^2+82^2+77^2+81^2+70^2+85^2+90^2+85^2}$
$= \sqrt{5625+6084+6400+6728+5929+6561+4900+}$
$= \sqrt{7225+8100+7225}$
$= \sqrt{64773} = 254{,}51$

$$r_{11} = \frac{75}{254{,}50} = 0{,}29 \qquad r_{61} = \frac{81}{254{,}50} = 0{,}32$$

$$r_{21} = \frac{78}{254{,}50} = 0{,}31 \qquad r_{71} = \frac{70}{254{,}50} = 0{,}28$$

$$r_{31} = \frac{80}{254{,}50} = 0{,}31 \qquad r_{81} = \frac{85}{254{,}50} = 0{,}33$$

$$r_{41} = \frac{82}{254{,}50} = 0{,}32 \qquad r_{91} = \frac{90}{254{,}50} = 0{,}35$$

$$r_{51} = \frac{77}{254{,}50} = 0{,}30 \qquad r_{101} = \frac{85}{254{,}50} = 0{,}33$$

$x_2 = \sqrt{90^2+94^2+77^2+81^2+80^2+84^2+75^2+80^2+83^2+90^2}$
$= \sqrt{8100+8836+5929+6561+6400+7056+5625+}$
$= \sqrt{6400+6889+8100}$
$= \sqrt{69{,}896} = 264{,}38$

$$r_{12} = \frac{90}{264{,}37} = 0{,}34 \qquad r_{62} = \frac{84}{264{,}37} = 0{,}32$$

$$r_{22} = \frac{94}{264{,}37} = 0{,}36 \qquad r_{72} = \frac{75}{264{,}37} = 0{,}28$$

$$r_{32} = \frac{77}{264{,}37} = 0{,}29 \qquad r_{82} = \frac{80}{264{,}37} = 0{,}30$$

$$r_{42} = \frac{81}{264{,}37} = 0{,}31 \qquad r_{92} = \frac{83}{264{,}37} = 0{,}31$$

$$r_{52} = \frac{80}{264{,}37} = 0{,}30 \qquad r_{102} = \frac{90}{264{,}37} = 0{,}34$$

The above calculation is done for all normalized matrices of $X_{11}, \ldots \ldots, X_{109}$. When finished, you will get a normalized matrix (R) as follows:

$$\begin{bmatrix} 0.29 & 0.34 & 0.29 & 0.30 & 0.26 & 0.32 & 0.30 & 0.33 & 0.30 \\ 0.31 & 0.36 & 0.28 & 0.32 & 0.28 & 0.27 & 0.29 & 0.31 & 0.32 \\ 0.31 & 0.29 & 0.31 & 0.27 & 0.33 & 0.32 & 0.33 & 0.29 & 0.34 \\ 0.32 & 0.31 & 0.36 & 0.32 & 0.28 & 0.33 & 0.31 & 0.33 & 0.34 \end{bmatrix}$$

$$\begin{pmatrix}
0.30 & 0.30 & 0.34 & 0.34 & 0.32 & 0.29 & 0.26 & 0.30 & 0.30 \\
0.32 & 0.32 & 0.36 & 0.33 & 0.35 & 0.34 & 0.33 & 0.33 & 0.27 \\
0.28 & 0.28 & 0.31 & 0.33 & 0.30 & 0.32 & 0.31 & 0.30 & 0.34 \\
0.33 & 0.30 & 0.29 & 0.33 & 0.34 & 0.30 & 0.34 & 0.30 & 0.32 \\
0.35 & 0.31 & 0.29 & 0.31 & 0.32 & 0.30 & 0.33 & 0.31 & 0.30 \\
0.33 & 0.34 & 0.32 & 0.30 & 0.35 & 0.36 & 0.34 & 0.34 & 0.30
\end{pmatrix}$$

If the normalization matrix has been formed, the next step is weighting by using the calculation below according to the weight of the criteria that have been set at the beginning (W = 5, 4, 5, 3, 4, 3, 5, 3, 4).

$$Y_{ij} = W_i r_{ij}$$

$Y_{11} = w_1 r_{11} = (5)(0.29) = 1.47$

$Y_{12} = w_2 r_{12} = (4)(0.34) = 1.36$

$Y_{13} = w_3 r_{13} = (5)(0.29) = 1.46$

$Y_{14} = w_4 r_{14} = (3)(0.30) = 0.91$

$Y_{15} = w_5 r_{15} = (4)(0.26) = 1.05$

$Y_{16} = w_6 r_{16} = (3)(0.32) = 0.96$

$Y_{17} = w_7 r_{17} = (5)(0,30) = 1,51$

$Y_{18} = w_8 r_{18} = (3)(0.33) = 1.00$

$Y_{19} = w_9 r_{19} = (4)(0.30) = 1.22$

$Y_{21} = w_1 r_{21} = (5)(0.30) = 1.53$

$Y_{22} = w_2 r_{22} = (4)(0.35) = 1.42$

$Y_{23} = w_3 r_{23} = (5)(0.28) = 1.42$

$Y_{24} = w_4 r_{24} = (3)(0.31) = 0.95$

$Y_{25} = w_5 r_{25} = (4)(0.28) = 1.13$

$Y_{26} = w_6 r_{26} = (3)(0.26) = 0.81$

$Y_{27} = w_7 r_{27} = (5)(0.28) = 1.45$

$Y_{28} = w_8 r_{28} = (3)(0.31) = 0.94$

$Y_{29} = w_9 r_{29} = (4)(0.32) = 1.29$

Perform the above calculations until Y_{109} is complete so that a Y-weighted normalization table is formed as shown below :

$$\begin{pmatrix}
1.47 & 1.36 & 1.46 & 0.91 & 1.05 & 0.96 & 1.51 & 1.00 & 1.22 \\
1.53 & 1.42 & 1.42 & 0.95 & 1,13 & 0.81 & 1.45 & 0.94 & 1.29 \\
1.57 & 1.16 & 1.57 & 0.82 & 1.33 & 0.95 & 1.67 & 0.86 & 1.37 \\
1.61 & 1.23 & 1.78 & 0.95 & 1.10 & 0.99 & 1.53 & 1.00 & 1.37 \\
1.51 & 1.21 & 1.72 & 1.03 & 1.30 & 0.88 & 1.31 & 0.91 & 1.22 \\
1.59 & 1.27 & 1.78 & 0.99 & 1.39 & 1.02 & 1.67 & 1.00 & 1.06 \\
1.38 & 1,13 & 1.53 & 0.98 & 1.22 & 0.96 & 1.55 & 0.89 & 1.37 \\
1.67 & 1.21 & 1.46 & 0.99 & 1.36 & 0.91 & 1.71 & 0.91 & 1.29
\end{pmatrix}$$

$$1.77 \quad 1.26 \quad 1.44 \quad 0.94 \quad 1.30 \quad 0.90 \quad 1.67 \quad 0.94 \quad 1.22$$
$$1.67 \quad 1.36 \quad 1.59 \quad 0.91 \quad 1.41 \quad 1.08 \quad 1.71 \quad 1.03 \quad 1.22$$

Determine the positive ideal value A $^+$ and the ideal negative value A $^-$ with the provisions on the positive ideal A $^+$ if he is Benefit then the maximum value is sought, if the cost you are looking for is the minimum/smallest value and vice versa for negative ideal A $^-$ if he is Benefit then what you are looking for is the minimum value, if the Cost you are looking for is the maximum value, as follows:

The ideal solution Positive A $^+$:

Y_1^+ Max {1,47;1,53;1,57;1,61;1,51;1,59;1,38;
        1,67;1,77;1,67}= 1.77

Y_2^+ Max {1,36;1,42;1,16;1,23;1,21;1,27;1,13;
        1 ,21 ;1,26;1,36}= 1.42

Do the calculations as above until Y_9^+.

Negative ideal solution A $^-$

Y_1^- Max {1,47;1,53;1,57;1,61;1,51;1,59;1,38;
        1,67;1,77;1,67}= 1.38

Y_2^- Max {1,36;1,42;1,16;1,23;1,21;1,27;1,13;
        1 ,21 ;1,26;1,36}= 1 .13

Do the calculations as above until Y_9^-.

If the steps above have been completed then the results obtained are as follows :

A+
$$1.77 \quad 1.42 \quad 1.78 \quad 1.03 \quad 1.41 \quad 1.08 \quad 1.71 \quad 1.03 \quad 1.37$$

A-
$$1.38 \quad 1,13 \quad 1.42 \quad 0.82 \quad 1.05 \quad 0.81 \quad 1.31 \quad 0.86 \quad 1.06$$

Next is to perform calculations to measure alternative distances with positive ideal solutions and negative ideal solutions.

 a) Calculation of the distance between an alternative with a positive ideal solution.

$D_1^+ = \sqrt{(1,77\text{-}1,47)^2 + (1,42\text{-}1,36)^2 + (1,78\text{-}1,46)^2 +}$
$= \sqrt{(1,03\text{-}0,91)^2 + (1,41\text{-}1,05)^2 + (1,08\text{-}0,96)^2 +}$
$= \sqrt{(1,71\text{-}1,51)^2 + (1,03\text{-}1,00)^2 + (1,37\text{-}1,22)^2}$
$= \sqrt{(0,3)^2 + (0,06)^2 + (0,32)^2 + (0,12)^2 + (0,36)^2 +}$
$= \sqrt{(0,12)^2 + (0,2)^2 + (0,03)^2 + (0,15)^2}$
$= \sqrt{0,09 + 0,0036 + 0,1024 + 0,0144 + 0,1296 + 0,0144 +}$
$= \sqrt{0,04 + 0,0009 + 0,0225}$
$= \sqrt{0,4178} = 0,64$

$D_2^+ = \sqrt{(1,77\text{-}1,53)^2 + (1,42\text{-}1,42)^2 + (1,78\text{-}1,42)^2 +}$
$= \sqrt{(1,03\text{-}0,95)^2 + (1,41\text{-}1,13)^2 + (1,08\text{-}0,81)^2 +}$
$= \sqrt{(1,71\text{-}1,45)^2 + (1,03\text{-}0,94)^2 + (1,37\text{-}1,29)^2}$
$= \sqrt{(0,24)^2 + (0)^2 + (0,36)^2 + (0,08)^2 + (0,28)^2 +}$
$= \sqrt{(0,27)^2 + (0,26)^2 + (0,09)^2 + (0,08)^2}$
$= \sqrt{0,0576 + 0 + 0,1296 + 0,0064 + 0,0784 + 0,0729 +}$
$= \sqrt{0,0676 + 0,0081 + 0,0064}$
$= \sqrt{0,427} = 0,65$

Do the calculations as above until D_{10}^+.

b) Calculation of the distance between an alternative with a negative ideal solution.

$D_1^- = \sqrt{(1,47\text{-}1,38)^2 + (1,36\text{-}1,13)^2 + (1,46\text{-}1,42)^2 +}$

$\quad = \sqrt{(0,91\text{-}0,82)^2 + (1,05\text{-}1,05)^2 + (0,96\text{-}0,81)^2 +}$

$\quad = \sqrt{(1,51\text{-}1,31)^2 + (1,00\text{-}0,86)^2 + (1,22\text{-}1,06)^2}$

$\quad = \sqrt{(0,09)^2 + (0,23)^2 + (0,04)^2 + (0,09)^2 + (0)^2 +}$

$\quad = \sqrt{(0,15)^2 + (0,2)^2 + (0,14)^2 + (0,16)^2}$

$\quad = \sqrt{0,0081 + 0,0529 + 0,0016 + 0,0081 + 0 + 0,0225 +}$

$\quad = \sqrt{0,04 + 0,0196 + 0,0256}$

$\quad = \sqrt{0,1784} = 0,42$

$D_2^- = \sqrt{(1,53\text{-}1,38)^2 + (1,42\text{-}1,13)^2 + (1,42\text{-}1,42)^2 +}$

$\quad = \sqrt{(0,95\text{-}0,82)^2 + (1,13\text{-}1,05)^2 + (0,81\text{-}0,81)^2 +}$

$\quad = \sqrt{(1,45\text{-}1,31)^2 + (0,94\text{-}0,86)^2 + (1,29\text{-}1,06)^2}$

$\quad = \sqrt{(0,15)^2 + (0,29)^2 + (0)^2 + (0,13)^2 + (0,08)^2 + (0)^2}$

$\quad = \sqrt{+ (0,14)^2 + (0,08)^2 + (0,23)^2}$

$\quad = \sqrt{0,0225 + 0,0841 + 0 + 0,0169 + 0,0064 + 0 +}$

$\quad = \sqrt{0,0196 + 0,0064 + 0,0529}$

$\quad = \sqrt{0,2088} = 0,46$

The final step is to calculate the relative proximity of the alternative to the ideal solution or to find the preference value for each alternative.

$$v_1 = \frac{D_1^-}{D_1^- + D_1^+} = \frac{0,42}{0,42 + 0,64} = \frac{0,42}{1,09} = 0,40$$

$$v_2 = \frac{D_2^-}{D_2^- + D_2^+} = \frac{0,46}{0,46 + 0,65} = \frac{0,46}{1,11} = 0,41$$

From the results of the preferences above, we can conclude, or we determine the ranking of the best alternatives based on the specified criteria, which ranking calculations will become a reference in selecting majors for prospective students at SMK Telkom Lampung.

No	Alternative	Preference value	Rating	Major
1	Nito	0.40	10	TJAT
2	Nayan	0.41	9	TJAT
3	Rifki	0.55	6	RPL
4	Tisya	0.58	4	RPL
5	fine	0.45	7	TJAT
6	Ijah	0.65	2	RPL
7	farhan	0.44	8	TJAT
8	Sultan	0.60	3	RPL
9	Femas	0.57	5	RPL

10	Pen	0.72	1	RPL

From the ranking table above, it can be concluded that of the 10 samples of prospective students above, there were 4 students selected to enter the Telecommunications Access Network Engineering (TJAT) major and 6 students selected to enter the Software Engineering (RPL) department based on a series of calculations that have been carried out that refer to predetermined criteria, so that the school can immediately decide on the selection of majors for these students.

V. CONCLUSION

In this study, the conclusions that can be drawn are that nowadays it is irrelevant if in choosing majors at a learning institution, especially in this study at Telkom Lampung Vocational School, they still use the system manually. In selecting majors using a Decision Support System (DSS) can really help facilitate and make the desired results more accurate, here the TOPSIS method is chosen because this method is still quite relevant if only one method is used in decision making. The purpose of this research is to make it easier in terms of selecting majors which previously were still manual and lacked transparency, this time it was made digitally with the help of the TOPSIS SPK which can save a lot of time and the results are faster and more accurate. But in this study there are still weaknesses, where in the operation of the system you still have to input one by one the test results of prospective students. It is hoped that in the future there will be research that can cover this weakness, where student data can be input simultaneously in a fairly fast period of time and the results are accurate.

REERENCES

[1]   Z. Rokhmah, S. Assegaff, M. Information Systems, U. Dynamics of the Nation, and J. Jl Jend Sudirman Thehok-Jambi, "Decision Support System for Determining Majors Using the Saw Method at State Vocational High School 1 Merangin," 2021.

[2]   R. Oktapani *et al.* , "Application of the Analytical Hierarchy Process (Ahp) Method for the Selection of Majors at the Prayer National Vocational High School Palabuhanratu," *J. Swabumi* , Vol. 8, No. 2, 2020.

[3]   "Smk Telkom Lampung – School Of Technology Digital Era." Https://Smktelkom-Lpg.Sch.Id/ (Accessed 20 November 2022).

[4]   "Ppdb Vocational High School Telkom Lampung 2023-2024." Https://Ppdb.Smktelkom-Lpg.Sch.Id/ (Accessed 20 November 2022).

[5]   B. Harpad, I. Arfyanti, and D. Rifaldi, "Decision Support System for Higher Education Selection for High School Students at SMA Negeri 1 Anggana Using the Web-Based Topsis Method".

[6]   K. Dwi, G. Supartha, G. Ayu, P. Eka, and P. Dewi, "Decision Support System for Determining Majors at SMK Kertha Wisata Denpasar Using Fuzzy Saw," J. *Nas. Educator. Tech. inform.* , Vol. 3, No. 2, 2014.

[7]   M. Rahmayu Information Systems Study Program at Stmik Nusa Mandiri Jakarta and R. Kusuma Serli, "Decision Support System for Major Selection at Putra Nusantara Jakarta Vocational High School Using the Analytical Hierarchy Process (Ahp) Method," J. Symmetris , *Vol* . 9, No. 1, 2018.

[8]   "2022 Spk Selection of Majors in Sman 2 Batang Anai Saw Method".

[9]   A. Fitriyani, R. Irma Handayani, E. Widanengsih, and S. Nusa Mandiri Jakarta, "Decision Support System for Major Selection at Ymik Joglo Vocational High School, West Jakarta Using the Simple Additive Weigting (Saw) Method," Jtksi , *Vol* . 03, No. 01, 2020.

[10] "Topsis Method (Technique For Others Preference By Similarity To Ideal Solution) - Raharja University." Https://Raharja.Ac.Id/2020/04/02/Metode-Topsis-Technique-For-Others-Reference-By-Similarity-To-Ideal-Solution/ (Accessed 6 November 2022).

[11] U. Islam, K. Muhammad, A. Al, B. Banjarmasin, A. Fath, and R. Kholdani, "System of Determining Major Selection Decisions for Students of Sman 4 Banjarbaru Using the Simple Additive Weighting (Saw) Method Faculty of Information Technology ."

[12] ES Wijay, RM Faozy, J. Raya, and D. Purwokerto, "Decision Support System for Department Selection Using Simple Additive Weighting (Saw) Method at SMA Muhammadiyah 1 Purwokerto Decision Support System Of Department Selection Using Simple Additive Weighting (Saw)) Method In SMA Muhammadiyah Purwokerto."

[13] CTP Sojow, VC Poekoel, and FD Kambey, "January-March 2021, p," *J. Tek. inform.* , Vol. 16, No. 1, p. 47–56.

[14] E. Putri and B. Sembiring, "Decision Support System for Determining Majors at the Vocational School Level Using the Smart Method (Case Study: State Vocational School 2 Binjai) Decision Support System For Determining Departments At The Vocational School Level Using The Smart Method (Case Study : State Vocational High School 2 Binjai)," 2021.