

Recommendation of SAW “Simple Additive Weighting” Model Employee Acceptance Decision Support System with Analysis Regression

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Abstract: Decision support system as a tool for decision makers that is integrated directly with computers provide useful information to help make structured and unstructured decisions. This study aims to implement the SAW (Simple Additive Weighting) Model to calculate the weights of the criteria that become benchmarks for the feasibility of prospective applicants in providing optimal solutions. The results of correlation and regression in building this application analysis for the sixth criteria used in the assessment of employee acceptance for each alternative candidate there are five criteria that can be recommended in the employee acceptance decision support system, with the result that the correlation criteria value for work experience is 0.300, Educational Level criteria 0.253, Psychological Test criteria 0.479, criteria for the Administrative Test is 0.723 and the criteria for the Interview Test 0.748 shows a sufficient and very high relationship, while for the Age criteria -0.112 for a weak relationship so it is not recommended.

1 INTRODUCTION

An institution or college is driven by humans who are trained and have certain skills and have experience. Human resources in an institution or college are very important things to support the progress and quality of institutions or universities in achieving their goals (Sinaga et al., 2016).

Employees are one of the resources used as a driving force in advancing a company (Umar et al., 2018). Employee acceptance selection is a very important factor for the smooth process in an institution or college to fill in a position that is classified as suitable criteria for occupying a position proposed by an institution or college (Sinaga et al., 2016). In accordance with the goals of institutions or universities, it is very necessary for the process of receiving human resources in a professional and accurate way to produce human resources that can support the quality and success of institutions or universities.

Problems encountered in employee recruitment are difficulties in determining standards that will be used to measure selection qualifications objectively (N, 2014). Difficulty in getting the right, honest and objective selector (Hidayat, 2015), and to determine applicants in accordance with specifications do not have a standardized decision system that can assess the feasibility of prospective job applicants in

accordance with the needs of the agency or university (Sinaga et al., 2016). Decision is a series of activities to choose an action in solving a problem. The act of choosing from an alternative faced based on facts and carried out through a systematic approach that can provide the best solution done by the leader is called decision making (Palasara, 2017).

The study entitled The Effect of Financial Performance on Stock Prices (Rinianty and Sukardi,) aims to develop theory and problem solving through systematic analysis. In managing data, the analysis used in this paper is descriptive, in the form of hypothesis testing using statistical tests, namely Statistical Product and Service Solution (SPSS).

Assessment of employee soft skills by applying four criteria has been discussed (Umar et al., 2018). These four criteria are communication skills, ability to work together, honesty, and interpersonal skills. Data analysis applies the Analytical Hierarchical Process (AHP) method, which allows mathematical calculations with various criteria. The results showed the value of the consistency ratio of 0.053 which means less than the value of the consistency ratio used in the AHP method that is 0.1, so the results of the calculation are valid, and can be used. This study resulted in the competency competency skills assessment required by the company as follows: 48% of Communication, 27% of Cooperation, 16% of Honesty, and

10% of Interpersonal. The results of this study prove that the AHP method can be used in the assessment of employee soft skills.

In a study of the best decision making system for employee selection using Analytic Hierarchy Process (Komalasari, 2020) shows clear differences in prioritization because there is data until the 4th digit is behind the comma still has the same numbers, which is ranked 2 and 3 with the same value - equal to 0.1040 and at rank 6 and 7 with a value equal to 0.0980.

This study implements the SAW (Simple Additive Weighting) Model to calculate the weights of the criteria that become benchmarks for the feasibility of applicants in providing optimal solutions and information as a tool for making employee acceptance decisions, and knowing the relationship between the criteria contained in the employees acceptance system using Correlation and Regression analysis.

2 METHODOLOGY

2.1 Research Mechanism

For the calculation of criteria with each weight that has been determined, this study was taken using the calculation of Simple Additive Weighting.

The SAW method can assist in the decision-making of a case, in a calculation that produces the greatest preference value that will be chosen as the best alternative. SAW method is more efficient because the time needed in the calculation is shorter (De Christin and Djmain, 2015).

The SAW method requires the process of normalizing the decision matrix (X) to a scale that can be compared with all available alternative ratings. Where determining the transformation value into a decision matrix (X) is a value from the results of the above match rating table made into a matrix form as follows:

$$\begin{bmatrix} x1 & x2 & x3 \\ x4 & x5 & x6 \\ x7 & x8 & x9 \end{bmatrix} \quad (1)$$

The formula for normalizing it (De Christin and Djmain, 2015) is as follows:

$$r_{ij} = \begin{cases} \frac{x_{ij}}{\text{Max}x_{ij}} \\ \frac{\text{Min}x_{ij}}{x_{ij}} \end{cases}$$

Where r_{ij} is the normalized performance rating of the alternative A_i in the attribute C_j ; $i=1,2,\dots,m$ and $j=1,2,\dots,n$. The preference value for each alternative (V_i) the following.

$$v_i = \sum_{j=1}^n w_j r_{ij} \quad (2)$$

Larger V_i values indicate that alternatives A_i are more chosen.

Following is the flow diagram of the calculation using the SAW method, can be seen in figure 1 below.

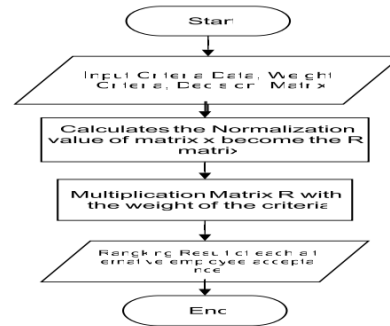


Figure 1: Flowchart for calculation of SAW method

2.2 System Requirements

In this study used 6 criteria symbolized by C, that is work experience (C1), education level (C2), age (C3), administrative test (C4), interview test (C5), and psychological test (C6). Making Alternative Data used in this employee acceptance system are prospective employees who submit applications. From several applicants who submitted applications, 12 alternative people were taken. Next is the determination of the weight of each criterion for each Alternative Value (A_i) in each Criteria (C_i) that has been determined. Each component of the criteria must be given a weight or value, according to the degree of importance, the weight value of the criteria component is obtained from the results of interviews related to which value is greater or smaller.

the importance of each criterion is shown in Figure 2, judged by weights 1 to 4, where weight 1 (KP) is less important, weight 2 (CP) is quite important, weight 3 (P) is important and weight 4 (SP) is very important shown in the following figure 2

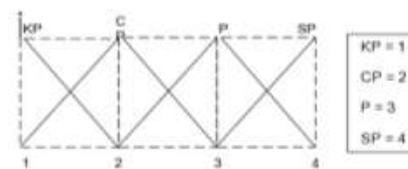


Figure 2: Weighted fuzzy numbers

In this study decision-making will be carried out using the Simple Additive Weighting (SAW) Model. Suppose the data used is as in Figure 3.

No	Alternative / Applicants	Criteria					
		C1	C2	C3	C4	C5	C6
1	A1	4	3	2	2	3	1
2	A2	2	1	4	3	2	3
3	A3	4	3	4	4	3	2
4	A4	1	3	4	2	2	1
5	A5	1	2	4	1	2	3
6	A6	2	3	3	2	4	4
7	A7	4	1	2	2	3	3
8	A8	4	4	3	3	2	1
9	A9	4	1	2	2	3	3
10	A10	4	2	3	3	2	1
11	A11	3	2	3	4	4	4
12	A12	3	2	2	4	3	4

Figure 3: Rating match alternatives and criteria.

Based on the alternative suitability rating table and the above criteria, an X decision matrix can be formed (Figure 4) as follows.

$$X = \begin{pmatrix} 4 & 3 & 2 & 2 & 3 & 1 \\ 2 & 1 & 4 & 3 & 2 & 3 \\ 4 & 3 & 4 & 4 & 3 & 2 \\ 1 & 3 & 4 & 2 & 2 & 1 \\ 1 & 2 & 4 & 1 & 2 & 3 \\ 2 & 3 & 3 & 2 & 4 & 4 \\ 4 & 1 & 2 & 2 & 3 & 3 \\ 4 & 4 & 3 & 3 & 2 & 1 \\ 4 & 1 & 2 & 2 & 3 & 3 \\ 4 & 2 & 3 & 3 & 2 & 1 \\ 3 & 2 & 3 & 4 & 4 & 4 \\ 3 & 2 & 2 & 4 & 3 & 4 \end{pmatrix}$$

Figure 4: Alternative match matrix and criteria

1) Normalizing the matrix X to be the matrix R based on equation

$$r_{ij} = \begin{cases} \frac{x_{ij}}{\text{Max}x_{ij}} \\ \frac{x_{ij}}{\text{Min}x_{ij}} \end{cases}$$

The results of normalization of the X matrix are obtained by the R matrix, presented in the following Figure 5:

$$R = \begin{pmatrix} 1 & 0.75 & 0.5 & 2 & 3 & 1 \\ 0.5 & 0.25 & 1 & 3 & 2 & 3 \\ 1 & 0.75 & 1 & 4 & 3 & 2 \\ 0.25 & 0.75 & 1 & 2 & 2 & 1 \\ 0.25 & 0.5 & 1 & 1 & 2 & 3 \\ 0.5 & 0.75 & 3 & 2 & 4 & 4 \\ 1 & 0.25 & 2 & 2 & 3 & 3 \\ 1 & 1 & 3 & 3 & 2 & 1 \\ 1 & 0.25 & 2 & 2 & 3 & 3 \\ 1 & 0.5 & 3 & 3 & 2 & 1 \\ 0.75 & 0.5 & 3 & 4 & 4 & 4 \\ 0.75 & 0.5 & 2 & 4 & 3 & 4 \end{pmatrix}$$

Figure 5: Matrix of normalization results

2) Perform ranking process by doing multiplication process using equation

$$v_i = \sum_{j=1}^n w_j r_{ij} \tag{3}$$

The weight vector (W) that has been determined is: W = [3, 4, 3, 3, 4, 4]

$$V1 = (3)(1) + (4)(0.75) + (3)(0.5) + (3)(0.5) + (4)(0.75) + (4)(0.25) = 3 + 3 + 1.5 + 1.5 + 3 + 1 = 13$$

$$V2 = (3)(0.5) + (4)(0.25) + (3)(1) + (3)(0.75) + (4)(0.5) + (4)(0.75) = 1.5 + 1 + 3 + 2.25 + 2 + 3 = 12.75$$

$$V3 = (3)(1) + (4)(0.75) + (3)(1) + (3)(0.5) + (4)(0.5) + (4)(0.25) = 3 + 3 + 3 + 3 + 3 + 2 = 17$$

$$V4 = (3)(0.25) + (4)(0.75) + (3)(1) + (3)(0.5) + (4)(0.5) + (4)(0.25) = 0.75 + 3 + 3 + 1.5 + 2 + 1 = 11.25$$

$$V5 = (3)(0.25) + (4)(0.5) + (3)(1) + (3)(0.25) + (4)(0.5) + (4)(0.75) = 0.75 + 2 + 3 + 0.75 + 2 + 3 = 11.5$$

$$V6 = (3)(0.5) + (4)(0.75) + (3)(0.75) + (3)(0.5) + (4)(1) + (4)(1) = 1.5 + 3 + 2.25 + 1.5 + 4 + 4 = 16.25$$

$$V7 = (3)(1) + (4)(0.25) + (3)(0.5) + (3)(0.5) + (4)(0.75) + (4)(0.75) = 3 + 1 + 1.5 + 1.5 + 3 + 3 = 13$$

$$V8 = (3)(1) + (4)(1) + (3)(0.75) + (3)(0.75) + (4)(0.5) + (4)(0.25) = 3 + 4 + 2.25 + 2.25 + 2 + 1 = 14.5$$

$$V9 = (3)(1) + (4)(0.25) + (3)(0.5) + (3)(0.5) + (4)(0.75) + (4)(0.75) = 3 + 1 + 1.5 + 1.5 + 3 + 3 = 13$$

$$V10 = (3)(1) + (4)(0.5) + (3)(0.75) + (3)(0.75) + (4)(0.5) + (4)(0.25) = 3 + 2 + 2.25 + 2.25 + 2 + 1 = 12.5$$

$$V11 = (3)(0.75) + (4)(0.5) + (3)(0.75) + (3)(1) + (4)(1) + (4)(1) = 2.25 + 2 + 2.25 + 3 + 4 + 4 = 17.5$$

$$V12 = (3)(0.75) + (4)(0.5) + (3)(0.5) + (3)(1) + (4)(0.75) + (4)(1) = 2.25 + 2 + 1.5 + 3 + 3 + 4 = 15.75$$

3) From the calculation of the final value, the biggest value is found in V11 so that alternative V11 is the alternative chosen as the best alternative. The following ranking for prospective applicants can be seen in Figure 6 and Figure 7 below.

Alternative	Work experience	Educational level	Criteria				Results
			Age	Administration Test	Interview Test	Psychology Test	
A1	3	3	1.5	1.5	3	1	13
A2	1.5	1	3	2.25	2	3	12.75
A3	3	3	3	3	3	2	17
A4	0.75	3	3	1.5	2	1	11.25
A5	0.75	3	3	0.75	2	3	11.5
A6	1.5	3	2.25	1.5	4	4	16.25
A7	3	1	1.5	1.5	3	3	13
A8	3	4	2.25	2.25	2	1	14.5
A9	3	1	1.5	1.5	3	3	13
A10	3	2	2.25	2.25	2	1	12.5
A11	2.25	2	2.25	3	4	4	17.5
A12	2.25	2	1.5	3	3	4	15.75

Figure 6: Ranking for prospective applicants.

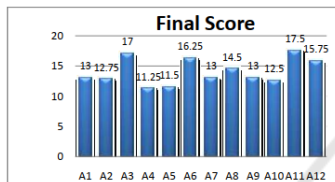


Figure 7: Chart ranking prospective applicants

From the graph in Figure 7 above shows the first rank 17.5 for A11 and second rank 17 for A3 as a recommendation for hiring employees

3 RESULTS AND DISCUSSION

3.1 Test System for Users

In this study, there are 4 step in the trial Implementation of the SAW Method and Regression in the Employee Acceptance decision support system, as follows:

1. The technique used in this trial uses a questionnaire
2. The trial implementation of the SAW Method and Regression in the Employee Acceptance System was tested at the Janabadra University Campus
3. Determine the average user rating of the system with a Likert scale
4. Calculate the percentage of user ratings of the system.

- (a) Determining the answer score, is the answer value that will be given by the respondent (Sugiyono, 2017), the answer score can be seen in Figure 8 below:

Scale Answer	Value
Very Good	4
Good	3
Pretty good	2
Not Good	1

Figure 8: Score Answers.

- (b) Calculating the ideal score, is a score used to determine the rating scale and the number of all answers, (Sugiyono, 2017). To calculate the number of ideal scores (criteria) of all items, use the following formula:

$$CriterionScore = \frac{Scalevalue \times x}{Numberofrespondents} \quad (4)$$

The ideal score results are presented in Figure 9 below:

Ideal score	Value
4 x 2 = 8	4
3 x 2 = 6	3
2 x 2 = 4	2
1 x 2 = 2	1

Figure 9: Ideal score (Kriterium).

- (c) Calculating the Scale, the scores that have been obtained are then entered into the rating scale presented in Figure 10 below:

Value Answer	Scale
7-8	Very Good
5-6	Good
3-5	Pretty good
0-2	Not Good

Figure 10: Skor rating scale.

NO	Question	Likert Scale Percentage (%)			
		Very Good	Good	Pretty Good	Not Good
1	Is this system easy to operate ?	1%			
2	Are the instructions for use easy to understand ?	0.87%			
3	Is this system able to help staffing and foundations as a result of employee recruitment recommendations ?	0.87%			
4	Is the use of language in this system easy to understand?	0.87%			
5	Does this system have an attractive appearance ?		0.75%		
6	Does this system have easy navigation in switching pages?	1%			

Figure 11: User trials are presented.

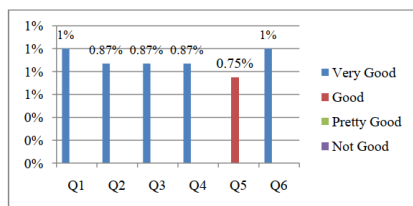


Figure 12: Percentage of System Assessment

From the graph in Figure 12 above shows Q1 1% average value for very good, Q2 0.87% average value, Q3 average value 0.87%, Q4 average value 0.87%, Q5 average value average value 0.75% and Q6 average value of the average value of 1% of the results of the quiz assessment of users.

3.2 Results of Correlation and Regression Analysis

1. Correlation Analysis of Relationships between Criteria

Correlation is a statistical method that is used to test the presence of relationships and the direction of relationships or two variables, (Ary,).

The results of data processing (see below) to see the relationship between criteria for employee acceptance using SPSS 17 software, can be seen in Figure 13 below:

	Total	Criteria				
		Pengalaman kerja	Jenjang pendidikan	Usia	Test administrasi	Test wawancara
Plenar Cakupan						
Total	1.000	300	253	-112	723	748
Pengalaman kerja	300	1.000	0.00	-819	303	308
Jenjang pendidikan	253	0.00	1.000	371	886	891
Usia	-112	-819	371	1.000	880	-424
Test administrasi	723	303	886	880	1.000	245
Test wawancara	748	308	891	-424	245	1.000
Test psikotes	479	-243	-482	-171	146	631
Sig (Praktik)						
Total	-	112	213	364	864	803
Pengalaman kerja	112	1.000	3916	118	207	224
Jenjang pendidikan	213	3916	1.000	364	482	803
Usia	364	118	364	1.000	864	207
Test administrasi	864	207	482	864	1.000	221
Test wawancara	803	221	221	207	221	1.000
Test psikotes	479	224	803	207	221	814
N						
Total	12	12	12	12	12	12
Pengalaman kerja	12	12	12	12	12	12
Jenjang pendidikan	12	12	12	12	12	12
Usia	12	12	12	12	12	12
Test administrasi	12	12	12	12	12	12
Test wawancara	12	12	12	12	12	12
Test psikotes	12	12	12	12	12	12

Figure 13: Correlation values between criteria

Correlation (relationship) Work Experience to Levels of Education, Age, Administrative Tests, Interview Tests and Psychological Tests. There are four criteria that have a Sig (Significant) > 0.05 value which indicates a very high relationship with Work Experience namely Education, Age, Administrative Tests, Interview Tests, Psychotest Tests while Age has a low relationship with Work Experience because of the Sig (Significant) < 0.05.

2. Regression Analysis Based on the results of data processing from each criterion as shown in figure

8, a regression (R) value of 1,000 is obtained. This value (R) shows that the influence between independent variables (Work Experience, Level of Education, Age, Administrative Test, Interview Test, Psychological Test) with total dependent variable (overall value) has a positive nature and has a very strong relationship, because correlation value of 1,000. (Ary,) And the coefficient of determination (R2 Square) is 1,000. This indicates that the overall criteria greatly affect employee acceptance.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	1.000 ^a	1.000	1.000	.00000

a. Predictors: (Constant), Tespsikotes, Tesadministrasi, Usia, Jenjangpendidikan, Teswawancara, Pengalamankerja

Figure 14: Results of Data Processing Criteria for Regression analysis

4 CONCLUSIONS

From the research that has been done, it can be concluded as explained below:

1. Decision support system application for employee acceptance method of Simple Additive Weighting (SAW) and Regression that is built can help in evaluating according to predetermined criteria, so that there is no exact final value.
2. Based on the results of regression analysis for the criteria used in building this application has an R-square value of 1,000, it can be recommended in the employee acceptance decision support system where the criteria have a very high relationship.
3. Correlation for the sixth criteria used in the assessment of employee acceptance for each alternative candidate there are five criteria that can be recommended in the employee acceptance decision support system, with the result that the correlation criterion value for work experience is 0.300, Educational Level criteria 0.253, Psychological Test criteria 0.479, criteria for the Administrative Test is 0.723 and the Criteria for the Interview Test 0.748 shows a sufficient and very high relationship, while for the age criteria -0.112 for a weak relationship so it is not recommended.

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