SISTEM PENDUKUNG KEPUTUSAN SELEKSI PENERIMA BEASISWA MENGGUNAKAN METODE SIMPLE ADDITIVE WEIGHTING (SAW)

Putri Mardhiah[1], Mutiana Pratiwi[2], Dinul Akhiyar[3], Ulya Ilhami Arsyah[4]

[1,2,3] Universitas Putra Indonesia YPTK Padang
[4] Politeknik Negeri Padang
Corresponding Author: [1] mutiana_pratiwi@upiyptk.ac.id

ABSTRACT (10 PT)

The advancement of science facilitates the development of new technologies that signify the progress of society. MTsS Muhammadiyah Kurai Taji aims to incorporate information technology into its data processing activities. Currently, the school relies on manual methods for processing student data, which often results in inaccuracies, particularly in classifying underprivileged students and other categories. This manual approach has led to challenges in maintaining valid data, which in turn complicates the decision-making process for scholarship allocations. To address these issues, the author proposes the development of a web-based A decision Support System (DSS). A DSS is a computer-based information system designed to support organizational decision-making. The proposed system will utilize MySQL database management to ensure the accuracy and validity of the data. By implementing this web-based information system, the school will benefit from increased time efficiency in data retrieval and scholarship processing. Additionally, this system will streamline reporting processes and improve the identification of students eligible for scholarship assistance, thereby addressing the current challenges faced by the school.

1. INTRODUCTION

The development of this science supports the creation of new technologies that mark the progress of the times. Until now, the developing technology has entered the digital stage (Pratiwi et al. 2021). Including in Indonesia, every field has begun to utilize technology to facilitate work, including in the field of education. As an entity related to human culture and civilization, education in various parts of the world has undergone fundamental changes in the era of globalization (Mulyadi, Nugroho, and ... 2023). There are many scientific and technological advances that humanity can enjoy. But on the other hand, this progress also goes hand in hand with the misery of many human children, especially in the current era of globalization (Vadreas 2021). When a person gets a good education, it will be open to him to get a better life. Realizing that education is very important, the state strongly supports every citizen to get the highest education possibleOne of them is by conducting a scholarship program (Rohman Soleh and Supatman 2024). Scholarships are a form of assistance or

appreciation for outstanding students or students so that they can study to a higher level (Murtiwiyati et al. 2022). Scholarships are often given to students or students who excel and are also intended for students or students who have good achievements but are less capable in the economic field. Scholarships can be said to be financing that does not come from their own or parents' funding, but is given by the government, private companies, embassies, universities, as well as educational or research institutions, or also the office where they work which because of one's achievements can be given the opportunity to increase the capacity of their human resources through education (Arsana and Lestari 2021). In selecting the scholarship, of course, there will be difficulties due to the large number of scholarship applicants and the many criteria used to determine the decision to receive the scholarship as expected. Determination and determination of scholarship acceptance based on the results of data recapitulation carried out by the curriculum section, there is no special calculation and weighting of each

criterion to determine student scholarship recipients (Yulisman and Wahyuni 2021). For this reason, a decision support system is needed, so that the decisions obtained are more accurate (Awaludin, Bahri, and Muslih 2021). SPK is a system for assembling and integrating each individual's intellectual resources with computer capabilities to improve the quality of decisions produced (Andriansyah et al. 2023). The goal of forming an effective SPK is to utilize the advantages of both elements, namely humans and electronic devices (Noviardi and Fryonanda 2020). Decision support systems are indicated for decisions that require judgment or on decisions that cannot be supported by algorithms at all (Safira, Awal, and Firdaus 2021). The SAW method is to find the weighted sum of the performance ratings of each alternative on all attributes (Shabira and Sutrisno 2023). The SAW method requires a normalization process of the decision matrix (X) to a scale that can be compared with all ratings (Suyanto and Andri 2020). The SAW method requires a process of normalizing the decision matrix (X) to a scale that can be compared with all existing alternative ratings.

SAW Method Formula:

$$R_{ij} = \begin{bmatrix} \dfrac{X_{ij}}{Max\ X_{ij}} & Jika\ j\ adalah\ jenis\ variabel\ benefit \\ \dfrac{Min\ X_{ij}}{X_{ij}} & Jika\ j\ adalah\ jenis\ variabel\ cost \end{bmatrix}$$

Description:
R_{ij} = Nomalized performance rating value
X_{ij} = The attribute value of each performance Max
X_{ij} = The largest value of each criterion
Man X_{ij} = The smallest value of each criterion
Benefit = If the largest value is the best
Cost = If the smallest value is the best

$$V_i = \sum_{j=1}^{n} W_j\ R_{ij}$$

Description:

V_i = series for each alternative
W_j = Weight value of each criterion
R_{ij} = Nomalized performance rating value

A larger value of Vi identifies that alternative Ai is preferred.

2.   Research Methodology

Based on the preliminary research above, data analysis is carried out so that problem solving can find the right solution and avoid the emergence of new problems. The decision support system using the Simple Additve Weighting (SAW) method can be used as a solution to solving existing problems, namely in decision making in the selection of scholarship recipients for MTsS Muhammadiyah Kurai Taji City.

1.   Data Analysis
This analysis is carried out to limit the object to be studied so that it becomes information that is more systematic and easy to understand. The data analysis stage is the most important stage in developing a system. The data obtained in the form of interview results at MTsS Muhammadiyah Kurai Taji Pariaman City.

2.   Proses Analysis
This analysis is done to find out how to solve the problem so that it can produce a solution with the right method. The method used in this research is the Simple Additve Weighting (SAW) method which is a method for obtaining precise and accurate decision results.

3.   System Analysis

This analysis is done to find out what is needed in system design. Where the program will be made PHP and MySQL database.

At this stage will make a system design that will be run, starting from analyzing the current program, and designing the program that we will run. This design stage, researchers use the Unified Modeling Language (UML) as a tool in explaining the flow of program analysis where UML is used.

System implementation is the stage of putting the system into operation. Implementation aims to confirm the design modules, so that users can provide input to system development. At this stage the system design is carried out using the PHP programming language and MySQL database.

After the data collection process is complete, the testing process will be carried out on the application made using the PHP programming language and MySQL database, this is done to find out whether the program has run in accordance with the design carried out. Evaluation is a stage carried out to assess the results of system testing. If the results of system testing are in accordance with the results of analysis and design, the system can be applied to the research site to help solve existing problems. But if the system that has been tested is not in accordance with the results of analysis and design, it is necessary to re-analyze the system and find where the errors are in the system, before the system is applied to the research site. After finding errors in the system, improvements are made to the system and testing of the system is carried out again until the system is in accordance with the results of analysis and design and is ready to be applied to the research site.

3. RESULTS AND DISCUSSION

System analysis is understanding, observing, dividing and identifying the weaknesses and advantages of the current system and then proposing system development to be able to maintain system advantages and minimize or even eliminate the weaknesses of the old system in order to form a perfect system. Before developing a system, there needs to be a description of the existing or running system. This is done to make it easier to design the system so that what is done is as expected. In this analysis and results chapter, it will be explained about the analysis of the current system and the analysis of the system to be designed.

Tabel 3.1 Alternative Assessment

Kode	Nama	Kriteria				
		K1	K2	K3	K4	K5
A1	Responden1	0,50	0,75	0,75	0,25	0,50
A2	Responden2	0,75	1	0,75	0,25	0,25
A3	Responden3	0,50	0,75	0.25	0,75	0,25
A4	Responden4	0,75	0,25	0,75	0,25	0,50
A5	Responden5	1	1	0.25	0,25	0,75
A6	Responden6	0,50	0,25	0,75	0,25	1
A7	Responden7	0,50	0,50	0,75	0,25	0,50
A8	Responden8	0,75	1	0,25	0,75	0,25
A9	Responden9	0,50	0,75	0,75	0,25	0,50
A10	Responden10	0,75	0,75	0,75	0,25	0,25

Based on the assessment table above, an example of normalizing the formula of the Simple Additive Weighting (SAW) method will be carried out as follows:

$$R_{ij} = \frac{X_{ij}}{Max\ X_{ij}}$$

The following is to determine the normalization matrix of alternative values according to the type of criteria with the provisions.

Profit Criteria
Cost Advantage
Normalization for Criterion 1:

$$R_{1,1} = \frac{0,50}{1} = 0,50$$

$$R_{2,1} = \frac{0,75}{1} = 0,75$$

$$R_{3,1} = \frac{0,50}{1} = 0,50$$

$$R_{4,1} = \frac{0,75}{1} = 0,75$$

$$R_{5,1} = \frac{1}{1} = 1$$

$$R_{6,1} = \frac{0,50}{1} = 0,50$$

$$R_{7,1} = \frac{0,50}{1} = 0,50$$

$$R_{8,1} = \frac{0,75}{1} = 0,75$$

$$R_{9,1} = \frac{0,50}{1} = 0,50$$

$$R_{10,1} = \frac{0,75}{1} = 0,75$$

Normalization for Criterion 2:

$$R_{1,2} = \frac{0,75}{1} = 0,75$$

$$R_{2,2} = \frac{1}{1} = 1$$

$$R_{3,2} = \frac{0,75}{1} = 0,75$$

$$R_{4,2} = \frac{0,25}{1} = 0,25$$

$$R_{5,2} = \frac{1}{1} = 1$$

$$R_{6,2} = \frac{0,25}{1} = 0,25$$

$$R_{7,2} = \frac{0,50}{1} = 0,50$$

$$R_{8,2} = \frac{1}{1} = 1$$

$$R_{9,2} = \frac{0,75}{1} = 0,75$$

$$R_{10,2} = \frac{0,75}{1} = 0,75$$

Normalization for Criterion 3:

$$R_{1,3} = \frac{0,25}{0,75} = 0,333$$

$$R_{2,3} = \frac{0,25}{0,75} = 0,333$$

$$R_{3,3} = \frac{0,25}{0,25} = 1$$

$$R_{4,3} = \frac{0,25}{0,75} = 0,333$$

$$R_{5,3} = \frac{0,25}{0,25} = 1$$

$$R_{6,3} = \frac{0,25}{0,75} = 0,333$$

$$R_{7,3} = \frac{0,25}{0,75} = 0,333$$

$$R_{8,3} = \frac{0,25}{0,25} = 1$$

Normalization for Criterion 4:

$$R_{1,4} = \frac{0,25}{0,25} = 1$$

$$R_{2,4} = \frac{0,25}{0,25} = 1$$

$$R_{3,4} = \frac{0,25}{0,75} = 0,333$$

$$R_{4,4} = \frac{0,25}{0,25} = 1$$

$$R_{5,4} = \frac{0,25}{0,25} = 1$$

$$R_{6,4} = \frac{0,25}{0,25} = 1$$

Normalization for Criterion 5:

$$R_{1,5} = \frac{0,25}{0,50} = 0,50$$

$$R_{2,5} = \frac{0,25}{0,25} = 1$$

$$R_{3,5} = \frac{0,25}{0,25} = 1$$

$$R_{4,5} = \frac{0,25}{0,50} = 0,50$$

$$R_{5,5} = \frac{0,25}{0,75} = 0,333$$

$$R_{6,5} = \frac{0,25}{1} = 0,25$$

$$R_{7,5} = \frac{0,25}{0,50} = 0,50$$

$$R_{8,5} = \frac{0,25}{0,25} = 1$$

$$R_{9,5} = \frac{0,25}{0,50} = 0,50$$

$$R_{10,5} = \frac{0,25}{0,25} = 1$$

$$R = \begin{bmatrix} 0,50 & 0,75 & 0,333 & 1 & 0,50 \\ 0,75 & 1 & 0,333 & 1 & 1 \\ 0,50 & 0,75 & 1 & 0,333 & 1 \\ 0,75 & 0,25 & 0,333 & 1 & 0,50 \\ 1 & 1 & 1 & 1 & 0,333 \\ 0,50 & 0,25 & 0,333 & 1 & 0,25 \\ 0,50 & 0,50 & 0,333 & 1 & 0,50 \\ 0,75 & 1 & 1 & 0,333 & 1 \\ 0,50 & 0,75 & 0,333 & 1 & 0,50 \\ 0,75 & 0,75 & 0,333 & 1 & 1 \end{bmatrix}$$

The final preference value (Vi) is obtained from the sum of the multiplication of the normalized matrix row elements (R) with the corresponding preference weights (W) matrix column elements (W).

$$Vi = \sum_{j=1}^{n} Wj \ Rij$$

With:

Vi = ranking for each alternative

Wj = weight value of each criterion

Rij = normalized performance rating value

Below is the calculation of the preference value for each alternative Vi:

A1
=(1*0,50)+(1*0,75)+(0,5*0,333)+(0,5*1)+(0,5*0,50)

$$= 2,1667$$

A2 =(1*0,75)+(1*1)+(0,5*0,333)+(0,5*1)+(0,5*1)

=2,9167

From the calculation using the SAW method, the best alternative that is entitled to a scholarship can be drawn.

Tabel 4.2 Alternative Assessment

Kode	Alternatif	Hasil (Vi)
A1	Responden1	2,1667
A2	Responden2	2,9167
A3	Responden3	2,4167
A4	Responden4	1,9167
A5	Responden5	3,1667
A6	Responden6	1,6667
A7	Responden7	1,9167
A8	Responden8	2,9167
A9	Responden9	2,1667
A10	Responden10	2,6667

System Implementation

The system implementation stage is one of the stages in the system development life cycle. Several activities sequentially take place in this stage, starting from implementing the implementation plan, carrying out implementation activities, and follow-up implementation. An implementation plan needs to be made in advance, so that the implementation runs well and as expected. This implementation plan is intended to organize how the system can be useful and needed during the implementation stage.

Figure 1. Assessment Process View

This display is a display where the decision results of the assessment process that have been inputted from the alternative data earlier. The display of the results of the assessment decision can be seen in Figure 2 below

Figure 2. Decision result display

4.   Conclusion

Based on observations and system analysis, it can be concluded that the implementation of a new system for determining scholarship recipients at MTsS Muhammadiyah Kurai Taji, Pariaman City, will provide significant benefits for parties who need accurate information. First, with this system, the company can identify the number of scholarship recipients more efficiently and reduce the risk of data errors. Second, the application of the Simple Additive Weighting (SAW) method in this system helps the company to determine scholarship recipients as well as better manage the acceptance time interval, so that the announcement and subsequent acceptance process can be done in a timely and accurate manner. Thirdly, the use of MySQL database in this decision support system ensures that the data is securely stored and easily accessible when needed. Finally, the implementation of this new system will increase the effectiveness and efficiency of employees' work in inputting data and making reports, so that the work process becomes faster and less error-prone.

Bibliography

Andriansyah, Ibnu, Ericho Ilham Farelli, Muhamad Tarra Wratasanka, and Perani Rosyani. 2023. "Sistem Pendukung Keputusan Penilaian Kinerja Guru Menggunakan Metode SAW." *Jurnal Ilmu Komputer Dan Pendidikan* 1(2):275–82.

Arsana, I. Nyoman Alit, and Ayu Sri Lestari. 2021. "Rancang Bangun Sistem Informasi Laporan Keuangan Pada SMP Nasional Berbasis Web." *Jurnal Krisnadana* 1(1):47–56.

Awaludin, Rizal Fahmi, Saeful Bahri, and Muhammad Muslih. 2021. "Penerapan Zachman Framework Dalam Perancangan Sistem Informasi Manajemen Keuangan Sekolah." *Jurnal Tekno Kompak* 15(1):55. doi: 10.33365/jtk.v15i1.912.

Mulyadi, M. F., A. S. Nugroho, and ... 2023. "Analisis Perbandingan Metode SAW, WP, Dan TOPSIS Pada Sistem Pendukung Keputusan Pemberian Beasiswa." *... Ilmu Komputer Dan ...* 1(2):170–79.

Murtiwiyati, Murtiwiyati, Deasy Indayanti, Renandy Jaka Saputra, Siti Chodidjah, and Afrila Eka Pradita. 2022. "Sistem Penunjang Keputusan Pemilihan Karyawan Terbaik Dengan Metode SAW." *Jurnal Sosial Teknologi* 2(2):99–107. doi: 10.59188/jurnalsostech.v2i2.300.

Noviardi, Refli, and Harfebi Fryonanda. 2020. "Perancangan Sistem Pendataan Permohonan Surat Izin Mendirikan Bangunan Di Kecamatan Lubuk Sikarah Kota Solok." *Kalbiscentia* 7(1):67–73.

Pratiwi, Mutiana, Ulya Ilhami Arsyah, Aggy Pramana Gusman, and Abulwafa Muhammad. 2021. "Inventory System Using Supply Chain Management Method in Regulating Amount of Medicine Availability at Pharmacies Sistem Persediaan Menggunakan Metode Supply Chain Management Dalam Mengatur Jumlah Ketersediaan Obat Pada Apotik." *IJIRSE: Indonesian Journal of Informatic Research and Software Engineering* 1(2):139–45.

Rohman Soleh, Irwan, and Supatman Supatman. 2024. "Sistem Penunjang Keputusan Untuk Menentukan Negara Tempat Berlibur Di Asia Menggunakan Metode SAW." *INNOVATIVE: Journal Of Social Science Research Volume* 4(3):10160–72.

Safira, Silky, Hasri Awal, and Firdaus. 2021. "Web-Based Library Information System Design." *International Journal of DYNAMICS in Engineering and Science (IJDES)* 6(2).

Shabira, Hazna Putri, and Joko Sutrisno. 2023. "Sistem Penunjang Keputusan Penentuan Supplier Dengan Menggunakan." Pp. 58–63 in *Sistem Penunjang Keputusan Penentuan Supplier Dengan Menggunakan Metode AHP dan SAW*.

Suyanto, Suyanto, and Andri Andri. 2020. "Implementasi Rapid Application Development Dalam Pengembangan Aplikasi Pelaporan Kerusakan Jalan." *JIPI (Jurnal Ilmiah Penelitian Dan Pembelajaran Informatika)* 5(2):89. doi: 10.29100/jipi.v5i2.1758.

Vadreas, Andrew Kurniawan. 2021. "Sistem Pendukung Keputusan Pemberian Reward Penyiar Radio Dengan Metode Multifactor Evaluation Process." *Jurnal Teknologi Dan Sistem Informasi Bisnis* 3(2):276–86. doi: 10.47233/jteksis.v3i2.242.

Yulisman, Yulisman, and Refni Wahyuni. 2021. "Sistem Pendukung Keputusan Penentuan Bonus Karyawan Dengan Metode SAW Pada PT. Delima Makmur Aceh Singkil." *JTIM : Jurnal Teknologi Informasi Dan Multimedia* 3(2):78–90. doi: 10.35746/jtim.v3i2.154.