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Determinate Student Final Project Supervisor Based AHP and SAW

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Abstract: Determining competent supervisors for student research projects is one of the factors that play the most important role because it can affect the success of student education, so it deserves attention. However, the process of determining a supervisor is not an easy thing because it involves various complex criteria and sub-criteria for making decisions consistently and objectively. Therefore, we propose AHP and SAW methods be utilized simultaneously with the criteria for education level, educational background, guiding experience, lecturer experience area, publication, guide quota, and student concentration, along with Forty-Three (43) other sub-criteria. This research purpose is to provide knowledge about how the AHP-SAW methods can be utilized together to cover each other's weaknesses in determining supervisors for student research projects. Where the AHP method works to calculate the priority level of criteria and sub-criteria that will be used by the SAW method in forming a matrix of criteria and alternatives and calculates the consistency value of the criteria and sub-criteria, while the SAW method works to calculate the matrix normalization value and ranking value for each alternative by utilizing the value of priority level of the criteria obtained from work of AHP. The results showed that the two methods were able to complement each other in determining the main supervisor of student research projects, with a ranking score of 1,00 for alternative ALec_002 and a co-supervisor ranking score of 0,97 for alternative ALec_007 out of 35 candidates.

Keywords: Analytical Hierarchy Process, Simple Additive Weighting, Supervisor

1. Introduction

One of the most crucial elements that affect the effective completion of education is the process of choosing a supervisor [1]. This merits attention, particularly the aid academic supervisors provide in completing excellent student research projects. However, a lot of researchers seriously disregard it [2], which results in a low level of degree research completion at a tertiary institution [3].

In order to find qualified supervisors in the field of student research projects who can guide, inspire, and facilitate the success of research projects at the testing stage, the determination of supervisors for student research projects must be adjusted to the research title project submitted by students and share certain criteria [4]. To be consistent and transparent in decision-making, selecting a qualified supervisor for a student research project entails a number of complex criteria and sub-criteria, thus it is not a simple process.

In order to support the selection of supervisors for student research projects based on commonly used criteria, such as education level criteria, educational background criteria, guiding experience criteria, lecturer experience area criteria [5], publication criteria [6], guide quota criteria, and student concentration criteria [7], along with forty-three (43) other students, we propose the AHP method and the SAW method.

There are several previous studies related to determining supervisors for student theses or research projects, such as those conducted by the research [8] using the weighted product (WP) method with the criteria of assistance schedule, appropriate teaching topics, direction, consequence, English communication, attention, willing to help with references technique, relationship with the work team, duration of assistance and easy grader to selection thesis supervisor in the department of English, Tadulako University, while [9] also utilized the weighted product (WP) method with the criteria of education level, lecturer certification, group tenure, academic position and achievement in the field of three pillars of higher education to decide supervisors for creative students in the computer engineering department, Sriwijaya State Polytechnic.

And E. R. Arumi et al. [1] use AHP method with the criteria of lecturer interest, lecturer's courses, student submissions of thesis themes, and guiding experience to decide title of the thesis proposal submitted by students, while J. S. Simanungkalit and H. T. Sihotang [5] also use AHP method with the criteria of lecturer status, guiding experience, level of education, functional, educational background, and areas of expertise to decide supervisors based on field research supervisors.

And also [10] utilize the SAW method, with the criteria for lecturers' competence, lecturer credit workload, education background, consulting services, supervisor experience, status, average guidance time per student, and completed number of thesis guidance to decide student supervisors in the information systems department, mathematics and natural sciences faculty, Tanjungpura University, while [11] also utilize the SAW method with the criteria education, functional competence, competence, lecture status, and total of mentoring students to decide thesis supervisors at the computer science faculty at Batam International University.

In addition, D. Meidelfi et al. [12] utilized the SAW and BORDA methods to determine student project research titles with the criteria of originality, methodology, target and topic contribution, novelty, and similarity in the department of information technology, Padang State Polytechnic. Meanwhile, A. J. Latipah [7] utilized the AHP-ELECTRE method to decide trustee and student collaboration schemes based on the criteria of functional degree of lecturer, guide quota, roadmap similarities, and student concentration at Muhammadiyah University, East Kalimantan.

Meanwhile, M. Khurwolah and Y. Chuttur [13] built a system that can help allocate student research projects online at the University of Mauritius, while [14] utilized genetic algorithm method to allocate supervisors for student research projects.

From some of the previous studies described above, it can be concluded that no research has used AHP method and SAW method together, using different criteria and sub-criteria to determine supervisors for student final projects.

In this case, AHP method utilized to determine importance level weight, determine the priority level value for each criterion and sub-criteria and determine consistency value of each criterion and sub-criteria. While SAW method is used to determine cost/benefit, calculate the minimum and maximum values of each criterion for all alternatives, normalize matrix of each criterion for all alternatives, and determine the ranking value for each candidate.

This research is translated into: Portion 1 describes problems and ideas related to previous research. Portion 2 describes materials and methods offered. Portion 3 describes results of the research and study, and Portion 4 describes current conclusions and subsequent research.

2. Research Method

2.1. Materials

This research used secondary data provided by the Engineering and Science Faculties, consisting of the Civil Engineering Department, Mechanical Engineering Department, and Computer Science Department in the form of lecturer data, teaching-learning interest data, as well as end-of-semester student data, submitted a research project proposal at the Dili Institute of Technology (DIT) for the 2022-2023 academic years. By involving Six (7) modification criteria from several previous studies, like the findings [5-7] according to the conditions of the current research location and Forty-Three (43) sub-criteria according to higher education needs, as provided in Table 1.

Table 1. *The Criteria and sub-criteria.*

No	Criteria Code	Criteria Name	Sub Criteria	
1	EL	Education Level	EL1	S1
			EL2	S2
			EL3	S3
2	EB	Educational Background	EBD1	Information Systems & Multimedia
			EBD2	Computer Network Systems
			EBD3	Intelligent Systems
			EBD4	Structures Engineering
			EBD5	Geotechnical Engineering
			EBD6	Transportation Engineering
			EBD7	Water Engineering
			EBD8	Energy Conversion
			EBD9	Material
			EBD10	design Machine
3	P	Publication	P1	Consistency publication
			P2	not Consistency publication
4	GE	Guiding Experience	GE1	<1 Year
			GE2	1-5 years
			GE3	> 5 Years

No	Criteria Code	Criteria Name	Sub Criteria	
5	AEL	Area Experience Lecturer	AExL_1	Information Systems & Multimedia
			AExL_2	Computer Network Systems
			AExL_3	Intelligent Systems
			AExL_4	Structures Engineering
			AExL_5	Geotechnical Engineering
			AExL_6	Transportation Engineering
			AExL_7	Water Engineering
			AExL_8	Energy Conversion
			AExL_9	Material
			AExL_10	design Machine
6	GQ	Guide Quota	GQ1	Guiding ≥ 8
			GQ2	Guiding ≤ 7
			GQ3	Guiding ≤ 5
			GQ4	Guiding ≤ 3
			GQ5	Guiding < 2
7	SC	Student Concentration	SCt_1	Information Systems & Multimedia
			SCt_2	Computer Network Systems
			SCt_3	Intelligent Systems
			SCt_4	Structures Engineering
			SCt_5	Geotechnical Engineering
			SCt_6	Transportation Engineering
			SCt_7	Water Engineering
			SCt_8	Energy Conversion
			SCt_9	Material
			SCt_10	Design Machine

The process of determining supervisors for student final projects begins with the submission of final project proposal titles by finalist students to each department head, and then the department head will determine supervisors based on certain criteria. The results of the determination will be given to the dean to be appointed as a supervisor and approved by the vice chancellor for education and teaching, then returned to the finalist students to follow the mentoring process until completion.

2.2. State-of-the-Art Approach

The method proposed as a state-of-the-art approach in this study to determine supervisors for student final projects, proposes two (2) methods, namely the AHP method and the SAW method, which can collaborate through several stages to arrive at a final result decision, as shown in Figure 1.

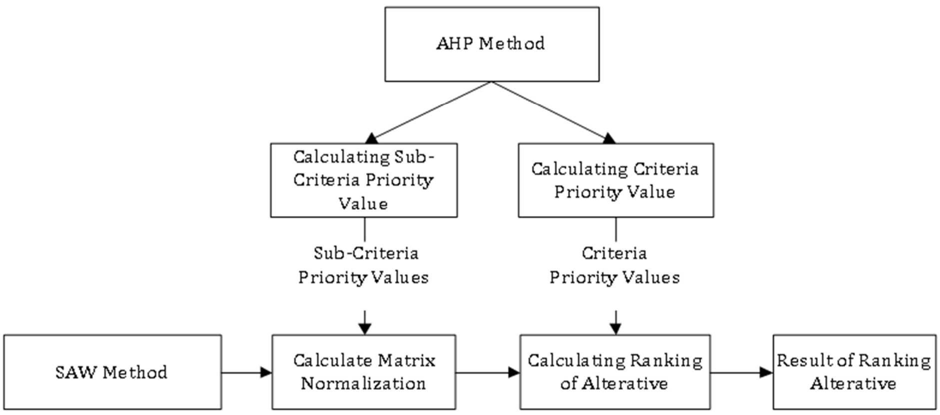

Figure 1. *Propose methods process.*

The AHP method is used to calculate the priority values of the criteria and sub-criteria, which will later be used by the SAW method as the weight value of the cost-benefit attribute, while the SAW is used to calculate the normalized value of the alternative matrix with the criteria and ranking values for each alternative.

2.2.1. Analytical Hierarchy Process (AHP) Method

In solving this case using AHP, several stages were passed, namely.

a) Develop a hierarchical process structure for existing problems, as shown in Figure 2.

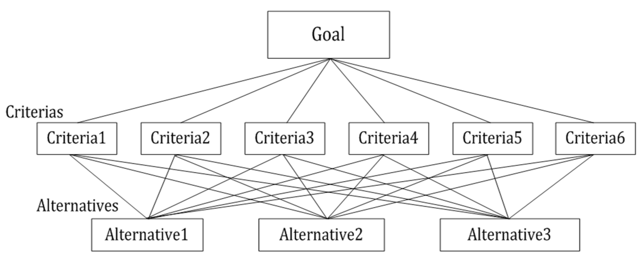

Figure 2. *Structure of AHP [15].*

Beginning with determining the goals, criteria, and sub-criteria required by each alternative to achieve the goals that have been set up.

b) Determine the pairwise comparison scale value of each parameter in each criterion with Table 2.

Table 2. *Fundamental scale of numbers [16].*

Important Strength	Meaning	Description
1	The importance is identical	Both aspects have the same contribution
3	Moderate significance of one over another	Assessment of one aspect slightly above one other aspect
5	Crucial of powerful significance	Assessment of the activity of one aspect strongly favors the other
7	Very powerful significance	The activity of one aspect is preferred over another; he said in practice
9	Very grade significance	Evidence of the activity of one aspect supports it above the other as the highest stage of discernment
2, 4, 6, 8	The intermediate value between the two adjacent judgments	when a compromise is needed

c) Perform matrix comparison calculations for each parameter with Equation (1) [17]

$$\begin{bmatrix} & A_1 & A_2 & \cdots & \cdots & A_n \\ A_1 & \frac{W_1}{W_1} & \frac{W_1}{W_2} & \cdots & \cdots & \frac{W_1}{W_n} \\ A_2 & \frac{W_2}{W_1} & \frac{W_2}{W_2} & \cdots & \cdots & \frac{W_2}{W_n} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ A_n & \frac{W_1}{W_1} & \frac{W_1}{W_1} & \cdots & \cdots & \frac{W_n}{W_n} \end{bmatrix} \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{bmatrix} = n \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{bmatrix} \quad (1)$$

Where:

$A_1 \ldots . A_n$= Criteria/sub-criteria/program alternatives.

$W_1 \ldots . W_n$= Weight of criteria/sub-criteria/program alternatives.

d) As well as calculate the value of the consistency ratio from the results of the comparison of each criterion, with Equations (2) and (3) as follows [15], where there is Equation (2) calculates the consistency index (CI).

$$CI = \left(\frac{\lambda max - n}{n-1}\right) \quad (2)$$

Where:
CI = Consistency Index.
λmax = Eigenvalue Max.
n= Ordos Matrix.

While equation (3) calculates the consistency ratio of the value of each criterion.

$$CR = \frac{CI}{RI} \quad (3)$$

Where:
CR= Consistency Ratio.
CI= Consistency Index.
RI= Random Index (seen Table 3).

The data judgment needs to be corrected if the CR value is higher than 10%. The calculation results, however, can be deemed feasible or consistent to move on to the next process if the consistency ratio value is 0,1. Where the random index can be obtained from Table 3.

Table 3. *Random consistency index (R. I.) [15].*

N	1	2	3	4	5	6	7	8	9	10	…..	15
R. I.	0	0	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49	…..	1.58

2.2.2. Simple Additive Weighting (SAW) Method

The weighted sum method based on performance ratings for each alternative on all attributes is SAW [18, 19]. The SAW technique's primary objective is to determine the overall weight of the performance rating for each alternative across all criteria, which is also known as the weighted sum method [20]. The matrix (x) must be normalized to the same scale for all possible ratings in the SAW approach [21], The normalization process is carried out first, before carrying out the ranking process. However, in the matrix normalization process *(x)*, it is necessary to determine the two main types of attributes in SAW, namely benefit and cost [22].

In general, there are several stages involved in applying the SAW method to resolve a case, including the ones listed below [23, 24]:

a) Decide or choose an alternative, namely A_i.
b) Identify the criteria that will be used in decision-making, namely (C_i).
c) Develop a decision matrix using the (C_i) criteria by using the following Equation (4).

$$X_{ij} = \begin{vmatrix} X_{1.1} & X_{1.2} & X_{1.n} \\ X_{2.1} & X_{2.2} & X_{2.n} \\ X_{m.1} & X_{m.2} & X_{m.n} \end{vmatrix} \quad (4)$$

Where:
x_{ij} = Decision matrix.
i = Alternative (row).
j = Attribute/criteria (column).
n = Number of attributes.
m = Number of alternatives/row.

a) Matrix normalization uses an equation adjusted for the type of attribute to create a normalized matrix R_{ij}, with the following Equation (5).

$$R_{ij} = \begin{cases} \frac{x_{ij}}{MaxX_{ij}} & if\ j\ atribute\ is\ benefit \\ \frac{MinX_{ij}}{X_{ij}} & if\ j\ atribute\ is\ cost \end{cases} \quad (5)$$

Where:
R_{ij}= Normalized value.
x_{ij}= Attribute value for each criterion.
$Max\ x_{ij}$= Highest score for each criterion.
$Min\ x_{ij}$= The lowest score for each criterion.

b) The number of normalized matrix multiplication R with the weight vector to achieve the highest value is selected as the best option (A_i) by using the following Equation (6).

$$V_i = \sum_{j-1}^{n} W_j R_{ij} \quad (6)$$

Where:
V_i= Result of ranking each alternative.
W_i= Weighted score for each criterion.
R_{ij} = The result of the normalization of the largest V_i value is identified as the best alternative (A_i).

3. Results

3.1. The Analytical Hierarchy Process (AHP) Method of Calculation

a) Develop a hierarchical process structure.

The process of interpreting the results of this research is based on the stages described in Figure 1, which begin with the preparation of a hierarchical process structure (Figure 3) for the problems that have been described in the research background.

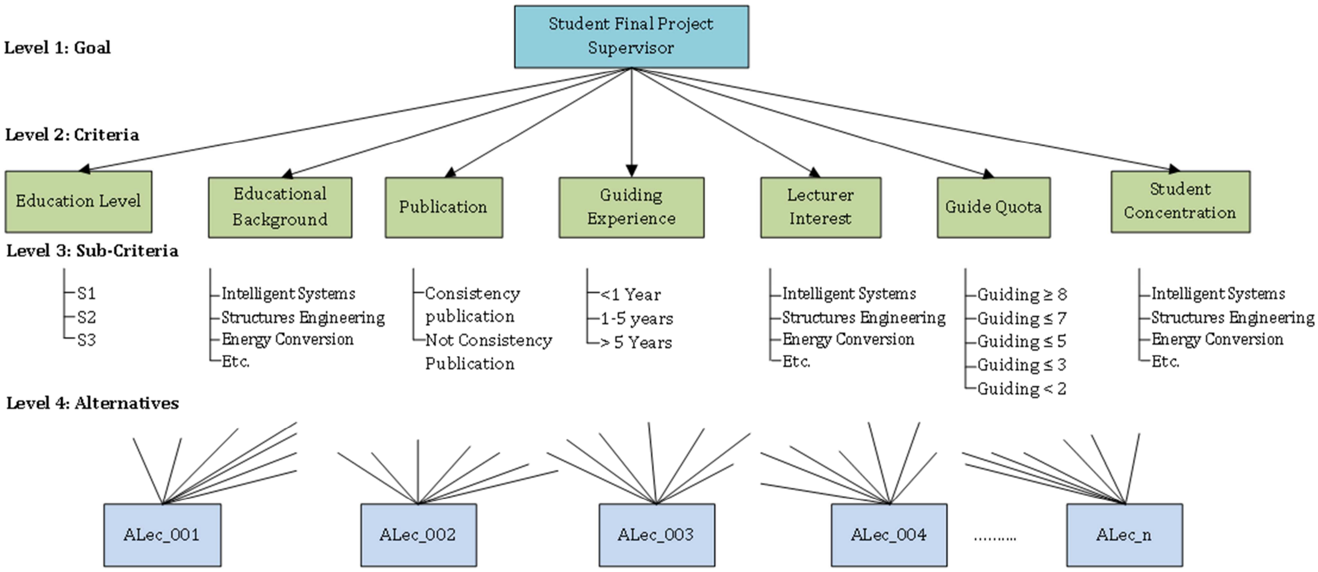

Figure 3. *Student final project supervisor hierarchy processes.*

Figure 3: Lecturer as an alternative or supervisor candidate for the final student project, which will be determined based on the criteria of education level, educational background, publication, guiding experience, area experience lecturer, guide quota, and student concentration, along with Forty-Three (43) sub-criteria, to obtain suitable supervisor candidates according to the interest of the final proposal title of the student project.

b) Comparison of criteria matrix.

The matrix comparison between the criteria values in this study is according to the concept of the AHP method with Equation (1). Where the value scale of the criteria given is based on the importance level between the criteria in Table 2, as provided in Table 4.

Table 4. *Matrix criteria comparison.*

Goal	EL	EB	P	GE	AEL	GQ	SC
EL	1	2	2	3	5	5	7
EB	0,500	1	2	3	3	5	5
P	0,500	0,500	1	2	3	3	5
GE	0,333	0,333	0,500	1	2	3	3
AEL	0,200	0,333	0,333	0,500	1	2	3
GQ	0,200	0,200	0,333	0,333	0,50	1	2
SC	0,143	0,200	0,200	0,333	0,33	0,500	1
Totals	2,876	4,567	6,367	10,167	14,833	19,500	26,000

A comparison of the matrix values in Table 4 shows that the *EL* criteria have a moderate importance value compared to the *EB* and *P* criteria, but the essentials of strong importance are compared to the *AEL* and *GQ* criteria and very strong importance compared to the *SC* criteria.

c) Calculation of the priority value for each criteria.

To obtain priority values for each criterion, you can use Equation (1). The criteria priority value is provided in Table 5.

Table 5. *Mark of criteria priority.*

Goal	EL	EB	P	GE	AEL	GQ	SC	Total Rows	Mark Priority	Result
EL	0,348	0,438	0,314	0,295	0,337	0,256	0,269	2,258	0,32	7,266
EB	0,174	0,219	0,314	0,295	0,202	0,256	0,192	1,653	0,24	7,304
P	0,174	0,109	0,157	0,197	0,202	0,154	0,192	1,186	0,17	7,230
GE	0,116	0,073	0,079	0,098	0,135	0,154	0,115	0,770	0,11	7,195
AEL	0,070	0,073	0,052	0,049	0,067	0,103	0,115	0,529	0,08	7,112
GQ	0,070	0,044	0,052	0,033	0,034	0,051	0,077	0,360	0,05	7,069
SC	0,050	0,044	0,031	0,033	0,022	0,026	0,038	0,244	0,04	7,156
Totals	1,000	1,000	1,000	1,000	1,000	1,000	1,000	7,000	1,000	50,332

Next, calculate the value of the consistency ratio (CR) with Equations (2) and (3), where the value of n or the total criteria is 7, so that the value of I. R. 1,35 is obtained from Table 3, thus the CR value is 0,023, in the following way:

$$\lambda max = \frac{Total\ Result\ Value}{n} = \frac{50,332}{7} = 7,190$$

$$CI = \frac{(\lambda max - n)}{(n-1)} = \frac{7,190-7}{7-1} = 0,032$$

$$CR = \frac{CI}{IR} = \frac{0,032}{1,35}$$

$$CR = 0,023$$

The value of the consistency ratio (CR) is 0,1, so it is said to be consistent to proceed to the next steps.

d) Comparison of the sub-criteria matrix.

The matrix comparison between the sub-criteria values is carried out in the same way as the matrix comparison between the criteria values with Equation (1), with the criteria value scale given based on the level of importance between the criteria in Table 2, here is the matrix between the sub-criteria values of the *EL* criteria as provided in Table 6.

Table 6. *Sub-criteria matrix comparison.*

Goal	S3	S2	S1
S3	1	3	7
S2	0,333	1	5
S1	0,143	0,200	1
Totals	1,476	4,200	13

A comparison of the matrix values in Table 6 shows that sub-criteria S3 has moderate importance compared to sub-criteria S2, but has very strong importance compared to sub-criteria S1, while sub-criteria S2 has an essence of strong importance compared to criteria S1.

e) Calculation of the priority value for the each sub-criteria.

To obtain priority values for each *LE* sub-criteria, you can use Equation (1). The results of the priority values for the *LE* sub-criteria as provided in Table 7.

Table 7. *Values of the priority for the LE sub-criteria.*

Goal	S3	S2	S1	Sum Rows	Mark Priority	Result
S3	0,677	0,714	0,538	1,930	0,643	3,121
S2	0,226	0,238	0,385	0,849	0,283	3,062
S1	0,097	0,048	0,077	0,221	0,074	3,013
Totals	1,000	1,000	1,000	3,000	1,000	9,197

Next, calculate the value of the consistency ratio (CR) with Equations (2) and (3), where the value of n or the total criteria is 3, so that the value of I. R. 0,52 is obtained from Table 3, thus the CR value is 0,063 in the following way:

$$\lambda max = \frac{Total\ Result\ Value}{n} = \frac{9,197}{3} = 3,066$$

$$CI = \frac{(\lambda max - n)}{(n-1)} = \frac{3,066-3}{3-1} = 0,033$$

$$CR = \frac{CI}{IR} = \frac{0,033}{0,52}$$

$$CR = 0,063$$

The value of the consistency ratio (CR) is ≤ 0,1. So it is said to be consistent to proceed to the next steps.

Take the same steps to calculate the priority scores for each other sub-criteria, to obtain priority values for the other sub-criteria as provided in Table 8.

Table 8. *Mark of priority for each sub-criterion.*

No	Criteria code	Sub-criteria code	Mark priority
1		EL1	7
2	EL	EL2	28
3		EL3	64
4		EBD1	10
5		EBD2	10
6		EBD3	10
7		EBD4	10
8	EB	EBD5	10
9		EBD6	10
10		EBD7	10
11		EBD8	10

No	Criteria code	Sub-criteria code	Mark priority
12		EBD9	10
13		EBD10	10
14	P	P1	83
15		P2	17
16		GE1	11
17	GE	GE2	26
18		GE3	63
19		AExL_1	10
20		AExL_2	10
21		AExL_3	10
22		AExL_4	10
23	AEL	AExL_5	10
24		AExL_6	10
25		AExL_7	10
26		AExL_8	10
27		AExL_9	10
28		AExL_10	10
29		GQ1	7
30		GQ2	11
31	GQ	GQ3	16
32		GQ4	23
33		GQ5	43
34		SCt_1	10
35		SCt_2	10
36		SCt_3	10
37		SCt_4	10
38	SC	SCt_5	10
39		SCt_6	10
40		SCt_7	10
41		SCt_8	10
42		SCt_9	10
43		SCt_10	10

3.2. The Simple Additive Weighting (SAW) Method of Calculation

a) Develop a judgment matrix.

The judgment matrix is arranged based on Equation (4). In this case using 10 alternative supervisor candidates as an example of the calculation, by inputting the criterion value based on the priority value of the sub-criteria, as provided in Table 9.

Table 9. *Values of criteria for each alternative.*

Alternatives/Criteria	EL	EB	P	GE	AEL	GQ	SC
ALec_001	64	10	17	11	10	43	10
ALec_002	64	10	83	63	10	43	10
ALec_003	7	10	17	26	10	43	10
ALec_004	64	10	83	11	10	43	10
ALec_005	28	10	17	26	10	7	10
ALec_006	64	10	17	11	10	7	10
ALec_007	64	10	83	63	10	16	10
ALec_008	64	10	17	26	10	7	10
ALec_009	28	10	83	63	10	7	10
ALec_010	7	10	83	11	10	43	10

Please note that the value of each criterion for one alternative is obtained from the priority value of the sub-criteria. For example, the value of 64 for the *EL* criteria and the *ALec_001* alternative is obtained from the priority value of the *EL3* sub-criteria in Table 8.

b) Determine the cost/benefit interest value.

Based on SAW's needs, it is necessary to determine the value for the cost/benefit attribute from the existing criteria, where in this case there are Seven (7) criteria so that Six (6) criteria are benefit attributes and one criterion is a cost attribute, as shown in Table 10.

Table 10. *Attribute importance values.*

No	Criteria	Mark priority	Attribute
1	EL	0,32	Benefit
2	EB	0,24	Benefit
3	P	0,17	Benefit
4	GE	0,11	Benefit
5	AEL	0,08	Benefit
6	GQ	0,05	Benefit
7	SC	0,04	Cost

It should be noted that in Table 10 the priority value for each attribute is obtained from the AHP calculation results in Table 5. So for the priority criterion value ≥0,05, it is selected as the benefit attribute value while the criterion priority value ≤0,05 is selected as the cost attribute value.

c) Compute minimum and maximum values.

At this stage, compute minimum and maximum values for each criterion value obtained for each alternative from Table 9, so that it is provided in Table 11.

Table 11. *Values of the Minimum and Maximum for each criterion.*

Alternatives/Criteria	EL	EB	P	GE	AEL	GQ	SC
ALec_001	64	10	17	11	10	43	10
ALec_002	64	10	83	63	10	43	10
ALec_003	7	10	17	26	10	43	10
ALec_004	64	10	83	11	10	43	10
ALec_005	28	10	17	26	10	7	10
ALec_006	64	10	17	11	10	7	10
ALec_007	64	10	83	63	10	16	10
ALec_008	64	10	17	26	10	7	10
ALec_009	28	10	83	63	10	7	10
ALec_010	7	10	83	11	10	43	10
Minimum	7	10	17	11	10	7	10
Maximum	64	10	83	63	10	43	10

d) Perform matrix normalization.

Matrix normalization between criteria and alternatives can be done using Equation (5).

It should be noted that the value of each *EL* criterion for the *ALec_001* alternative is obtained using Equation (5) in the following way:

$R_{ij} = \frac{iX_{ij}}{MaxX_{ij}}\ if\ j\ atribute\ is\ benefit = \frac{64}{64} = 1,$ Where the number 64 for iX_{ij} is taken from the *EL* criteria value for the *ALec_001* alternative, while the number 64 for $MaxX_{ij}$ is taken from the maximum value of the *EL* criteria in Table 11, $R_{ij} = \frac{MinX_{ij}}{X_{ij}}\ if\ j\ atribute\ is\ cost = \frac{10}{10} = 1,$ Where the number 10 for $MinX_{ij}$ is taken from the minimum *SC* criterion value, while the number 10 for X_{ij} is taken from the criterion value for the *ALec_001* alternative in Table 11.

Table 12. *Normalized values for each criterion and alternative.*

Alternatives/Criteria	EL	EB	P	GE	AEL	GQ	SC
ALec_001	1	1	0,2	0,2	1	1	1
ALec_002	1	1	1	1	1	1	1
ALec_003	0,11	1	0,205	0,413	1	1	1
ALec_004	1	1	1	0,175	1	1	1
ALec_005	0,44	1	0,205	0,413	1	0,163	1
ALec_006	1	1	0,205	0,175	1	0,163	1
ALec_007	1	1	1	1	1	0,372	1
ALec_008	1	1	0,2048	0,413	1	0,163	1
ALec_009	0,44	1	1	1	1	0,163	1
ALec_010	0,11	1	1	0,175	1	1	1

Do the same process to get the normalized value of the criteria matrix and other alternatives, so you get the results shown in Table 12 above.

e) Ranking of alternative values.

To calculate the ranking results of 10 supervisor candidates as an example with 7 criteria from the two methods, use Equation (6) as follows:

$$V_1 = (1 \text{ x } 0{,}32) + (1 \text{ x } 0{,}24) + (0{,}2 \text{ x } 0{,}17) + (0{,}2 \text{ x } 0{,}11) + (1 \text{ x } 0{,}08) + (1 \text{ x } 0{,}05) + (1 \text{ x } 0{,}04).$$

$V_1 = 0{,}77$ (V_1 Vector value calculation for alternative *ALec_001*). Perform the same calculation process for other alternative vector values, to obtain the ranking values for each supervisor alternative, as shown in Table 13.

Table 13. *The final ranking results.*

No	Alternative	Ranking values
1	ALec_002	1,00
2	ALec_007	0,97
3	ALec_004	0,91
4	ALec_009	0,78
5	ALec_001	0,77
6	ALec_008	0,76
7	ALec_006	0,73
8	ALec_010	0,62
9	ALec_005	0,58
10	ALec_003	0,51

The ranking results show that out of 10 supervisor candidates with Seven (7) criteria and Forty-Three (43) sub-criteria, our research results show that the *ALec_002* alternative as a supervisor candidate has the highest ranking value to become the main supervisor for the final student research project, with a value of 1,00, and alternative *ALec_007* has the second rank to become co-supervisor with a value of 0,97.

4. Conclusions

Results of research experiments show that the AHP and SAW method can be used together to support decide supervisor and co-supervisor candidates for student research projects at the Dili Institute of Technology (DIT), with a ratio value consistent with the criteria of 0,023 out of Seven (7) criteria, so that it is suitable for further processing. And being able to determine the main supervisor candidate is worth 1,00 won by *ALec_002*, and the co-supervisor candidate is worth 0,97 won by *ALec_007* out of 35 candidates in the engineering and science faculties. Furthermore, we will develop this research using the Natural Language Processing (NLP) approach by matching the profile of the supervisor candidate with the abstract of the student research project proposal and adding other criteria to determine a more appropriate supervisor candidate.

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