Decision Support System for Selecting the Best Internship Students Using the SAW Method

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Abstract:

The goal of this study is to find a solution to the issue of choosing the best student internship for the BPKD office in Pematangsiantar city. This office decides the best intern candidates to hire competent, skilled candidates who can improve their adaptability and perception in enhancing their performance and carrying out the assigned tasks. A Decision Support System (DSS) powered by computers is used for this selection. The decision support system applies the SAW approach. Responsibility, Delay, Attitudes/Ethics, Presence, and Cooperation are the criteria employed in this strategy. The results of the study include recommendations for the top interns, with Mona Rachel Sitohang coming in at number one with an alternative value of 0.7500, followed by Irviana Soneta Manalu at number two with a value of 0.7042 and Elsa Paulina Simanjuntak at number three with a value of 0.6042. This office may find it simpler to choose the top student internship candidates using this decision assistance system.

1. INTRODUCTION

Information and technology are two concepts that cannot currently be separated. This can be seen in obtaining information quickly, precisely, and accurately, assisted by advances in increasingly sophisticated technology. With these technological advances, many companies, institutions, and organizations use technology, computerization, and networks to support their work more effectively and efficiently. Application systems are in demand in various areas of life, including the field of government. The organization of regional devices in most regions makes the application system an essential part of the continuity of the organization's activities. The application system is one of the most important means by which the authorities can quickly and accurately process and retrieve the required data with the help of the application system to use the remaining time to carry out other activities.

One of the resources for local governments in asset management and regional finances is the Regional Financial Management Agency, also known as BPKD Pematangsiantar City. This office is tasked with supporting the implementation of provincial government based on the principle of autonomy and joint management in regional financial management. Every year- The BPKD of Pematangsiantar City always accepts students to carry out internships to train their quality, skills, and leadership and

develop their adaptability and perception in improving performance and carrying out the tasks given.

Moreover, to measure the success of student internships, BPKD Pematangsiantar City conducts an assessment for internship participants, and the highest score of one name will be used to become the best intern participant. In determining the best student internship participants, BPKD Kota Pematangsiantar currently calculates the total value obtained by participants for each criterion and enters the data into Microsoft Excel to then be averaged and sorted based on the highest average value. This is considered less effective in decision-making because it will cause cognitive limits when processing or storing information, making the results obtained less objective.

Multiple technologies have been incorporated in the current era of technological development to help resolve issues in daily life [1]-[9], [10]-[15]. One of them is utilizing computer-based decision support systems [16]–[23]. Many different problems have been solved using decision support systems, especially in the fields of education, health, and other public areas [24]-[29], [30]-[32]. A good system is therefore required to choose the best students for internships at the BPKD office. The Simple Additive Weighting (SAW) technique is one option. The SAW method (20,21,22,23,24,25)has been widely used in previous research in determining rankings, including:

a) Decision Support System for Receiving Mission Aim Scholarships with the Web-Based SAW Method (Fauzan, Indrasary, & Muthia, 2018).

b) SAW (Simple Additive Weighting) Method as a Decision Support System for Outstanding Teachers (Putra, Aryanti, & Hartati, 2018).

c) Selection of Favorite Departments at SMK Sirajul Falah with the SAW Method (Nurlela, Akmaludin, Hadianti, & Yusuf, 2019).

Based on the above problems, a Field Work Practice Report with the title "Decision Support System for the Selection of the Best Student Internship at the Office of the Regional Financial Management Agency with the SAW Method" was created to improve effectiveness and objectivity in the selection of the best interns at the Regional Financial Management Agency of Pematangsiantar City.

2. THEORY

The SAW (Simple Additive Weighting) Method (26,27,28,29,30) is a multi-attribute decision-making (MADM) technique used to evaluate and rank alternatives based on multiple criteria. It is a relatively straightforward method, making it popular for various applications. Besides SAW (31,32), there are other methods for decision-making, such as the Weighted Product Method (WPM), Technique for Order Preference by Similarity to an Ideal Solution (TOPSIS), Elimination and Choice Expressing Reality (ELECTRE), Analytic Hierarchy Process (AHP), PROMETHEE, and Concordance and Discordance Analysis (CODA). Secara spesifik keunggulan dan perbedaan dari metode-metode ini dapat dilihat dari Table 1.

Table 1. Advantages and differences of various decision-making methods

Method	The Advantages	Differences
Simple Additive Weighting (SAW)	- Simple and easy to understand and implement. - Computationally efficient. - Suitable for both quantitative and qualitative criteria. - Provides a clear ranking of alternatives.	- Assumes linear relationships between criteria and overall performance. - Sensitive to the selection of criteria weights. - May not capture complex interactions between criteria.
Weighted Product Method (WPM)	- Similar advantages to SAW, but with multiplication instead of addition. - Can be advantageous for criteria where having a low value on one criterion can significantly outweigh having high values on others.	- More sensitive to extreme values than SAW.
Technique for Order Preference by Similarity to an Ideal Solution (TOPSIS)	- Considers both positive and negative ideal solutions. - Can be helpful when there is a clear "ideal" alternative.	- More computationally complex than SAW or WPM. - May be sensitive to the selection of the ideal solutions.
Elimination and Choice Expressing Reality (ELECTRE)	- Flexible and allows for the consideration of uncertainties and vetoes. - Can be used for both quantitative and qualitative criteria.	- More complex and computationally intensive than other methods. - It may be challenging to understand and interpret the results.
Analytic Hierarchy Process (AHP)	- Allows for the consideration of both quantitative and qualitative criteria. - Can help to identify critical decision factors.	- Time-consuming and requires expert judgment. - Can be sensitive to the consistency of the pairwise comparisons.
PROMETHEE	- Similar advantages to ELECTRE, but with a different approach to calculating outranking relations. - Can be helpful when there are multiple stakeholders with different interests.	- Can be computationally intensive, especially for significant problems. - It may be challenging to interpret the results.
Concordance and Discordance Analysis (CODA)	- Considers concordance (agreement) and discordance (disagreement) between criteria. - Can be helpful when there are trade-offs between different criteria.	- More complex and computationally intensive than other methods. - It may be challenging to understand and interpret the results.

3. METHOD

The stages shown in Figure 1 are followed to complete the Decision Support System for Selecting the Best Internship Students Using the SAW Method.
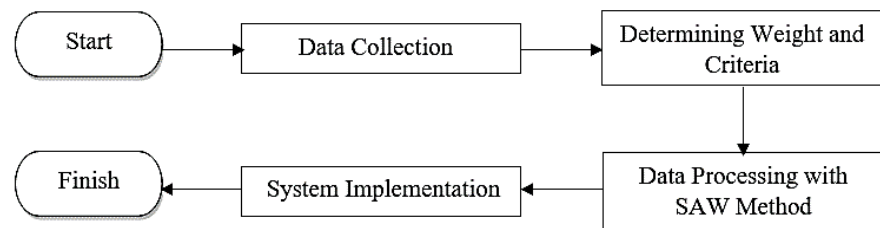
Figure 1. Research Framework

The employee observed the workplace environment to conduct a student internship in BPKD Pematangsiantar City. The purpose is to collect reports of interns on the support system to choose the best student for the internship; moreover, some of the parameters used as a reference guide when choosing the most qualified internship candidates are in Table 2.

Table 2. Criteria Table

Criteria	Criterion Name	Characteristic	Weight
C1	Responsibility	Benefits	0.25
C2	Delay	Cost	0.10
C3	Attitudes/Ethics	Benefits	0.20
C4	Presence	Benefits	0.20
C5	Cooperation	Benefits	0.25

Furthermore, depending on how essential one parameter or criterion is compared to another, sub-criteria become parameters directly related to each criterion. Sub-criteria can be seen in Table 3.

Table 3. Sub Criteria

Criterion					Value
C1	C2	C3	C4	C5	
Low	< 2 Days	Low	1 – 5 Days	Low	1
Enough	2 – 4 Days	Enough	6 – 10 Days	Enough	2
Good	5 – 8 Days	Good	11 – 15 Days	Good	3
Excellent	> 8 Days	Excellent	16 – 20 Days	Excellent	4

Moreover, the assessment data recap is a collection of student internship data along with the value of each participant on each of the existing criteria. A recap of assessment data is shown in Table 4.

Table 4. Assessment Data Recap Table

No	National student identification number	Name	Responsibility	Delay	Criterion Attitudes/ Ethics	Presence	Cooperation
1	0020889955	Irviana Soneta Manalu	Good	5 - 8 Days	Enough	6 - 10 Days	Excellent
2	0045036910	Mona Rachel Sitohang	Enough	< 2 Days	Good	16 - 20 Days	Enough
3	0040735317	Winda Uliarta Damanik	Low	> 8 Days	Low	1 - 5 Days	Low
4	324070400837	ElsaPaulina Simanjuntak	Excellent	> 8 Days	Low	16 - 20 Days	Low
5	0075275959	Farel Alfoncus	Enough	2 – 4 Days	Enough	6 - 10 Days	Enough

4. RESULT AND ANALYSIS

The data from student internships was coded as an alternative based on the number in Table 4. The weight value of each alternative in each criterion, as shown in Table 5, makes up the alternative match rating on the criteria.

Table 5. Alternative Match Rating Table on Criteria

No	Alternative	Criterion				
		C1	C2	C3	C4	C5
1	A1	3	3	2	2	4
2	A2	2	1	3	4	2
3	A3	1	4	1	1	1
4	A4	4	4	1	4	1
5	A5	2	2	2	2	2

Normalized Matrix

A normalized matrix results from a normalization process that is poured into the form of a matrix as follows.

$$\begin{bmatrix} 0,75 & 0,33 & 0,67 & 0,50 & 1,0 \\ 0,50 & 1,00 & 1,00 & 1,00 & 0,50 \\ 0,25 & 0,25 & 0,33 & 0,25 & 0,25 \\ 1,00 & 0,25 & 0,33 & 1,00 & 0,25 \\ 0,50 & 0,50 & 0,67 & 0,50 & 0,50 \end{bmatrix}$$

Rankings

The ranking is multiplying each value in a normalized matrix with a criterion weight. The results of the hierarchy are as follows.

A1 =	(0,75 x 0,25) + (0,33 x 0,10) + (0,67 x 0,20) + (0,50 x 0,20) + (1,00 x 0,25)	=	0,7042
A2 =	(0,5 x 0,25) + (1,00 x 0,10) + (1,00 x 0,20) + (1,00 x 0,20) + (0,5 x 0,25)	=	0,7500
A3 =	(0,25 x 0,25) + (0,25 x 0,10) + (0,33 x 0,20) + (0,25 x 0,20) + (0,25 x 0,25)	=	0,2667
A4 =	(1,00 x 0,25) + (0,25 x 0,10) + (0,33 x 0,20) + (1,00 x 0,20) + (0,25 x 0,25)	=	0,6042
A5 =	(0,50 x 0,25) + (0,50 x 0,10) + (0,67 x 0,20) + (0,50 x 0,20) + (0,5 x 0,25)	=	0,5333

Calculation Results

After obtaining the ranking results, the results are entered into the alternative table and ranked on each alternative. Table 6 shows the outcomes of the calculations that have been done.

Table 6. Calculation Results Table

No	Alternative	Name	Result	Rank
1	A1	Irviana Soneta Manalu	0,7042	2
2	A2	Mona Rachel Sitohang	0,7500	1
3	A3	Winda Uliarta Damanik	0,2667	5
4	A4	Elsa Paulina Simanjuntak	0,6042	3
5	A5	Farel Alfoncus	0,5333	4
		MAX	0,7500	
		MIN	0,2667	
		AVERAGE	0,5717	

Ranking Results

Moreover, after obtaining rankings and results in each alternative, data is sorted based on the orders received to see the assessment results of the best internship students, as in Table 7.

Table 7. Ranking Results Table

No	NIM	Name	Result	Rank
1	0045036910	Mona Rachel Sitohang	0,7500	1
2	0020889955	Irviana Soneta Manalu	0,7042	2
3	324070400837	Elsa Paulina Simanjuntak	0,6042	3
4	0075275959	Farel Alfoncus	0,5333	4
5	0040735317	Winda Uliarta Damanik	0,2667	5

5. CONCLUSION

The best student internships at BPKD of Pematangsiantar City were chosen using the SAW (Simple Additive Weighting) method. This decision-making support system may help with the issues that appear. The SAW method can perform complex calculations to identify the optimal alternative, allowing for a visualization of the conclusions. Compared to the current method used in BPKD today, the SAW method provides a more detailed and practical decision. Simple additive weighting can reduce cognitive constraints when processing or saving information, resulting in more objective results.

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AUTHOR CONTRIBUTIONS

All Author is responsible for building Conceptualization, Methodology, analysis, investigation, data curation, writing—original draft preparation, writing—review and editing, visualization, supervision of project administration, funding acquisition, and have read and agreed to the published version of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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