Decision Support System for Determining Employee Bonus Using Analytical Hierarchy Process (AHP) and Simple Additive Weighting (SAW) Method At Spin Warriors Indonesia

Michael Vernannes Marpaung[1]*, Aditiya Hermawan[2]

[1][2]*Buddhi Dharma University*
Jl. Imam Bonjol No 41 Karawaci Ilir, Tangerang, Indonesia

[1]mvernandes123@gmail.com

[2]aditiya.hermawan@ubd.ac.id

Abstract

Spin Warriors Indonesia has a number of employees who help in its development, employees are the main factor in the smooth running, progress and success of a company. Therefore, the provision of employee bonus allowances is carried out so that it affects all aspects of employee work. In general, the appraisal process for each employee takes a long time and is not necessarily accurate. All that happened because it used manual calculations. Based on the problems, a decision support system application was create which aims to simplify and perform a fast calculation process. This application uses the AHP and SAW methods which can provide accurate result because these methods have their respective advantages that complement each other. To test the system that was made then 7 users were distributed and filled out a questionnaire. Based od questionnaires that have been distributed and filled out by users, the results show that about 67.1% of respondents said they were quite satisfied with this application. Based on this data, it can be said that this application is useful for users to assist and facilitate companies in determining employee bonuses.

I. INTRODUCTION

Spin Warriors Indonesia as a business entity that sells bicycles and bicycle equipment in Indonesia has a number of employees who help the development of Spin Warriors Indonesia. As employees, they must provide energy and thoughts for the advancement of the business entity where the employee works. Employees as one of the main factors in advancing, progress and success of the company [1], employees are a source of energy used as a driving tool in advancing a company [2]. Therefore it is necessary to provide appropriate remuneration for employees every month and also in the form of bonus allowances that affect employee performance [3].

The system that has been running so far is from the finance department providing employee bonuses by doing manual calculations by counting each employee one by one. The large number of employees and the lack of supporting data collection for decision-making on giving bonuses at Spin Warriors Indonesia causes the distribution of employee bonuses to be long and late. The work system becomes less effective because a lot of time has to be wasted to arrange the distribution of bonuses to each employee. To overcome this problem, a system is needed that can help provide information for decision making in giving bonuses to employees. The decision-making system can be done using the AHP (Analytical Hierarchy Process) method. With the AHP method, complex problems can be solved with an organized framework of thinking, thus enabling it to be applied in effective and efficient decision making [4]. Then to maximize information for decision making, the SAW method (Simple Additive Weighting) is added, which SAW has advantages compared to other decision-making methods, namely a more precise ability to make an assessment based on weight preferences and predetermined criteria [5].

II. LITERATURE REVIEW

Decision Support System

Decision support system is a system that uses a computer base that provides the results of a number of alternatives for decisions which ultimately results in a number of alternative decisions with the aim of helping management take action to deal with all kinds of problems[6]. Decision Support Systems are a specific concept of systems that link computerized information with decision makers as users.[7]

Analytical Hierarchy Process

Analytical hierarchy process (AHP) is one of the tools (processes) in decision making developed by Thomas L. Saaty in the 1970s. This procedure is so powerful that it is widely used in making important decisions. AHP is used not only for the private sector or even for government institutions, AHP is also used for the needs of an individual, especially in research related to policy or strategic planning. In essence, AHP has a task in solving a problem that tends to be complicated by carrying out a hierarchy of criteria.[8]

Simple Additive Weighting

The Simple Additive Weighting (SAW) method can also be recognized as a weighted addition method term. The basis of the concept of the SAW method is to find a weighted summation of the results of the performance rating on all the alternatives that exist for each attribute. The SAW method is also a method that is widely used to make decisions that have many attributes. The SAW method itself requires a process to normalize the decision matrix (x) to a scale where comparisons can be made to any existing alternative ratings[9].

III. METHODS

The methodology used in designing this System is SDLC (Lifecycle Development System) which has 7 Stages [10]:

1. Identify problems, opportunities and goals
   At this stage, the author understands that there are problems that arise, namely problems in the determining employee bonus and defining these problems in detail.
2. Determine information requirements
   At this stage the author determines the information needs where the author analyzes data related to the determinants of employee performance and determines whether the information needed can be used as alternative data and criteria in giving bonuses to employees.
3. Analyzing system requirements
   At this stage the author invades RE (Requirement Elicitation) to several respondents to find out what things need to be included in the system.
4. Analyzing system requirements
   a. Create a flowchart to arrange the process running from input, process, and output to the application of Employee Bonus to be more structured.
   b. Model hotel recommendations using the AHP and SAW methods
5. Develop software
   Implement the trial in the form of a application
6. Test and maintain the system
   Test and evaluate the application made.
7. Implementing the System.
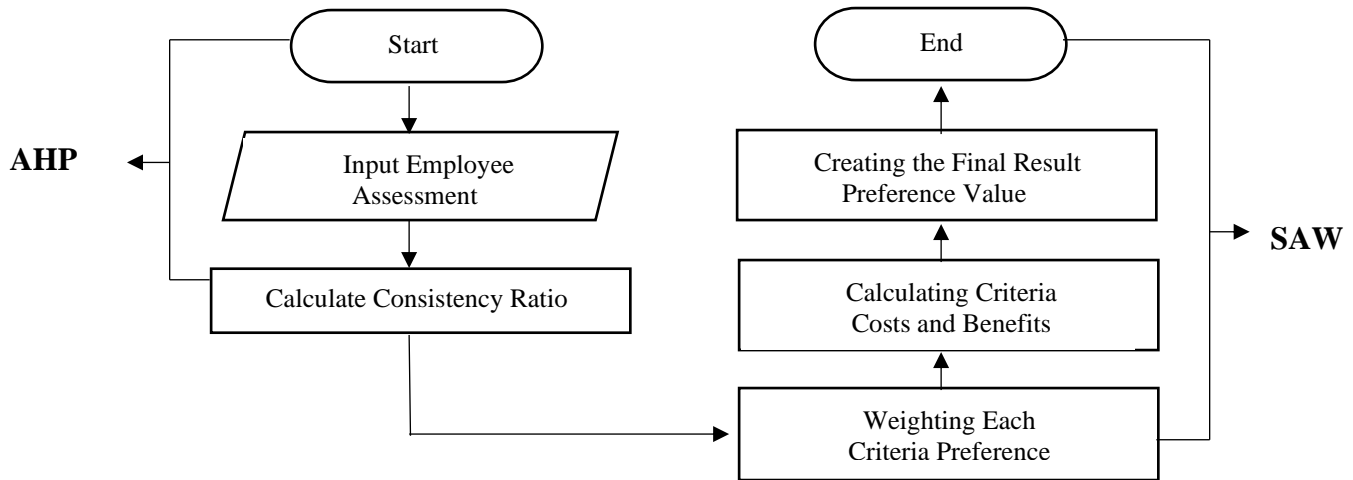
IV. RESULTS

Method Implementation

Figure 1. Flowchart

Test Case Implementasi of the AHP Method

Calculating the value of the level of importance

Table 1 Level of Importance Value

	Performance	Attendance	Hard-working
Performance	1	5	8
Attendance	1/5	1	3
Hard-working	1/8	1/3	1
Total	1,3250	6,3333	12,0000

Normalizing the matrix

Table 2 Level of Importance Value Normalization

	Performance	Attendance	Hard-working	Total
Performance	0,7547	0,7895	0,6667	2,2109
Attendance	0,1510	0,1579	0,2500	0,5589
Hard-working	0,0943	0,0526	0,0833	0,2302

After getting the number for each row, the next step is to calculate the priority by dividing the number of rows by the number of criteria (n = 3), so that the priority value of the criteria is as follows:

Performance criteria priority value : 2,2109/3 =0,7370; …………………………………………i
Attendance criteria priority value: 0,5589/3 =0,1863; …………………………………………ii
Hard-working criteria priority values: 0,2302/3 =0.0767 …………………………………………iii

Table 3 Criteria Priority Percentage

Criteria	Average	Precentage
Performance	0,7370	73,70%
Attendance	0,1863	18,63%
Hard-working	0.0767	7,67%
Total	1	100%

Conclusion: Priority percentage for Performance 73.70%, Attendance 18.63%, Craft 7.67%, thus Performance Criteria is higher compared to Attendance and Diligence

Determine λ
λmaks = (1,3250*0,7370) + (6,3333*0,1863) + (12,000*0.0767) = 0,976525 + 1,17989379 + 0,9204 = 3,07681879

Random Index Value

Order Matriks	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

Calculating the Consistency Index:
$$CI = \frac{\lambda maks - n}{n-1} = \frac{3,07681879 - 3}{3-1} = 0.038409395$$

Calculating Consistency Ratio (CR)
$$CR = \frac{ConsistencyIndex}{RandomIndex} = \frac{CI}{RI} = \frac{0.038409395}{0.58} = 0.06622$$

From the calculation, the result of the CR value is 0.06622. The assessment is said to be consistent if the value of the CR is not greater than 0.1. So that the comparative assessment of the criteria for giving bonuses to employees does not need to be recalculated because it is consistent.

Test Case Implementasi of the SAW Method

Based on the calculation between the criteria using the AHP method, the percentage weights of the criteria that have been consistent are determined as follows:

Kode Kriteria	Criteria	Weight
K1	Performance	73,70%
K2	Attendance	18,63%
K3	Hard-working	7,67%
Total		100%

Value on each of the available alternatives:

Table 4 Alternative Value

Alternatif	K1	K2	K3
Abdul Latip	4	5	3
Adhi	4	5	3
Ari Apriadi	3	5	5
Irvan	4	5	4
Sonny Wahjudi	3	5	4
Sugito	2	5	3

(Value 1 for the least weight and value 5 for the greatest weight)

First, normalize it into a matrix, the calculation is based on the profit criteria or the cost criteria.

Calculation of K1	Calculation of K2	Calculation of K3
R11 $\frac{4}{4} = 1,0000$	R12 $\frac{5}{5} = 1,0000$	R13 $\frac{3}{5} = 0,6000$
R21 $\frac{4}{4} = 1,0000$	R22 $\frac{5}{5} = 1,0000$	R23 $\frac{3}{5} = 0,6000$

R31 $\frac{3}{4}$ = 0,7500	R32 $\frac{5}{5}$ = 1,0000	R33 $\frac{5}{5}$ = 1,0000
R41 $\frac{4}{4}$ = 1,0000	R42 $\frac{5}{5}$ = 1,0000	R43 $\frac{4}{5}$ = 0,8000
R51 $\frac{3}{4}$ = 0,7500	R52 $\frac{5}{5}$ = 1,0000	R53 $\frac{4}{5}$ = 0,8000
R61 $\frac{2}{4}$ = 0,5000	R62 $\frac{5}{5}$ = 1,0000	R63 $\frac{3}{5}$ = 0,6000

The results of the alternative normalization produce the following normalization matrix:

Table 5 Alternative Value Normalization Table

Alternatif	K1	K2	K3
Abdul Latip	1,0000	1,0000	0,6000
Adhi	1,0000	1,0000	0,6000
Ari Apriadi	0,7500	1,0000	1,0000
Irvan	1,0000	1,0000	0,8000
Sonny Wahjudi	0,7500	1,0000	0,8000
Sugito	0,5000	1,0000	0,6000

1. Abdul Latip
   = {(0,7370*1,0000)+(0,1863*1,0000)+(0,0767*0,6000)}
   = (0,7370+0,1863+0,04602)
   = 0,96932
2. Adhi
   = {(0,7370*1,0000)+(0,1863*1,0000)+(0,0767*0,6000)}
   = (0,7370+0,1863+0,04602)
   = 0,96932
3. Ari Apriadi
   = {(0,7370*0,7500)+(0,1863*1,0000)+(0,0767*1,0000)}
   = (0,55275+0,1863+0,0767)
   = 0,81575
4. Irvan
   = {(0,7370*1,0000)+(0,1863*1,0000)+(0,0767*0,8000)}
   = (0,7370+0,1863+0.06136)
   = 0,98466
5. Sonny Wahjudi
   = {(0,7370*0,7500)+(0,1863*1,0000)+(0,0767*0,8000)}
   = (0,55275+0,1863+0.06136)
   = 0.80041
6. Sugito
   = {(0,7370*0,5000)+(0,1863*1,0000)+(0,0767*0,6000)}
   = (0,3685+0,1863+0,04602)
   = 0.60082

Table 3.6 Ranking Table of Each Alternative

Alternatif	Peringkat
Abdul Latip	2
Adhi	2
Ari Apriadi	3
Irvan	1
Sonny Wahjudi	4
Sugito	5

From the above calculations, it can be concluded that the alternative that gets the biggest employee bonus is Irvan, the alternative that gets the smallest employee bonus is Sugito.

V. DISCUSSION

From the results of the implementation of the decision support system using the AHP and SAW methods for giving employee bonuses that have been done, it produces a ranking order of the alternatives. The following is a ranking based on the calculation results of the AHP and SAW methods in determining employee bonus receipts.

Table 4.1 Ranking Table of Each Alternative

Alternatif	Peringkat
Irvan	1
Abdul Latip	2
Adhi	2
Ari Apriadi Irvan	3
Sonny Wahjudi	4
Sugito	5

Differences in the ranking of employees are carried out by performing the method process by normalizing AHP for each criterion, after obtaining the normalization, immediately calculating the priority of each criterion to obtain the priority percentage for each criterion After getting the percentage, we check the consistency ratio to see whether the consistency value is fairly consistent.

After getting a consistent priority percentage, then continue to carry out the SAW process by normalizing each alternative, from the results of the alternative normalization, multiplying it with the priority percentage obtained and producing a ranking for each alternative.

The AHP method is carried out in the initial process and then the SAW process is carried out because the AHP process itself has the advantage that it takes into account a broad scale but does not focus on weighting each of the criteria used. Meanwhile SAW weighted each criterion but did not take it into account from a broader perspective. Therefore, it combines the advantages of the AHP method and the SAW method to perform new calculations in solving decision support system problems.

VI. CONCLUSIONS

From the research that has been conducted by the author, the calculation using the AHP and SAW methods can be concluded as follows:

1. Companies can make decisions appropriately, because employee ratings are determined based on the quality of their work.
2. The percentage and performance of each employee will be seen more clearly, because this decision support system application uses two different methods and produces a calculation that has a fixed value with a percentage of 67.10%.
3. The existence of calculations that use definite data makes the result of giving employees indeed the performance given by each employee.

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