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Research Original Article

Decision Support System For Selecting School Majors in Man Using The Weighted Aggregated Sum Product Assessment Method

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Abstract
Determining school majors at Madrasah Aliyah Negeri (MAN) is an important process that must consider various factors such as academic grades, interests, and talents of students. However, the determination of the applicable majors still has problems due to several factors such as the environment or parents' requests so that the selection of students' majors is not in accordance with the abilities and talents of students. The selection of majors is also still done manually, so it is less efficient and takes a long time. This research aims to design and build a web-based Decision Support System (DSS) using the Weighted Aggregated Sum Product Assessment (WASPAS) method that is useful for helping schools determine majors that are in accordance with student abilities. This decision support system combines various criteria such as report card scores, academic test results, and practical skills to provide optimal majoring recommendations. The WASPAS method was chosen because of its ability to combine the Weighted Sum Model (WSM) and Weighted Product Model (WPM) methods, which results in more accurate calculations. The calculation test results show that the system built is able to provide major recommendations more quickly and effectively compared to the manual method. This system is expected to help schools in managing student majors more efficiently and objectively.
Keywords: Decision Support System, WASPAS Method, Majoring, Web-based DSS.

Introduction
The rapid development of information technology today has had a significant impact on various fields of life, including the world of education. One of the implementations of this technology is in the form of a Decision Support System (DSS) which is a computer-based system built with a series of certain programs to help make decisions. In the decision support system there are also stages of the resolution process used when making decisions or what is commonly referred to as methods. The development of decision support system methods is currently growing rapidly, especially in conducting evaluations. In making decisions that must be considered are alternatives so that later they can produce optimal decisions.[1]

There are several decision support system methods that can be applied to solve problems such as the WASPAS (*Weighted Aggregated Sum Product Assesment)* method. The WASPAS method performs an optimal performance assessment on each criterion, then forms a normalization matrix on each criterion and calculates the value of the normalization matrix by optimizing the estimation of the low value and the highest value[2]. In the context of selecting majors at MAN 3 Langkat, the WASPAS method is used to calculate the weights of various criteria such as report cards, academic test results, and religious practices, thus helping to determine the most suitable majors for students.

In the field of education, especially in the process of selecting majors, it is often difficult for students to determine majors that match their interests, talents, and potential in the future. One example of a case is at MAN 3 Langkat, where the selection of majors is still done manually, causing less than optimal results and taking a long time. With the presence of a web-based DSS, this process also makes it easier for schools to manage student data, criteria data, and final results of majors. This web-based system is designed to be easily accessed by teachers and students whenever needed, thus increasing the work efficiency of school staff. Thus, it is expected that the implementation of this decision support system will not only help students in choosing the right major, but also support schools in running the selection process efficiently.

Overall, this research aims to develop a web-based system with the WASPAS method to assist schools in determining

student majors at MAN 3 Langkat. With this system, it is expected to improve the process of selecting majors that are faster, more accurate, and based on comprehensive data analysis.

Research Metodhs

Decision Support System

Decision support system is a system that is able to solve problems efficiently, effectively, which aims to help decision making by choosing various alternative decisions[3]. According to [4] decision support system modeling has 4 stages, namely: Intelligence Phase (problem mapping process), Design Phase (system design process), Choice Phase (alternative solution selection process), Implementation Phase (system implementation process).

Weighted Aggregated Sum Product Assesment (WASPAS) Method

The WASPAS method is a method that can determine the weight value for each attribute then proceed with the ranking process which will select the best alternative from the number of alternatives with the ranking method [5]. This method combines two approaches, namely Weighted Sum Model (WSM) and Weighted Product Model (WPM), to assess the performance of alternatives based on predefined criteria. In this method, the highest value is found according to the 2 highest criteria [6].

The steps for completing the waspas method in the decision support system are as follows:

1. Creating a Decision Matrix

$$X = \begin{bmatrix} x_{11} & x_{21} & . & x_{1n} \\ x_{21} & x_{22} & . & x_{2n} \\ . & . & . & . \\ x_{m1} & x_{m2} & . & x_{mn} \end{bmatrix} \quad \text{.....(1)}$$

Description:
Where m is the number of alternative candidates, n is the number of criteria.

2. Normalizing the Decision Matrix

Profit Criteria:

$$\bar{x} = \frac{x_{ij}}{max_i x_{ij}} \quad \text{.....(2)}$$

$$\bar{x} = \frac{min_i x_{ij}}{xij}$$

Benefit Criteria

.....(3)

Description:
Xij = performance value of alternative i againts criterion j
max_i = largest value of alternative
min_i = smallest value of alternative

3. Calculating Qi Preference Value

$$Qi = 0{,}5 \sum_{j=1}^{n} x_{ij} w + 0{,}5 \prod_{j=1}^{n} (x_{ij})^{wj} \quad \text{.....(4)}$$

Description:
Qi = value of Q to alternative i
0,5 = constancy
$X_{ij}w$ = multiplication of value x_{ij} with weight (w)

4. Perform Ranking

Ranking is done by looking at the results of the Qi calculation. The results of the final value calculation are then sorted from the largest to the smallest value, the alternative with the largest final value shows the best alternative.

System Development Method

In making this system using development using the waterfall method.

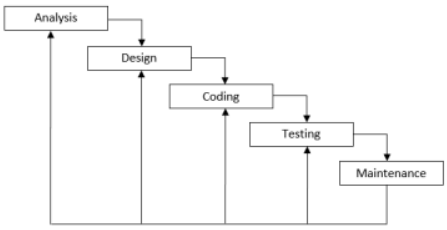

Figure 1 Waterfall Method

The following are the stages of system development using the waterfall method:

a. Analysis
   At this stage, an analysis of the needs of system users is carried out. to identify the problems that exist in the system along with the limitations of the problem and determine the specifications of system requirements.
b. Design
   At this stage, the module is made from the software requirement specification using a structured method. This stage will translate the needs of the software presentation system, its quality can be estimated before the coding stage is carried out.
c. Coding
   Coding is the activity of translating the design results into a form that can be understood by the machine using the system programming language.
d. Testing
   The purpose of this testing is to correct or review errors that occur and ensure that the input that has been defined outputs in accordance with the required results.
e. Maintenance
   At this stage, the application operation is carried out on the actual system.

System Schematic

A system schema is a workflow designed to help explain and illustrate how research is conducted. This scheme is usually in the form of a diagram or visual representation that shows how the research components are interconnected. The following is a system scheme of a school major selection decision support system using the Weight Aggregated Sum Product Assesment (WASPAS) method.

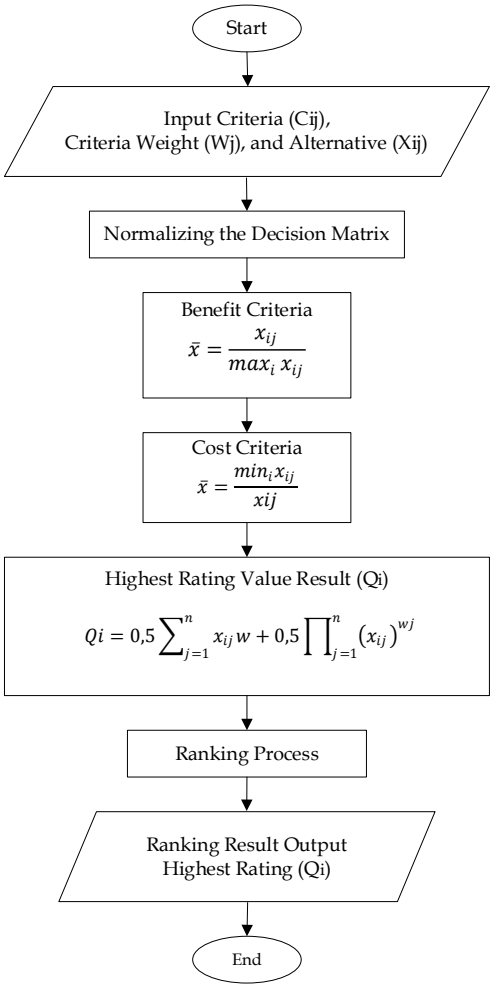

Figure 2 System Schematic

Results and Discussion

The decision support system for determining majors with the SAW method has input, process and output. The inputs needed in this system are criteria data, matrix comparison data between criteria. The process carried out in this system is the score scoring process and the majoring selection process, while the output is the result of each student's majoring selection.

Database Manegement

This system is made with DFD (Data Flow Diagram) to describe the system process visually so that anyone can understand how the system works and flows.

a. Diagram Context

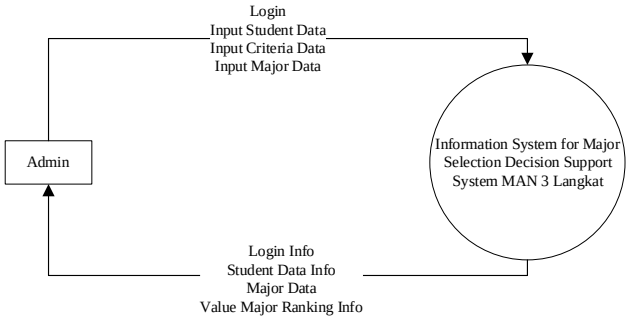

Figure 3 Diagram Context

b. Data Flow Diagram

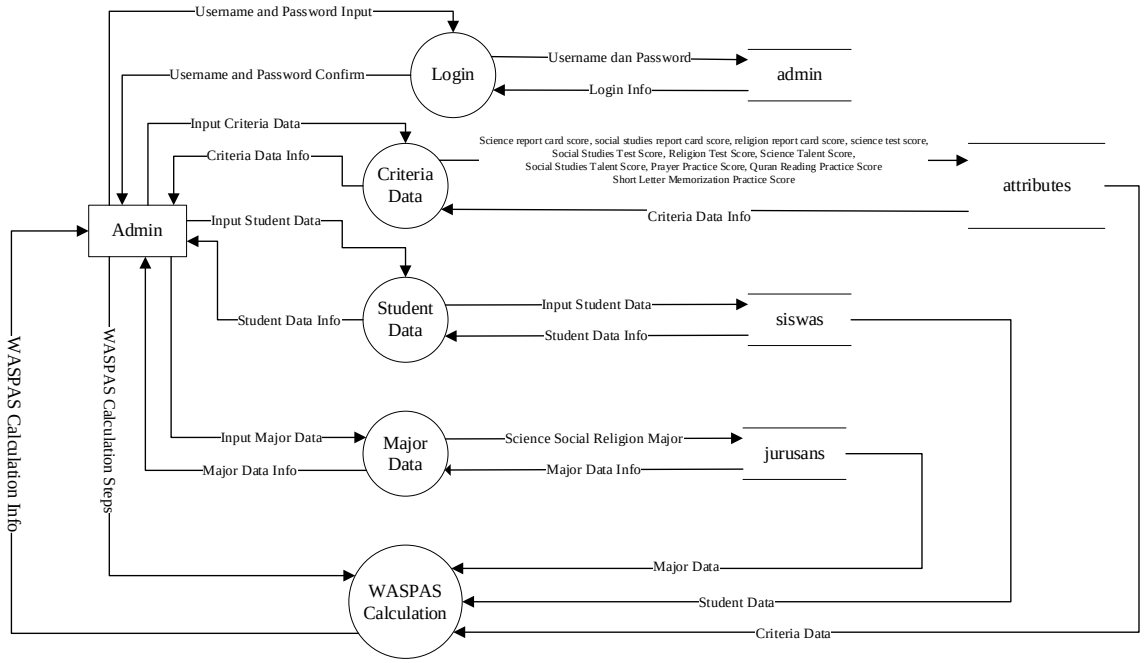

Figure 4 Data Flow Diagram System

Determination of Weight and Criteria

The criteria used refer to school rules in determining majors to enter the desired class as can be seen in the table below:

Table 1 Criteria Data

Criteria	Description
Key Criteria	Academic Score
Supporting Criteria	Report Card Score
Additional Criteria	Aptitude Score and Practice Score

From each of these criteria, the weights will be determined, more clearly the weights are formed in the table below.

Table 2 Weighting Criteria for Science Majors

Criteria	Description	Weight
Key Criteria	Science Academic Test Score	5
Supporting Criteria	Science Report Card Score	3
Additional Criteria	Science Practice Score	2

Table 3 Weighting Criteria for Social Majors

Criteria	Description	Weight
Key Criteria	Social Academic Test Score	5
Supporting Criteria	Social Report Card Score	3
Additional Criteria	Social Practice Score	2

Table 4 Weighting Criteria for Religion Majors

Criteria	Description	Weight
Key Criteria	Religion Academic Test Score	5
Supporting Criteria	Religion Report Card Score	3
Additional Criteria	Religion Practice Score	2

Application of the WASPAS Method

From the total number of students, several students were taken as alternative examples of the application of the waspas method in determining majors with the names of the students, namely, Umi Habiba (A1), Muhammad Abid Tamimsyah (A2), Farhan Al Farizi (A3), Auffa Dzakwan Al-Fayyadh (A4), Ayla Azura (A5), Annisa Firza Desfiya (A6), Keysya Latifa

Azzahra (A7), Angga Prayuga (A8). The details of the data are as follows:

Table 5 Alternative Value Breakdown

Criteria	Alternative							
	A1	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**
C1	41	88	72	97	92	66	87	94
C2	95	100	97	73	86	79	56	94
C3	65	56	47	77	93	81	76	89
C4	52	89	99	80	86	100	89	61
C5	97	81	88	87	88	98	87	52
C6	93	85	43	65	41	66	72	100
C7	41	89	91	85	62	74	34	33
C8	72	86	92	53	30	43	71	50
C9	93	92	79	82	97	93	89	81
C10	93	81	97	76	90	97	79	65
C11	80	87	88	54	50	64	87	84

a. Determine the Normalization of the Decision Matrix

After knowing the alternative values for each criterion, the next step is to convert the criteria values into a decision matrix with use benefit criteria formula so the results are as follows.

$$X = \begin{Bmatrix} 0{,}423 & 0{,}95 & 0{,}699 & 0{,}52 & 0{,}99 & 0{,}93 & 0{,}451 & 0{,}783 & 0{,}959 & 0{,}959 & 0{,}909 \\ 0{,}907 & 1 & 0{,}602 & 0{,}89 & 0{,}827 & 0{,}85 & 0{,}978 & 0{,}935 & 0{,}948 & 0{,}835 & 0{,}989 \\ 0{,}742 & 0{,}97 & 0{,}505 & 0{,}99 & 0{,}898 & 0{,}43 & 1 & 1 & 0{,}814 & 1 & 1 \\ 1 & 0{,}73 & 0{,}828 & 0{,}8 & 0{,}888 & 0{,}65 & 0{,}934 & 0{,}576 & 0{,}845 & 0{,}784 & 0{,}727 \\ 0{,}948 & 0{,}86 & 1 & 0{,}86 & 0{,}898 & 0{,}41 & 0{,}681 & 0{,}326 & 1 & 0{,}928 & 0{,}568 \\ 0{,}680 & 0{,}79 & 0{,}871 & 1 & 1 & 0{,}66 & 0{,}813 & 0{,}467 & 0{,}959 & 1 & 0{,}727 \\ 0{,}897 & 0{,}56 & 0{,}817 & 0{,}89 & 0{,}888 & 0{,}72 & 0{,}374 & 0{,}772 & 0{,}918 & 0{,}814 & 0{,}989 \\ 0{,}979 & 0{,}94 & 0{,}957 & 0{,}61 & 0{,}531 & 1 & 0{,}363 & 0{,}543 & 0{,}835 & 0{,}670 & 0{,}955 \end{Bmatrix}$$

b. Determining the Preference Value and Decision Making (Qi)

After obtaining the normalization matrix, the next step is to calculate the preference value (Qi) formula so the results are as follows:

Table 6 Decision Making Result Table

Student Alternative	Final Qi Science	Final Qi Socials	Final Qi Relogion	Decision
Umi Habiba	2,3849	4,9315	4,4210	Passed Social
Muhammad Abid Tamimsyah	4,7633	4,6696	3,9936	Passed Science
Farhan Al Farizi	4,7829	4,9663	2,7720	Passed Science
Auffa Dzakwan Al-Fayyadh	4,5770	3,9261	3,6726	Passed Science
Ayla Azura	4,3472	3,8807	3,3610	Passed Science
Annisa Firza Desfiya	4,4380	4,2062	3,8850	Passed Science
Keysya Latifa Azzahra	3,9721	3,8270	3,9761	Passed Science
Angga Prayuga	3,3619	3,2852	5,0500	Passed Science

In the table above is the final result of the recommendation of the right major for each student. The values above are obtained from the calculation of the normalization of the decision matrix with each sub-criterion of each department, then ranking is carried out in each department In this case example, decision making is carried out from each student where the department is suitable for each student then those who do not pass the first department will be ranked again in other departments as obtained from the following provisions:

Table 7 Decision Rule Table

No.	Final Grade	Description
1.	≥ 2,90	Passed Science Major
2.	< 2,90	Graduated in Other Majors

System Implementation

a. Login Display Form

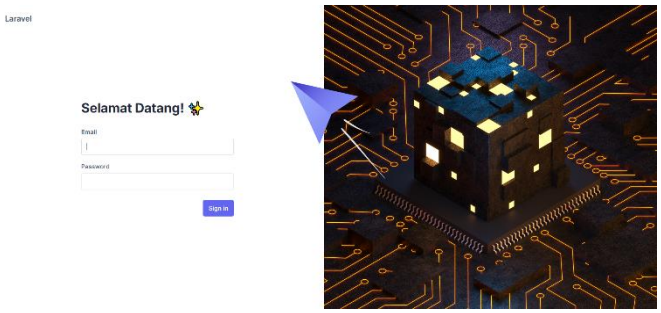

Figure 5 Login Display Form

b. Admin Dashboard Form

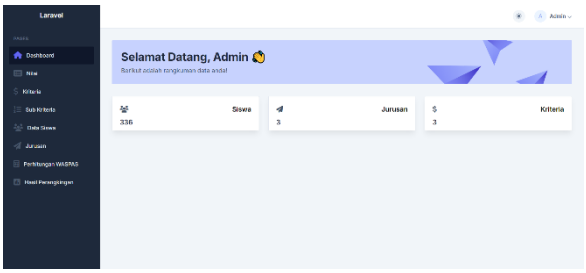

Figure 6 Admin Dashboard Form

c. Criteria Data Form

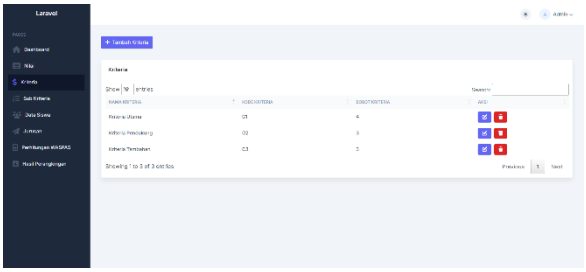

Figure 7 Criteria Data Form

d. Sub Criteria Data Form

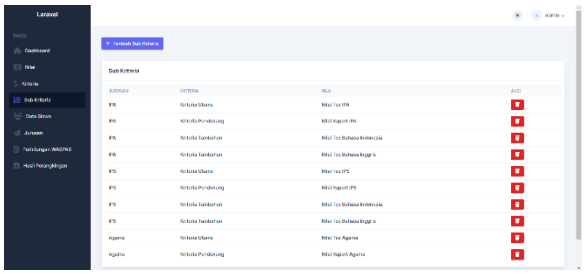

Figure 8 Sub Criteria Data Form

e. Student Data Form

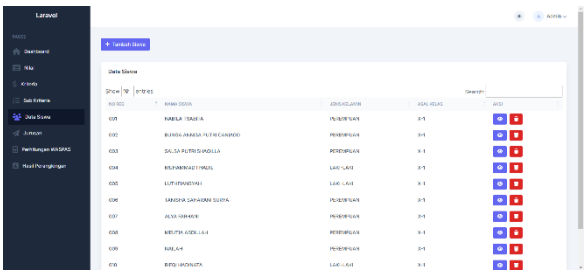

Figure 9 Student Data Form

f. Majors Data Form

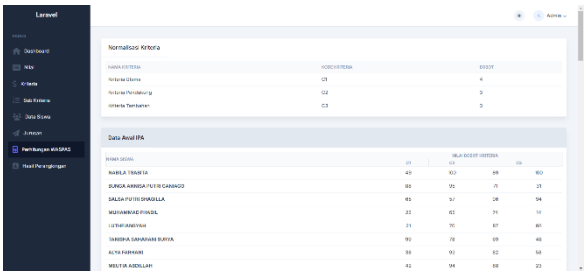

Figure 10 Majors Data Form

g. WASPAS Calculation Form

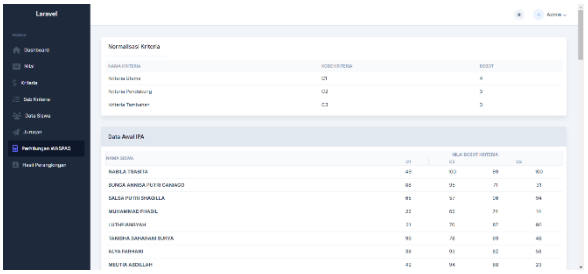

Figure 11 WASPAS Calculation Form

h. WASPAS Ranking Result Fom

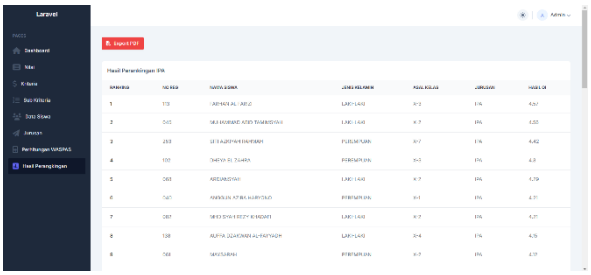

Figure 12 WASPAS Ranking Result Fom

i. Home Page Display

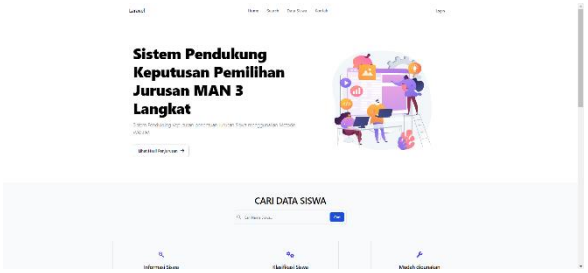

Figure 13 Home Page Display

j. Display System of Dealing Results

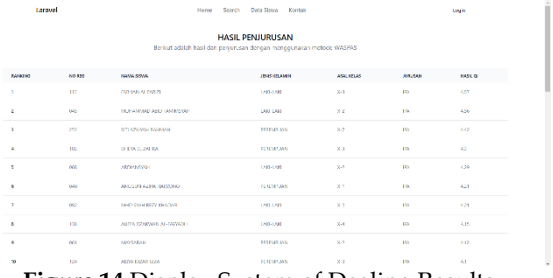

Figure 14 Display System of Dealing Results

k. Student Data Search Page

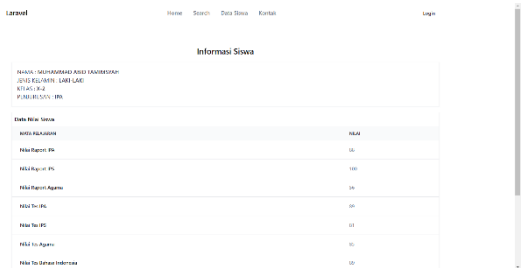

Figure 15 Student Data Search Page

The author implements the above design by using a web-based platform in the creation of the Information System Decision Support System for Department Selection MAN 3 Langkat. Here is a view of the system that has been implemented.

Conclusions

Based on research that has been conducted by researchers, it can be concluded that the existence of a decision support system to determine majors in science, ips, or religion can help in providing recommendations and considerations in determining students who will enter their majors based on calculations on each of the criteria that have been processed in the system.

1. This major decision support system application helps schools in making decisions to determine students in the right class according to students' academic abilities or student grades.
2. This major decision support system application simplifies and speeds up the work of teacher staff who are responsible for determining this major.
3. The best major recommended by the system is the final value of the WASPAS method calculation which has the largest (Qi) value.

References

[1] Rizal, H. A. K. Aidilof, and A. I. Nasution, "Sistem Pendukung Keputusan Penerimaan Beasiswa Peningkatan Prestasi Akademik Menggunakan Metode Preference Selection Index," *J. Teknoinfo*, vol. 16, no. 2, p. 198, 2022, doi: 10.33365/jti.v16i2.1802.

[2] M. B. K. Nasution, K. Kusmanto, A. Karim, and S. Esabella, "Sistem Pendukung Keputusan Penilaian Kinerja Ketua Program Studi Menerapkan Metode WASPAS dengan Pembobotan ROC," *Build. Informatics, Technol. Sci.*, vol. 4, no. 1, pp. 130–136, 2022, doi: 10.47065/bits.v4i1.1619.

[3] Ariani Susanti, "Perancangan Sistem Pendukung Keputusan Penentuan Jurusan Siswa Sma Negeri 2 Kutacane Berbasis Web Dengan Menggunakan Metode Analytical Hierarchy Process (AHP)," *J. Multimed. dan Teknol. Inf.*, vol. 3, no. 02, pp. 68–74, 2022, doi: 10.54209/jatilima.v3i02.152.

[4] H. Jeperson, N. Fifto, D. Abdullah, Kraugusteeliana, and A. Qurrotul, *Sistem Pendukung Keputusan*. Jakarta: Yayasan Kita Menulis, 2023.

[5] K. Ihsan and guidio leonarde Ginting, "Penerapan Metode WASPAS Untuk Menentukan Penerima Beasiswa Pada Perguruan Tinggi Negeri," *TIN (Terapan Inform. Nusantara)*, vol. 1, no. 1, pp. 1–7, 2020, [Online]. Available: https://ejurnal.seminar-id.com/index.php/tin/article/view/231

[6] D. M. Pagan and M. Syahrizal, "Penerapan WASPAS Dalam Mendukung Keputusan Penerima Beasiswa Mahasiswa Berprestasi," *TIN Terap. Inform. …*, vol. 1, no. 1, pp. 8–13, 2020, [Online]. Available: https://ejurnal.seminar-id.com/index.php/tin/article/view/230