Application of SAW (Simple Additive Weighting) for the Selection of Campus Ambassadors

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Submitted: **17/02/2021**; Accepted: **09/03/2021**; Published: **29/03/2021**

Abstract–Budi Darma University is one of the private colleges in North Sumatra, Indonesia. To make this campus even better, a campus ambassador was chosen who would later be assigned as student representatives to promote the campus to the community and also as an icon that could have a better impact on the campus environment. Campus ambassadors themselves are active students at the campus who are selected based on predetermined criteria according to the needs of the campus. In the process of selecting a campus ambassador to get more optimal results, a decision support system is needed. In this study using the simple additive weighting (SAW) method as decision support in selecting campus ambassadors.

Keywords: Decision Support System; SAW; Campus Ambassador

1. INTRODUCTION

Campus ambassadors are student icons consisting of a pair of students who were selected after passing several selection stages. The selected campus ambassadors are expected to be able to generate interest in learning and interest in achievement in the campus environment and become one of the promoters to promote the campus to the community [1]. For this reason, Budi Darma University held a selection of campus ambassadors who would later become important icons and to produce students who were creative, qualified, had a leadership spirit, were responsible and had extensive experience which essentially became the provisions of students in facing the world of work[2].

In the process of selecting campus ambassadors, there are several values that students must have to become a campus ambassador, namely: general knowledge, campus insight, GPA, public speaking skills, English, achievement. With the large number of participants who wanted to take part in the selection of campus ambassadors, the committee was overwhelmed in selecting the files and values of the participants so that the results of the campus ambassador election were less effective. So Budi Darma University needs the right system to assist in selecting the campus ambassadors. One of the right systems for this problem is a decision support system (DSS)[3].

Decision support system (DSS) is an unstructured and semi-structured problem solving step that combines models and data to be systematic and optimal[4][5]. In decision making, there are several types f methods, including the Elimination Et Choix Traduisant la Reealite (ELECTRE) method, Simple Additive Weighting (SAW), The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) and others. The SAW method is used to find the weighted sum of the performance ratings for each alternative on all attributes that require a decision matrix normalization process (X) to a scale that can be compared with all available alternative ratings [6]. The SAW method is used in this decision support system by first determining the weight value of each attribute and then carrying out a ranking process so that the best alternative fits the criteria. For this reason, the SAW method is very appropriate to use in the selection of campus ambassadors, because of its easy use, the results obtained are also very effective and maximum [7][4].

Based on previous research, Sri Emiyati (2011), in making scholarship acceptance decisions, the SAW method was chosen because it can determine the weight value for each attribute so as to get more accurate results. In previous research[8]. Shinta Siti Sundari, Yopi Firman Taufik (2014), at the recruitment of new employees using the SAW method is very appropriate because there is a ranking process that will select the best alternative from a number of alternatives [9]. In previous research, Frieyadie (2016), using the SAW method to determine promotion, said that this method is a calculation method that provides certain weighted criteria so that each value, the sum of the weights of the results obtained, will be the final decision [7].

Based on the background previously described, the author proposes the research title "Decision Support System for Campus Election at Budi Darma University". This research is expected to help the participant selection process objectively and support the decision to choose campus ambassadors so that the best campus ambassadors will be won.

2. RESEARCH METHODOLOGY

2.1 Research Stages

In conducting this research, the authors collected data at Budi Darma University by carrying out several stages, namely:
a. **Field Research**
   At this stage, the authors conducted several methods such as observation and interviews with the leadership of Budi Darma University as alternatives used in the selection of campus ambassadors [5].
b. **Literature Research**

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At this stage, the author reads literature related to previous research that has been carried out by several experts, and reads books related to decision support systems for the campus ambassador election.[5].

c. **Analysis and Testing Stages**

At this stage, the authors selected a sample of 10 (5 male and 5 female) student data related to alternatives that would serve as campus ambassadors and then ranked these alternatives, the test used the Simple Additive Weighting (SAW) method.

d. **Stages of Determination of Results and Resume**

At this stage, after getting the highest ranking from the ranking results of each alternative student / i, the author then sets the results for 2 students, namely 1 male and 1 female as the winner of the campus ambassador then the author will make a report (resume) of the research results which is conducted.
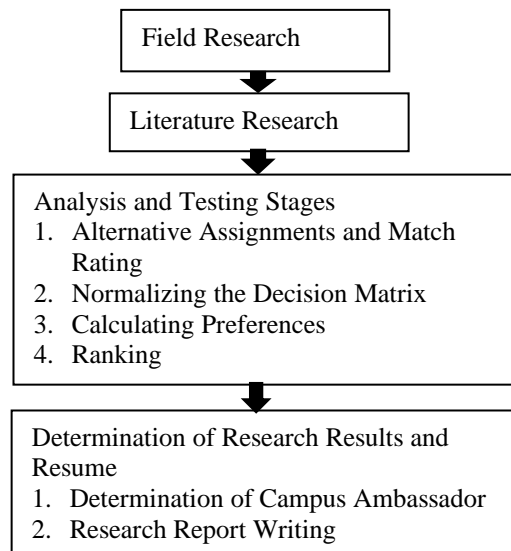
Field Research

↓

Literature Research

↓

Analysis and Testing Stages
1. Alternative Assignments and Match Rating
2. Normalizing the Decision Matrix
3. Calculating Preferences
4. Ranking

↓

Determination of Research Results and Resume
1. Determination of Campus Ambassador
2. Research Report Writing

Figure 1. Research Stages

2.2 Campus Ambassadors

Campus ambassadors are a pair of students who are selected through several stages of selection based on the criteria set by a university or college that has a high intellectual intelligence, has a good personality and responsibility that the campus can trust. The campus ambassador is also a campus icon who will later promote the campus to the community. The selected campus ambassadors are expected to be able to increase interest in learning and interest in achievement among campuses and provide good examples that can change the mindset of the campus community[1][3].

2.3 Decision Support System (DSS)

A decision support system or Decision Support System (DSS) is a system that is able to solve a problem and is also part of a computer-based information system to make decisions from a specific semi-structured or unstructured problem to be systematic and optimal[5], [8], [10], [11].

2.3 Simple Additive Weight (SAW)

The Simple Additive Weight (SAW) method, often also known as the weighted addition method. The basic concept of the Simple Additive Weight (SAW) method is to find the weighted sum of the performance ratings for each alternative on all attributes [6], [12].

The steps for completing the Simple Additive Weight method are:

1. **Prepare a decision matrix**

$$x_{ij} = \begin{bmatrix} x_{1.1} & x_{1.2} & x_{1.n} \\ x_{2.1} & x_{2.2} & x_{2.n} \\ x_{m.1} & x_{m.2} & x_{m.n} \end{bmatrix} \tag{1}$$

Note:

       x_{ij}: Decision matrix
       i: Alternative (line)
       j: Attribute / criteria (column)
       n: Number of attributes
       m: Number of alternatives / rows

2. **Calculate the normalization matrix (rij)**

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$$\text{rij} = \frac{x_{ij}}{max\ x_{ij}} \text{ If J is the benefit attribute} \tag{2}$$

$$\text{rij} = \frac{min\ x_{ij}}{x_{ij}} \text{ If J is the cost attribute} \tag{3}$$

Note:

> rij: Normalized matrix
> Max xij: The maximum value of each row and column of the x matrix
> Min xij: The minimum value of each row and column of the x matrix
> Xij: Rows and columns in the decision matrix

3. Calculating preference value (vi)

It is at this stage that the ranking value of each alternative is determined, the alternative that has a higher vi value will be the preferred alternative in this case as the campus ambassador.

$$\text{vi} = \sum_{j=0}^{n} w_j + r_{ij} \tag{4}$$

Note:

> Vi: Preference value
> Wj: Weight value
> Rij: Normalized matrix
> j: Criteria / attributes
> n: Number of criteria / attributes

3. RESULTS AND DISCUSSION

To determine which students will become campus ambassadors at Budi Darma University, the authors have taken the attribute / criteria data, weight values and alternatives used by the campus to determine which students will be crowned campus ambassadors. These students are those who have passed the file selection and meet the minimum GPA criteria of 3.00 so that they can take part in the event. In the selection of campus ambassadors, there are 6 attributes / criteria and have types of benefits. The attribute / criteria table used as a reference for selecting campus ambassadors is as follows:

Table 1. Attributes / criteria for selecting campus ambassadors

Criteria	Information	Type
C1	Campus insights	Benefit
C2	GPA	Benefit
C3	Achievement	Benefit
C4	English	Benefit
C5	Public speaking	Benefit
C6	General knowledge	Benefit

Attribute description in table 1:
C1 = Campus insight: Students' knowledge about the campus
C2 = GPA: The final grade of the semester the student has
C3 = Achievements: Achievements that have been made by students both outside and inside campus
C4 = English: Students' ability in speaking English
C5 = Public speakin: The student's ability to speak in public or at formal events
C6 = General knowledge: The knowledge that students have about the campus area and North Sumatra
The table describes all the attributes used in the selection of campus ambassadors. In the next table the weights of each attribute will be generated. The weighting for each attribute is determined by the campus with the sum of all attribute weights equal to 100%. The weighting of the attributes in table 2 can be seen in the following table:

Table 2. Attribute weights

Criteria	Information	Type	Weight
C1	Campus insights	Benefit	30%
C2	GPA	Benefit	20%
C3	Achievement	Benefit	20%
C4	General knowledge	Benefit	10%

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Criteria	Information	Type	Weight
C5	Public speaking	Benefit	10%
C6	English	Benefit	10%

Because the C3 criterion is a linguistic criterion, weighting must be done first. The following describes the weighting (wj) of the C3 criterion in table 3.

Table 3. Achievement Achievement criteria (C3)

No.	Achievement criteria	Criteria value
1	1-2 Local / 1-2 Regional / 1-2 Regional / 1-2 National / 1 International	4
2	1-2 Local / 1-2 Regional / 1-2 Regional / 1 National	3
3	1-2 Local / 1-2 Regions / 1 Regional	2
4	1-4 Local / 1-2 Regions	1

The champions that can be categorized as achievements in the process of selecting campus ambassadors are 1st to 3rd place winners.

Table 4. Weighting of the criteria for C1, C4, C5 and C6

Information	Score
Very good	5
Good	4
Pretty good	3
Not good	2
Not good	1

Then in the next stage, namely determining the alternatives to be used in the selection of campus ambassadors obtained through field research. The alternative is divided into 2, namely the male alternative and the female alternative. The following table describes the alternative data:

Table 5. Male alternative

Name	C1	C2	C3	C4	C5	C6
Faith (A1)	Very good	3.85	1st Place for Speech, National Poster Design Champion	Good	Very good	Very good
Arlansyah (A2)	Very good	3.80	2nd Place for Speech, Medan Regional English Debate Champion	Good	Good	Very good
Alvin Afandi (A3)	Good	3.65	1st Winner of Medan Regional Volley Ball	Pretty good	Not good	Not good
Rizky (A4)	Very good	3.75	Solo Vocal Champion	Pretty good	Pretty good	Not good
Menanti (A5)	Good	3.90	Typing master Champion, Medan Regional Chess Champion	Pretty good	Pretty good	Pretty good

Source: Budi Darma University, April 2020

Table 6. Alternative women

Name	C1	C2	C3	C4	C5	C6
Eliya (A1)	Very good	3.80	Medan Regional Dance Champion	Pretty good	Good	Good
Elya (A2)	Good	3.81	1st Winner Speech	Good	Pretty good	Good
Annisa (A3)	Good	3.75	English Debate Champion	Good	Pretty good	Good
Siti (A4)	Very good	3.83	National Dance Champion, 2nd Place for Speech	Good	Very good	Good
Khofifah (A5)	Good	3.79	1st Winner of Fashion Show	Pretty good	Good	Good

Source: Budi Darma University, April 2020

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After the alternative data displays alternative data as in tables 5 and 6, the next step is to display the suitability rating of each alternative in tables 7 and 8 below:

Table 7. Male alternative suitability rating

Alternative	C1	C2	C3	C4	C5	C6
A1	5	3.85	3	4	5	5
A2	5	3.80	2	4	4	5
A3	4	3.65	2	3	2	2
A4	5	3.75	1	3	3	2
A5	4	3.90	2	3	3	3

Table 8. Alternative female suitability rating

Alternative	C1	C2	C3	C4	C5	C6
A1	5	3.80	2	3	4	4
A2	4	3.81	1	4	3	4
A3	4	3.75	1	4	3	4
A4	5	3.83	3	4	5	4
A5	4	3.79	1	3	4	4

After all the necessary data have been met, then the next step is to implement the simple additive weight (SAW) method to obtain optimal results in the selection of campus ambassadors. Because the campus ambassadors will be elected two people, namely 1 from the male alternative and 1 from the female alternative, the solution will be carried out in 2 stages, the first is the male alternative and then the female alternative. The following are the stages of implementing the SAW method:

1. Establishing decision matrices for male alternatives (Xij)

$$X_{ij} = \begin{vmatrix} 5 & 3.85 & 3 & 4 & 5 & 5 \\ 5 & 3.80 & 2 & 4 & 4 & 5 \\ 4 & 3.65 & 2 & 3 & 2 & 2 \\ 5 & 3.75 & 1 & 3 & 3 & 2 \\ 4 & 3.90 & 2 & 3 & 3 & 3 \end{vmatrix}$$

Max: 5 3.90 3 4 5 5

2. Then find the normalized matrix (rij) using equation 2.
For C1 criteria (campus insight)
$r_{1.1} = = 15/5$
$r_{2.1} = = 15/5$
$r_{3.1} = = 0.84/5$
$r_{4.1} = = 15/5$
$r_{5.1} = = 0.84/5$
For C2 criteria (GPA)
$r_{1.2} = = 0.98713.85/3.90$
$r_{2.2} = = 0.97433.80/3.90$
$r_{3.2} = = 0.93583.65/3.90$
$r_{4.2} = = 0.96153.75/3.90$
$r_{5.2} = = 13.90/3.90$
For C3 criteria (Achievement)
$r_{1.3} = = 13/3$
$r_{2.3} = = 0.66662/3$
$r_{3.3} = = 0.66662/3$
$r_{4.3} = = 0.33331/3$
$r_{5.3} = = 0.66662/3$
For criteria C4 (General Knowledge)
$r_{1.4} = = 14/4$
$r_{2.4} = = 14/4$
$r_{3.4} = = 0.753/4$
$r_{4.4} = = 0.753/4$
$r_{5.4} = = 0.753/4$
For C5 criteria (Public Speaking)
$r_{1.5} = = 15/5$
$r_{2.5} = = 0.84/5$
$r_{3.5} = = 0.42/5$
$r_{4.5} = = 0.63/5$

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$r_{5.5} == 0.63/5$
For C6 criteria (English)
$r_{1.6} == 15/5$
$r_{2.6} == 15/5$
$r_{3.6} == 0.42/5$
$r_{4.6} == 0.42/5$
$r_{5.6} == 0.63/5$
From the results of calculations by each criterion against the decision matrix, a normalized matrix is obtained as follows:

$$= r_{ij} \begin{vmatrix} 1 & 0.9871 & 1 & 1 & 1 & 1 \\ 1 & 0.9743 & 0.6666 & 1 & 0.8 & 1 \\ 0.8 & 0.9358 & 0.6666 & 0.75 & 0.4 & 0.4 \\ 1 & 0.9615 & 0.3333 & 0.75 & 0.6 & 0.4 \\ 0.8 & 1 & 0.6666 & 0.75 & 0.6 & 0.6 \end{vmatrix}$$

3. The next step is to find the preference value (vi) using equation 3.

V1 = (0.30 * 1) + (0.20 * 0.9781) + (0.20 * 1) + (0.10 * 1) + (0.10 * 1) + (0.10 * 1)
= 0.9974
V2= (0.30 * 1) + (0.20 * 0.9743) + (0.20 * 0.6666) + (0.10 * 1) + (0.10 * 0.8) + (0.10 * 1)
= 0.9081
V3 = (0.30 * 0.8) + (0.20 * 0.9358) + (0.20 * 0.6666) + (0.10 * 0.75) + (0.10 * 0.4) + (0.10 * 0.4)
= 0.7154
V4= (0.30 * 1) + (0.20 * 0.9615) + (0.20 * 0.3333) + (0.10 * 0.75) + (0.10 * 0.6) + (0.10 * 0.4)
= 0.7339
V5 = (0.30 * 0.8) + (0.20 * 1) + (0.20 * 0.6666) + (0.10 * 0.75) + (0.10 * 0.6) + (0.10 * 0.6)
= 0.7683

Following are the results of the above calculations in table 7.

Table 9. Male preference value (Vi)

Name	Value Vi	Rank
Iman J. T Situmeang (A1)	0.9974	1
Arlansyah Tanjung (A2)	0.9081	2
Alvin Afandi (A3)	0.7154	5
Rizky S Nasution (A4)	0.7339	4
Menanti C Sianturi (A5)	0.7683	3

After getting the calculation results on the male alternative, the next step is to calculate the female alternative as follows:
1. Establishing decision matrices for women's alternatives (Xij)

$$X_{ij}= \begin{vmatrix} 5 & 3.80 & 2 & 3 & 4 & 4 \\ 4 & 3.81 & 1 & 4 & 3 & 4 \\ 4 & 3.75 & 1 & 4 & 3 & 4 \\ 5 & 3.83 & 3 & 4 & 5 & 4 \\ 4 & 3.79 & 1 & 3 & 4 & 4 \end{vmatrix}$$
Max: 5 3.83 3 4 5 4

2. Then find the normalized matrix (rij) using equation 2.
For C1 criteria (campus insight)
$r_{1.1} == 15/5$
$r_{2.1} == 0.84/5$
$r_{3.1} == 0.84/5$
$r_{4.1} == 15/5$
$r_{5.1} == 0.84/5$
For C2 criteria (GPA)
$r_{1.2} == 0.99213.80/3.83$
$r_{2.2} == 0.99473.81/3.83$
$r_{3.2} == 0.97913.75/3.83$
$r_{4.2} == 13.83/3.83$
$r_{5.2} == 0.98953.79/3.83$
For C3 criteria (Achievement)

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$r_{1.3} = = 0.66662/3$
$r_{2.3} = = 0.33331/3$
$r_{3.3} = = 0.33331/3$
$r_{4.3} = = 13/3$
$r_{5.3} = = 0.33331/3$

For criteria C4 (General Knowledge)
$r_{1.4} = = 0.753/4$
$r_{2.4} = = 14/4$
$r_{3.4} = = 14/4$
$r_{4.4} = = 14/4$
$r_{5.4} = = 0.753/4$

For C5 criteria (Public Speaking)
$r_{1.5} = = 0.84/5$
$r_{2.5} = = 0.63/5$
$r_{3.5} = = 0.63/5$
$r_{4.5} = = 15/5$
$r_{5.5} = = 0.84/5$

For C6 criteria (English)
$r_{1.6} = = 14/4$
$r_{2.6} = = 14/4$
$r_{3.6} = = 14/4$
$r_{4.6} = = 14/4$
$r_{5.6} = = 14/4$

From the results of calculations by each criterion against the decision matrix, a normalized matrix is obtained as follows:

$$= r_{ij} \begin{vmatrix} 1 & 0.9921 & 0.6666 & 0.75 & 0.8 & 1 \\ 0.8 & 0.9947 & 0.3333 & 1 & 0.6 & 1 \\ 0.8 & 0.9791 & 0.3333 & 1 & 0.6 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 \\ 0.8 & 0.9895 & 0.3333 & 0.75 & 0.8 & 1 \end{vmatrix}$$

3. **The next step is to find the preference value (vi) using equation 3.**

V1 = (0.30 * 1) + (0.20 * 0.9921) + (0.20 * 0.6666) + (0.10 * 0.75) + (0.10 * 0.8) + (0.10 * 1)
= 0.8867
V2= (0.30 * 0.8) + (0.20 * 0.9947) + (0.20 * 0.3333) + (0.10 * 1) + (0.10 * 0.6) + (0.10 * 1)
= 0.7656
V3 = (0.30 * 0.8) + (0.20 * 0.9791) + (0.20 * 0.3333) + (0.10 * 1) + (0.10 * 0.6) + (0.10 * 1)
= 0.7624
V4= (0.30 * 1) + (0.20 * 1) + (0.20 * 1) + (0.10 * 1) + (0.10 * 0.1) + (0.10 * 1)
= 1.0000
V5 = (0.30 * 0.8) + (0.20 * 0.9895) + (0.20 * 0.3333) + (0.10 * 0.75) + (0.10 * 0.8) + (0.10 * 1)
= 0.7595

Table 10. Female preference value (Vi)

Name	Value Vi	Rank
Eliya S Sipayung (A1)	0.8867	2
Elya Wita (A2)	0.7656	3
Annisa Aprilliani (A3)	0.7624	4
Siti Hummairoh (A4)	1.0000	1
Khofifah Indah (A5)	0.7595	5

From the calculation of the preference value above, it can be determined who will be the winner of the campus ambassador election event by looking at the ranking results of each alternative. It can be seen that Iman JT Situmeang (A1) is ranked 1st for the male category and Siti Hummairoh (A5) is ranked 1st for the female category. That way the two alternatives can be determined as campus ambassadors because they have a higher ranking and preference value compared to other alternatives.

4. CONCLUSION

In this research on the selection of campus ambassadors at Budi Darma University using the simple additive weight (SAW) method, it can be concluded that the SAW method is very appropriate to use to support decision making in the

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selection of campus ambassadors because the criteria used have weights for each attribute and in the final result process ranking for each alternative so as to be able to support decisions in the selection of campus ambassadors.

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Author's Biography

Iman Judi Tua Situmeang is the biological child of Mr. Jaheddin Situmeang and Mrs. Merdita Hutagang and is the last of 7 children. Born in Pelita Village, Sorkam District, Kab. Central Tapanuli on May 7, 1998. Educational history from SD N Pelita (2005-2011), continued to junior high school level at SMP N 4 Sorkam (2011-2013), then continued to vocational high school at SMK N 1 Sarudik (2014 -2016). Currently the author is an active sixth semester student at Budi Darma University and is taking the Informatics / IT study program. The author is also active in the field of organization since he was in vocational high schools such as OSIS, Paskibraka, PMPPKN, FARASTA and is currently also active in campus organizations such as the Budi Darma English Club (BEC) and the Informatics Engineering Student Association (HIMATIKA). Currently the author serves as the Ambassador of the Budi Darma University Campus (2019/2020) and Deputy Chair of HIMATIKA (2019/2020).
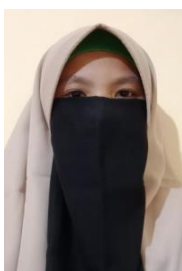
Sonya Malinda Harahap, the first of six children, is the biological daughter of Mr. Tohar Efendi and Mrs. Nurisam, born in Balangka Village, Sihapas Barumun District, Padang Lawas Regency on March 29, 1999. The author's education level came from SD Negeri 1201 Padang Nahornop (2005-2011), continuing junior secondary education at SMP Negeri 1 Sihapas Barumun (2011-2014), and at SMK Al-Hasanah Sibuhuan (2014-2017). The author is an active sixth semester student at the Budi Darma University,Medan (2017 - Present), taking the Informatics / IT Engineering study program. The author is also active in the field of organization from vocational schools such as Pramuka, OSIS, Deville, and up to high school levels such as BEC (Budi Darma English Club), LDK (Campus Da'wah Institute). Currently the author is active as general secretary at the Campus Da'wah Institute (LDK) Al-Hayyan Budi Darma University.

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