Multiple Attribute Decision Making with Simple Additive Weighting Approach for Selecting the Scholarship Recipients at Syiah Kuala University

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***Abstract*— Many scholarships have been routinely offered by the educational institutions including Syiah Kuala University. This university has extensively distributed academic achievement and Financial Aid scholarships. Generally, students who have submitted all requirement documents and applied to these scholarships will be selected by a scholarship committee. By using the scholarship committee preferences, the results obtained an amount of vagueness and subjective. The selection process is also too difficult and take so long time. In order to solve this problem, a decision support system (DSS) using Multiple Attribute Decision Making with Simple Additive Weighting Method was demonstrated by using a numerical example to determine the scholarship recipients. The method is able to display a list of the scholarship recipients by sorting the best alternative values from a number of alternative values in descending order. In this paper, we used ten scholarship recipient candidates as the alternatives and four scholarship requirements as the criteria or the attributes. The results obtained with finding the weight values of each attribute, then ranking the optimal score value of each alternative. Finally, this method can be used in this case study.**

Keywords*— Multiple Attribute Decision Making (MADM), Simple Additive Weighting (SAW), Scholarship Recipient Problem.

I. INTRODUCTION

Many educational institutions such as colleges and universities have routinely offered many scholarships for students, which can help pay tuition fees and support academic achievement. The scholarships usually require some special criteria. For instance, a scholarship program will require students to submit their academic transcripts, their student registration letters, their tuition fee payments, etc. By considering documents of these criteria or attributes, a scholarship committee can select students who are eligible to receive the scholarship.

Syiah Kuala University, which is one of public universities in Indonesia, has extensively distributed several scholarships to enrolled students in a variety of programs. Most distributed scholarships are academic achievement and Financial Aid scholarships. Typically, the students who want to apply the scholarships must submit all requirement documents to the university through their faculties. Those documents will be reviewed by a scholarship committee that consists of a faculty representative from each department. The committee will check, select, and rank the documents one by one. In the selection process, the committee member usually reviews a lot of scholarship applicants and several criteria for every academic year so that the process will be difficult and takes a lot of time.

In addition, the review process of assessing candidates is highly subjective. Prejudices and personal preferences will be a decisive role in interpreting the information and determining the decision. Therefore, the candidates who receive the scholarship are mostly not the right person.

Some researchers have developed various approaches to help universities in determining the right students in receiving scholarships. The results have shown that those approaches can be applied for their case studies. However, the results may be still biased, which is caused by methodological problems.

In general, there are two approaches to selecting the scholarship recipients. They are traditional and modern approaches. Traditional approaches mostly use a statistical analysis whereas modern approaches involve at least an expert. As a result, if a DSS uses the modern approach and a simple methodology, the results significantly obtained an amount of vagueness and subjectivity [1].

The scholarship selection process based on university's academic requirements and preferences of a scholarship committee is a highly complex problem. However, this can be solved by using Multi-Attribute Decision Making (MADM) methods. It can be applied as those methods consider many attributes at the same time, with various weights and thresholds, and having the potential to reflect on a very satisfactory degree of the vague committee preferences.

There are some methods that can be used in MADM. One of those methods is Simple Additive Weighting (SAW). The SAW is simple and its calculation can be performed by using a simple programming language. In addition to have ability to compare among criteria, it is also suitable to be implemented for decision making in personnel selection problem [2].

In this paper, SAW method is suggested to solving the scholarship selection process using multi-attribute decision

making. The SAW method was implemented by using Java Programming Language. The rest of this paper is organized as follows: In the next section, some relevant studies on the scholarship selection problem are described in brief. In section III, the concept of the SAW is briefly described. Section IV explains a numeric example of both the scholarship selection process of Academic Achievement and Financial Aid. In the last section, future steps and research challenges are discussed.

II. LITERATUR REVIEW

One of MADM problems that is often occurred at universities is the scholarship selection problem. This problem has attracted many researchers to discover and develop decision making methods with various their case studies. One of approaches is analytic hierarchy process (AHP) that introduced by Saaty [3]. This approach has been extensively utilized in the scholarship recipients' selection. For instance, decision making systems, implemented by Zamali et al. [4], Saptarini and Prihatini [5] and Guo et al. [6], constructed a judgment matrix consisting of weight value of criteria given by an expert, and then ranked a list of eligible scholarship recipients. This method is one of the more popular methods of MADM and has many advantages [2]. One of them is ease of use. The use of pair-wise comparison can allow experts to assign weights and compare alternatives with relative ease. It is also scalable and easily adjust in size to accommodate decision making problems by using its hierarchy structure. However, the AHP has also disadvantage. One is presented by Guo and Wei in [6]. They reported that the AHP method has a lot of subjectivity in making a judgment matrix and there exists some uncertainties.

The different case of using AHP for scholarship selection problem is the one presented by Putra et al. [7]. Putra in [7] used three methods which are the AHP for feature selection, SVM for classification classes, and TOPSIS for a list of scholarship recipient recommendation. The benefit of TOPSIS is simple to implement. However, TOPSIS will not be useful when it is not combined with a fuzzy approach.

Some other studies focus on proposed decision support systems to help scholarship recipient selection. Ibrahim and Sumiati in [8] developed a DSS to determine the scholarship recipients using SAW method. The system allowed an expert to give an interval of weight value for various criteria such as Grade Point Average (GPA), the number of semester that have been taken by students, the number of dependents parent, and parent incomes. The weight value scales were from 0 to 100. Similarly, Kurniawan in [9] developed a web based DSS for acceptance scholarship. The paper [9] advised that the system still needed to do a test of consistency for criteria weights by using a comparison matrix.

The SAW method was also utilized by many other researchers in different cases. Afshari et al. in [10] presented the method for personnel selection problem in a real application of personnel selection at the Telecommunication Company of Iran. The method was applied seven qualitative and positive criteria for selecting the best one amongst five people and then ranking them. Andriyendi in [11] compared SAW and Weighted Product (WP) method for food choice problem. The experimental result shown that decision using SAW method and WP method is the same with wheat as best alternative in MADM on food choice with highest values 0.8833 and 0.1563 respectively.

Ahsan et al. in [12] developed an DSS application that can help students in selecting a major in senior high school by using MADM techniques with SAW and AHP methods. The analytical results shown that the SAW is the best method for this case and the most influential components in determining majors are the interest of students, academic grade, phycologist test score, and parents' wishes.

According to Velasguez and Nester in [2], the SAW method has some advantages. Besides of having the ability to compensate among criteria, the method is also intuitive to decision makers or experts. The calculation is relatively simple and can be implemented without the help of complex programming languages.

III. METHODOLOGY

Simple Additive Weighting (SAW) which is the most popular method of handling MADM problems and also known as weighted linear combinations is a simple decision making method based on the weighted average. The method calculates an evaluation score of each alternative by multiplying the scaled value. The scaled value is given to the alternative over all attributes with the weights of relative importance. The steps of SAW are the following:

Step 1:

1) Construct a pairwise comparison matrix (n x n) for criteria with respect to objective. According to Bozoki and Rapcska in [13], a pairwise comparison matrix $\boldsymbol{A}$ can be denoted as:

$$A = \left[a_{ij}\right]\ i,j = 1,2,\dots,n\ \in\ R^{nxn} \qquad (1)$$

with properties $a_{ij} > 0$; $a_{ii} = 1$; $a_{ij} = 1/a_{ji}$, where a_{ij} is a comparison value (weight) between criteria *i* and criteria *j*. The properties of matrix $\boldsymbol{A}$ can be assigned by using Saaty's 1-9 scale of pairwise comparisons shown in Table 1. The matrix $\boldsymbol{A}$ is constructed to decide which of the two criteria is most important.

TABLE 1: SAATY'S 1-9 SCALE OF PAIRWISE COMPARISONS

Intensity of Importance	Definition	Explanation
1	Equal Importance	Two criteria contribute equally to the objective
2	Weak or Slight	
3	Moderate Importance	Experience and judgment slightly favor one activity over another
4	Moderate Plus	
5	Strong Importance	Experience and judgment slightly favor one activity over another
6	Strong Plus	

Intensity of Importance	Definition	Explanation
7	Very Strong	A criterion is favored very strongly over another
8	Very, very strong	
9	Extreme Importance	The evidence favoring one criteria over another is of the highest possible order of affirmation

Intensities of 2, 4, 6, 8 can be used to express intermediate values. Intensities of 1.1, 1.2, 1.3 etc can be used if two criteria are very close in importance

2) Compute total for each column of the matrix ***A***.
3) Compute the normalized pairwise comparison matrix by dividing each element of the matrix ***A*** by its column total.
4) Compute the priority vector ***W*** by calculating row average of the normalized pairwise comparison matrix A.
5) Construct a Weighted Sum Matrix (WSM) or Weighted Sum Vector (WSV) by multiplying the matrix A and the priority vector ***W***.
6) Compute the Consistency Vector (CV) by dividing all WSM elements with element of their respective priority vector ***W***.
7) Compute the maximal eigenvalue λ_{max} by calculating average of all CV elements.
8) Calculate the consistency Index (CI_n) by using (2).

$$CI_n = \frac{\lambda_{max} - n}{n-1} \quad (2)$$

where n is the pairwise comparison matrix size.

9) Calculate the consistency ratio (CR_n) by using (3).

$$CR_n = \frac{CI_n}{RI_n} \quad (3)$$

where RI_n is the average random consistency of n x n matrices, or also known as the average CI value of n x n random matrices [3].

10) Check the judgment consistency by comparing the CI_n value with the appropriate one shown in Table 2. The appropriate consistency index is also called the average random consistency index (RI_n). If the CR_n value is smaller or equal to 10% or 0.10, the consistency is acceptable [3]. Otherwise, we need to review the subjective judgment.

TABLE 2. AVERAGE RANDOM CONSISTENCY (RI_n)

Size of matrix	Random Consistency (*RI*)
1	0
2	0
3	0.58
4	0.9
5	1.12
6	1.24
7	1.32
8	1.41
9	1.45
10	1.49

Step 2:

1) Construct a decision matrix ***B*** (m x n) that consists of m students and n criteria. Each element r_{ij} of the matrix ***B*** can be either positive number or negative number.
2) Calculate the normalized decision matrix ***C*** (m x n) for positive criteria by using (4) and for negative criteria by using (5).

$$n_{ij} = \frac{r_{ij}}{r_j^*}, \quad i = 1,2,3,\dots,m, \quad j = 1,2,3,\dots,n \quad (4)$$

$$n_{ij} = \frac{r_j^{min}}{r_j}, \quad i = 1,2,3,\dots,m, \quad j = 1,2,3,\dots,n \quad (5)$$

Where r_j^* is a maximum number of r in the column of j.

Step 3:

Each alternative is evaluated by the SAW method by multiplying the normalized decision matrix ***C*** with the priority vector ***W***.

The data that is applied for this study is a real data sample. The weights of criteria will be computed by using a pairwise comparison matrix. A test of consistency for the weights of criteria will then be evaluated. If the consistency score is less than or equal to 0.1, this indicates sufficient consistency. Otherwise, we must revise the pairwise comparison matrix. After accepting the consistency, the SAW method is used for ranking students who will receive the scholarship. Fig 1 shows the procedure of methodology.

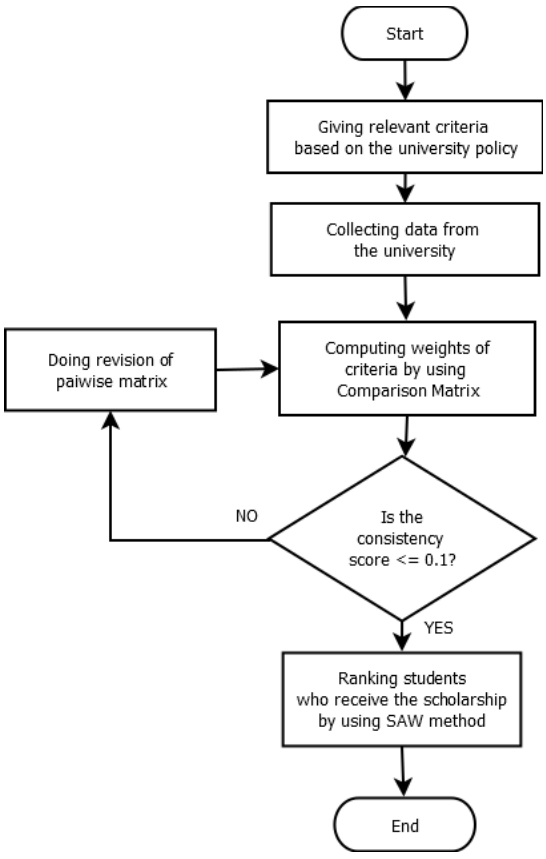

Fig. 1. The procedure of methodology

IV. A NUMERICAL EXAMPLE

In this section, we demonstrate the calculation of the suggested method. For numerical example purposes, suppose ten students have enrolled and applied the scholarships at Syiah Kuala University. We want to select seven of ten students in order to distribute the scholarship. The university has four criteria which the students have to satisfy: i) Grade Point Average (GPA), ii) number of credit point obtained, iii) number of siblings, and iv) parent income. Those four criteria are shown in table 3. In this section, we also want to show the result for Academic Achievement and Financial Aid Scholarships.

TABLE 3. CRITERIA'S NAME

Criteria	Explanation
C1	Grade Point Average (GPA)
C2	Number of credit points obtained
C3	Number of Siblings
C4	Parent income (in IDR)

The collected data that we want to demonstrate is shown in table 6. The attribute **C** means Criteria whereas the alternative **S** means Student. Because criterion C4 has a big significant value, we grouped it into five classes. Those classes are shown in table 5.

TABLE 4. THE REAL DATA

	C1	C2	C3	C4
S1	3,68	98	4	1500000
S2	3,9	98	4	2500000
S3	3,9	98	3	1000000
S4	3,7	54	2	2000000
S5	3,59	54	1	2500000
S6	3,43	54	4	2000000
S7	3,19	85	4	1000000
S8	3,28	41	4	1000000
S9	3,8	41	8	1000000
S10	3	20	6	5000000

TABLE 5. THE PARENT INCOME RATE

Parent Income Interval (IDR)	Value
0 - 1000000	5
1000001 - 2000000	4
2000001 - 3000000	3
3000001 - 4000000	2
4000001 - 5000000	1

TABLE 6. THE COLLECTED DATA

	C1	C2	C3	C4
S1	3,68	98	4	4
S2	3,9	98	4	3
S3	3,9	98	3	5
S4	3,7	54	2	4
S5	3,59	54	1	3
S6	3,43	54	4	4
S7	3,19	85	4	5
S8	3,28	41	4	5
S9	3,8	41	8	5
S10	3	20	6	1

A. Academic Achievement Scholarship

The academic achievement scholarship is a scholarship program that awarded to students who have had academic excellence while in the university by graduating a Grade Point Average of 3.0 or higher, and who have had a Credit Point Cumulative of 20 or higher. This scholarship is the university way of rewarding students who had good university grades and who show the potential to accomplished in the university. The following steps are the way for determining a list of the scholarship recipients by using the SAW method.

Step 1:

The pairwise comparison matrix $\boldsymbol{A}$ represents the relative importance of the criterion in the column compared to the criterion in the rows. Each element of the matrix A was assigned by the scholarship committee members.

$$A = \begin{matrix} criteria \\ C1 \\ C2 \\ C3 \\ C4 \end{matrix} \begin{matrix} C1 & C2 & C3 & C4 \end{matrix} \begin{pmatrix} 1 & 2 & 6 & 6 \\ 1/2 & 1 & 5 & 5 \\ 1/6 & 1/5 & 1 & 1 \\ 1/6 & 1/5 & 1 & 1 \end{pmatrix}$$

We sum each column of the pairwise comparison matrix $\boldsymbol{A}$ to obtain:

$$A = \begin{matrix} criteria \\ C1 \\ C2 \\ C3 \\ C4 \\ TOTAL \end{matrix} \begin{matrix} C1 & C2 & C3 & C4 \end{matrix} \begin{pmatrix} 1 & 2 & 6 & 6 \\ 1/2 & 1 & 5 & 5 \\ 1/6 & 1/5 & 1 & 1 \\ 1/6 & 1/5 & 1 & 1 \\ 1.83 & 3.4 & 13 & 13 \end{pmatrix}$$

Then we divide each element of the matrix $\boldsymbol{A}$ with its column total in order to get the normalized pairwise comparison matrix. The total of each column will obtain 1.

$$A = \begin{matrix} criteria \\ C1 \\ C2 \\ C3 \\ C4 \\ TOTAL \end{matrix} \begin{matrix} C1 & C2 & C3 & C4 \end{matrix} \begin{pmatrix} 0.55 & 0.59 & 0.46 & 0.46 \\ 0.27 & 0.29 & 0.38 & 0.38 \\ 0.09 & 0.06 & 0.08 & 0.08 \\ 0.09 & 0.06 & 0.08 & 0.08 \\ 1.00 & 1.00 & 1.00 & 1.00 \end{pmatrix}$$

The priority vector $\boldsymbol{W}$ can be obtained by averaging across the rows of the normalized pairwise comparison matrix $\boldsymbol{A}$.

$$W = 1/4 \begin{pmatrix} 0.55 + 0.59 + 0.46 + 0.46 \\ 0.27 + 0.29 + 0.38 + 0.38 \\ 0.09 + 0.06 + 0.08 + 0.08 \\ 0.09 + 0.06 + 0.08 + 0.08 \end{pmatrix} = \begin{pmatrix} 0.514 \\ 0.334 \\ 0.076 \\ 0.076 \end{pmatrix}$$

After that, we construct WSM or WSV by multiplying the pairwise comparison matrix $\boldsymbol{A}$ with the priority vector $\boldsymbol{W}$. The WSM is obtained as follows as:

$$WSM = A.W = \begin{pmatrix} 1 & 2 & 6 & 6 \\ 1/2 & 1 & 5 & 5 \\ 1/6 & 1/5 & 1 & 1 \\ 1/6 & 1/5 & 1 & 1 \end{pmatrix} \cdot \begin{pmatrix} 0.514 \\ 0.334 \\ 0.076 \\ 0.076 \end{pmatrix} = \begin{pmatrix} 2.09 \\ 1.35 \\ 0.30 \\ 0.30 \end{pmatrix}$$

The next step is to calculate the Consistency Vector by dividing all WSM elements with element of their respective priority vector ***W***.

$$CV = \begin{pmatrix}2.09\\1.35\\0.30\\0.30\end{pmatrix} / \begin{pmatrix}0.514\\0.334\\0.076\\0.076\end{pmatrix} = \begin{pmatrix}2.09/0.514\\1.35/0.334\\0.30/0.076\\0.30/0.076\end{pmatrix} = \begin{pmatrix}4.07\\4.04\\4.01\\4.01\end{pmatrix}$$

Aside from the relative weight, we need also to check the consistency of the scholarship committee members opinion by calculating the maximal eigenvalue λ_{max}.

$$\lambda_{max} = average(CV) = \frac{4.07 + 4.04 + 4.01 + 4.01}{4} = 4.03$$

The consistency index of matrix ***A*** with matrix *size 4 x 4* (CI_4) is obtained as the following:

$$CI_4 = \frac{4.03 - 4}{4 - 1} = 0.01$$

The consistency ratio $\boldsymbol{CR_4}$ will be computed by dividing $\boldsymbol{CI_4}$ with the amount of Average Random Consistency Index ($\boldsymbol{RI_4}$). The RI value for size of matrix 4 x 4 could be obtained by looking at table 2. The $\boldsymbol{CR_4}$ value is as follows as:

$$CR_4 = 0.01/0.9 = 0.0122$$

As the consistency ratio $\boldsymbol{CR_4}$ is less than 0.1, this is indicating that the opinion of the scholarship committee members is sufficient.

So the weighted criteria for this scholarship is shown in table 7.

TABLE 7. THE WEIGHTED CRITERIA

Criteria	C1	C2	C3	C4
weight	0.514	0.334	0.076	0.076

After collecting data and calculating the weighted criteria, the procedure of SAW method will be started as the following steps.

Step 2:

We construct the decision matrix ***B*** that consists of elements like table 6. Based on the matrix ***B***, we calculate the normalized decision matrix ***C*** (m x n) for positive criteria by using (4) and for negative criteria by using (5). In this case study, criteria have positive. The number of criteria and alternatives are 4 and 10 respectively.

$$B = \begin{array}{c} \\ S1 \\ S2 \\ S3 \\ S4 \\ S5 \\ S6 \\ S7 \\ S8 \\ S9 \\ S10 \end{array} \begin{array}{c} C1 \quad C2 \quad C3 \quad C4 \\ \begin{pmatrix} 3.68 & 98 & 4 & 4 \\ 3.9 & 98 & 4 & 3 \\ 3.9 & 98 & 3 & 5 \\ 3.7 & 54 & 2 & 4 \\ 3.59 & 54 & 1 & 3 \\ 3.43 & 54 & 4 & 4 \\ 3.19 & 85 & 4 & 5 \\ 3.28 & 41 & 4 & 5 \\ 3.8 & 41 & 8 & 5 \\ 3.00 & 20 & 6 & 1 \end{pmatrix} \end{array}$$

Where r_1^*, r_2^*, r_3^*, and r_4^* are 3.9, 98, 8, and 5 respectively.

$$C = \begin{array}{c} \\ S1 \\ S2 \\ S3 \\ S4 \\ S5 \\ S6 \\ S7 \\ S8 \\ S9 \\ S10 \end{array} \begin{array}{c} C1 \quad C2 \quad C3 \quad C4 \\ \begin{pmatrix} 0.9436 & 1 & 0.5 & 0.8 \\ 1 & 1 & 0.5 & 0.6 \\ 1 & 1 & 0.375 & 1 \\ 0.9487 & 0.5510 & 0.25 & 0.8 \\ 0.9205 & 0.5510 & 0.125 & 0.6 \\ 0.8795 & 0.5510 & 0.500 & 0.8 \\ 0.8179 & 0.8673 & 0.500 & 1 \\ 0.8410 & 0.4184 & 0.500 & 1 \\ 0.9744 & 0.4184 & 1 & 1 \\ 0.7692 & 0.2041 & 0.75 & 0.2 \end{pmatrix} \end{array}$$

Step 3:

The SAW method evaluates each alternative by multiplying the matrix ***C*** with the vector ***W***. Equation (6) is used to rank the scholarship recipients by using the SAW method. The result is shown in tabel 8.

$$Result = \text{C.W} \tag{6}$$

$$Result = \begin{array}{c} \\ S1 \\ S2 \\ S3 \\ S4 \\ S5 \\ S6 \\ S7 \\ S8 \\ S9 \\ S10 \end{array} \begin{array}{c} C1 \quad C2 \quad C3 \quad C4 \\ \begin{pmatrix} 0.9436 & 1 & 0.5 & 0.8 \\ 1 & 1 & 0.5 & 0.6 \\ 1 & 1 & 0.375 & 1 \\ 0.9487 & 0.5510 & 0.25 & 0.8 \\ 0.9205 & 0.5510 & 0.125 & 0.6 \\ 0.8795 & 0.5510 & 0.500 & 0.8 \\ 0.8179 & 0.8673 & 0.500 & 1 \\ 0.8410 & 0.4184 & 0.500 & 1 \\ 0.9744 & 0.4184 & 1 & 1 \\ 0.7692 & 0.2041 & 0.75 & 0.2 \end{pmatrix} \end{array} \cdot \begin{pmatrix}0.514\\0.334\\0.076\\0.076\end{pmatrix}$$

$$Result = \begin{array}{c} \\ S1 \\ S2 \\ S3 \\ S4 \\ S5 \\ S6 \\ S7 \\ S8 \\ S9 \\ S10 \end{array} \begin{pmatrix} 0.9179 \\ 0.9317 \\ 0.9526 \\ 0.7516 \\ 0.7124 \\ 0.7349 \\ 0.8241 \\ 0.6860 \\ 0.7925 \\ 0.5358 \end{pmatrix}$$

TABLE 8: THE RANKED SCHOLARSHIP RECIPIENTS

	C1	C2	C3	C4	SAW
S3	3,9	98	3	1000000	0,952566
S2	3,9	98	4	2500000	0,931695
S1	3,68	98	4	1500000	0,917868
S7	3,19	85	4	1000000	0,824135
S9	3,8	41	8	1000000	0,792539
S4	3,7	54	2	2000000	0,751564
S6	3,43	54	4	2000000	0,734939
S5	3,59	54	1	2500000	0,712395
S8	3,28	41	4	1000000	0,686033
S10	3	20	6	5000000	0,535799

Finally, in SAW method, the first student who will receive the scholarship is S3 and then S2, S1, S7, S9, S4, and S6 will be respectively.

B. Financial Aid Scholarship

The financial aid scholarship is a scholarship program that given to students who are from low income family, have had good academic while in the university by graduating a Grade Point Average of 2.75 or higher, and who have had a Credit Point Cumulative of 20 or higher. The aim of scholarship is to help the students to succesed in the university. The following steps in brief are the way for determining a list of the scholarship recipients by using the SAW method.

Similar to the academic achievement scholarship, a pairwise comparison matrix $\boldsymbol{A}$ is assigned by the scholarship committee members based on the university policy. The pairwise comparison matrix $\boldsymbol{A}$ for this scholarship is the following:

$$A = \begin{array}{c} criteria \\ C1 \\ C2 \\ C3 \\ C4 \end{array} \begin{array}{c} \begin{array}{cccc} C1 & C2 & C3 & C4 \end{array} \\ \begin{pmatrix} 1 & 5 & 0.65 & 1 \\ 1/5 & 1 & 0.4 & 0.1 \\ 1.54 & 2.5 & 1 & 1 \\ 1 & 10 & 1 & 1 \end{pmatrix} \end{array}$$

After doing the consistency test with the consistency ratio $\boldsymbol{CR_4}$ is 0.095 which is less than 0.1, the weighted criteria for this scholarship is shown in table 9.

TABLE 9. THE WEIGHTED CRITERIA

Criteria	C1	C2	C3	C4
weight	0.268	0.068	0.299	0.365

After calculating the matrix $\boldsymbol{B}$ and $\boldsymbol{C}$, we use the SAW to evaluates each alternative by multiplying the matrix $\boldsymbol{C}$ with the vector $\boldsymbol{W}$. Equation (6) is used to rank the scholarship recipients. The result for this scholarship is shown in tabel 9.

TABLE 8: THE RANKED SCHOLARSHIP RECIPIENTS

	C1	C2	C3	C4	SAW
S9	3,8	41	8	1000000	0,9537
S3	3,9	98	3	1000000	0,8130
S7	3,19	85	4	1000000	0,7925
S8	3,28	41	4	1000000	0,7683
S1	3,68	98	4	1500000	0,7623
S6	3,43	54	4	2000000	0,7147
S2	3,9	98	4	2500000	0,7045
S4	3,7	54	2	2000000	0,6584
S5	3,59	54	1	2500000	0,6135
S10	3	20	6	5000000	0,5176

For the financial aid scholarship, the SAW method shows that the first student who will receive the scholarship is S9 and then S3, S7, S8, S1, S6, and S2 will be respectively.

V. CONCLUSION

In this case study, we demonstrated an MADM procedure for selecting the scholarship recipicients using SAW method. The method was applied and demonstrated using the real data sample at Syiah Kuala University. We selected seven of ten students, and then ranked them based on the university policy of the Academic Achievement and Financial Aid Scholarships. To increase the efficiency of the SAW method, a web based application such as PHP can be performed for future work. The limitation of this paper is that the SAW method could not handle yet the fuzziness of experts' judgment while the decision making process. In this case, fuzzy numbers can be used to measure the evaluation matrix and the SAW method can be improved by using fuzzy numbers.

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