APPLICATION OF THE DIVIDE AND CONQUER AND SIMPLE ADDITIVE WEIGHTING TO DETERMINE THE BEST EMPLOYEE

Abstract

The research proposes the application of the divide and conquer algorithm to select the best employees at Dharmawangsa University based on the value points each employee gets based on several assessment criteria. Each employee is assessed based on responsibility, discipline, cleanliness, initiative, cooperation, and skill. In ranking employees, the simple additive weighted (SAW) method is used. The basic method of SAW is to make a sum as a consideration of the performance rating of each alternative on all attributes. It is necessary to normalize the decision matrix (X) in the SAW method into a scale that can later be compared with all existing alternative ratings. The selection of the best employees is one of the Simple Additive Weighting method implementations. The purpose of this research is to determine the choice of the best employees at Dharmawangsa University. by doing this research what you want to achieve is to create a system that can assist in making optimal decisions.

Keyword: divide and conquer; employee; simple additive weighting; ranking;

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I. INTRODUCTION

Technology is growing rapidly at this time to make all fields take advantage of a technology [1]. One of The influence of technology is the internet which is a global online network without limits providing millions of types information[2]. Development of information technology so needed by various fields life so that it can be warmly welcomed by society [3]. Therefore, making a technology as a means to help solve problems in various fields [4]**.** Human resources are the most important part in advancing the company. So it really needs every human resource that is competent and expert in their field, so that the company. In this case, the object of assessment is Dharmawangsa University Medan employees. As educators, good service quality is needed so that Dharmawangsa University can develop for the better. In addition to the selection of employees who are strictly recruited and actually have skills, it is also necessary to evaluate employee performance as a form of consistency in the employee's contribution to Dharmawangsa University. Evaluation of employee performance at each company is different as well as at Dharmawangsa University in Medan, there are several important criteria in evaluating the performance of Dharmawangsa University employees, namely responsibility, discipline, cleanliness, initiative, teamwork. work), and the abilities (skills) possessed by the employee. A decision support system (DSS) or decision support system (DSS) using the simple additive weighting method can be used to assist Dharmawangsa University in determining the best employee by comparing each of the predetermined criteria. At the beginning of each year, Dharmawangsa University gives prizes to the best employees from each faculty in order to motivate each employee to improve their performance in each work unit. The model that will be used in this decision support system is the simple additive weighting model, this method was chosen because it can determine the weight value for each attribute, after that there is a ranking process that will select the best employee from several employees at Dharmawangsa University [5]. With this ranking method, it is hoped that it will be able to obtain an appropriate assessment because it is based on several predetermined criteria and weight values [6]**.** Decision Support System (DSS) as a computer-based system in which this system consists of three components that interact with each other, namely, the language system is used to provide communication between the user and the components, another Decision Support System, a knowledge system where the problem domain knowledge is stored in the Decision Support System or as a procedure, and the problem processing system which is the relationship between the two components, which consists of one or more general problem manipulation abilities needed in decision making [5]

II. LITERATURE REVIEW

1. **Decision Support System:** According to Turban (2011: 88) The concept of a Decision Support System was discovered in the 1970s by Little. According to him, the Decision Support System is a collection of model-based procedures that are used as material for consideration in making the right decisions and reducing the error rate.

   The definition of DSS is a system that is needed to support decision makers at the managerial level in decision situations so as to produce the right decisions. DSS is used to be a tool for decision makers to broaden their capabilities, but not to replace their judgments for comparison only. DSS aims at decisions that require judgment or decisions

that cannot be supported by algorithms at all (Turban, 2011: 88). The main characteristics and capabilities of DSS include the following (Turban, 2011:90) :

- DSS supports problems that arise repeatedly, but managerial consideration is needed so that the resulting solutions are more complex.
- DSS support decisions for many levels of leadership.
- DSS supports individual and group decision making.
- The DSS supports both interrelated and unrelated decisions.
- DSS support a variety of ways and styles of decision making.
- The DSS is to be able to add, remove, and change the basic elements that the DSS manages.
- DSS is user-friendly so it can be easily adopted by all people.
- DSS are used to support managerial decision making, not replace the decision itself.
- DSS must be easy to configure, flexible to use and easy to modify in every decision making.
- DSS can use modeling in its analysis in decision making.
- Access provides a variety of forms, formats, and data source types.
- DSS can be developed as a standalone tool utilized by decision makers that is integrated with other applications, as well as distributed through information technology.

2. **Phases of the Decision Making Process:** According to Simon, the decision-making process includes three main phases, namely intelligence, design, and criteria, which is then added to a fourth phase, namely implementation [7]**.**

The decision-making process starts from the intelligence stage. The reality is tested, and the problem is identified and determined first then the problem is also defined. Furthermore, at the design stage, a model that is able to represent the system will be built. This is done to make assumptions that simplify reality and write down the relationships between all the variables that exist. This model is validated and criteria are determined according to the principle of selecting and evaluating alternative actions that have been identified from the problem.

In the model development process sometimes identifying solutions to alternatives and vice versa. Next is the choice phase which includes selecting the solutions proposed for the model. These solutions were tested to determine their viability. After that the solution is proposed logically, then it enters the final phase, namely the decision implementation phase. The successful outcome is that a real problem can be solved in the desired way. Meanwhile, implementation failure requires us to return to the previous phase.

3. **Divide and Conquer Algorithm:** The divide and conquer algorithm has 3 sub-plots namely the divide plot, the conquer path, and the combine path. The divide flow divides the problem into several sub-problems that are similar to the original problem but are smaller (ideally almost the same size) [8]**.** Conquer flow, solving (resolving) each sub-problem (recursively). The combine flow combines the solutions of each sub-problem to form the original problem solution. The division is done on input objects in the form of

tables (arrays), matrices, exponents, and other objects depending on the problem at hand. Each sub-problem must have problem characteristics that are similar to the characteristics of the initial problem, so that the divide and conquer method can work well on problems that are solved by repetition by calling itself (recursive). Algorithm Implementation of the Divide and Conquer Algorithm in determining the best employees.

4. **Simple Additive Weighting (SAW): T**he basic concept of the SAW method is to make the sum of the weights starting from the ranking of each alternative on all existing attributes. The SAW method requires the normalization of the decision matrix (X) to be a scale that can be compared with all the rankings of the existing alternatives. [9]. The Simple Additive Weighting (SAW) method is one of the methods in the decision-making process. This method has a more precise and accurate assessment capability, because it is based on predetermined criteria and weights, thus helping solve the problem of selecting outstanding employees quickly and precisely. Fishburn and MacCrimmon in their research stated that the SAW method, often also known as the sum method. The basic concept of the SAW method is to find the sum of the performance ratings for each alternative across all existing attributes.

   Companies can determine the assessment criteria according to existing needs.

$$rij = \begin{cases} \dfrac{X_{ij}}{Max_i X_{ij}} \; jika\ j\ adalah\ atribut\ keuntungan \\ \dfrac{Min_i X_{ij}}{X_{ij}} \; jika\ j\ adalah\ atribut\ biaya\ (cost) \end{cases}$$

   Where:
   Rij: Nor malized performance rating
   Maxij: Maximu m value of each row and column
   Minij: Minimum value of each row and column
   Xij: Rows and colu mns of the matrix

   With Rij: is the normalized performance rating of alternative Ai on Cj attribute; i = 1,2,…..m and j = 1,2,…,n.

$$V_i = \sum_{j=1}^{n} W_j R_{ij}$$

   A larger value of Vi indicates that alternative Ai is more preferred.

   Where:
   Vi: Final value of the alternative
   Wi: Predetermined weight
   Rij: Normalized matrix

   A larger value indicates that the alternative is more likely to be selected. The SAW method is reco mmended for solving selection problems in multi-process decision -

making systems. The SAW method is a method that is widely used in making decisions with many attributes.

There are several steps in completing the Simple Additive Weight (SAW) method, which are as follows:

- Determine the criteria used as a reference in decision support, namely Ci.
- Determine the suitability rating of each alternative on each criterion.
- Create a decision matrix based on criteria (Ci).
- Then normalize the matrix based on the equation adjusted for the type of attribute (attributes of profit and attributes of cost) so that a normalized matrix R is obtained.
- The final result obtained from the ranking process is the sum of the multiplication of the matrix R which has been normalized with the weight vector which is then chosen as the largest value as the best solution which is the best alternative (Ai) as well.

III. RESEARCH METHOD

The SAW method is also known as the sum of considerations method. The basic concept of the SAW method is to make a sum of considerations from the performance assessment of each alternative on all existing attributes. The matrix normalization process is needed in the decision in the SAW method. This research is in the form of a case study with research subjects at Dharmawangsa University in Medan, and was conducted using a descriptive analytical research method. Analytical descriptive research is research that aims to provide an overview of the reality of the object being studied objectively. Data analysis was carried out in this study using interview techniques and documentation studies. Interviews were used to find out the flow of the best employee selection process and to find out the problems that existed in the best employee selection process. A documentation study was conducted to collect data in the form of documents that are used as guidelines in selecting the best employees at Dharmawangsa University in Medan.

IV. RESULTS AND DISCUSSION

1. **Determination of Criteria for the Simple Additive Weighting (SAW) Method:** In this discussion there are several criteria for determining decision making using the Simple Additive Weighting (SAW) method, each of these criteria has a preference weight (W). The following is the data:

   C1 = responsibility (15%) = 0.15
   C2 = discipline (15%) = 0.15
   C3 = cleanliness (10%) = 0.1
   C4 = initiative (20%) = 0.2
   C5 = cooperation (20%) = 0.2
   C6 = skills (20%) = 0.2

   For each criterion has a different weight value, the following is the weight value of each criterion used:

- **Responsibility:** The indicators used in determining the best employee are based on the employee's responsibility for the job he has received.

Table 1: Responsibilities

Weight	Range	Criteria
Responsibility	>80% (Good)	0.8
	50%-79% (Typical)	0.5
	<49% (Not Good)	0.2

- **Discipline:** The indicators used in determining the best employee based on the employee's discipline in daily activities:

Table 2: Dicipline

Weight	Range	Criteria
Dicipline	>80% (Good)	0.7
	50%-79% (Typical)	0.4
	<49% (Not Good)	0.1

- **Cleanliness:** The indicators used in determining the best employee are based on the cleanliness of the employee in the office environment where the employee works.

Table 3: Cleanliness

Weight	Range	Criteria
Cleanliness	> = 80% (Clean)	0.8
	<=79% (Moderate)	0.4

- **Initiative:** The indicators used in determining the best employee based on the employee's initiative in daily activities:

Table 4: Initiatives

Weight	Range	Criteria
Initiatives	>80% (Good)	0.7
	50%-79% (Less)	0.4

- **Cooperation:** The indicators used in determining the best employee based on the employee's cooperation with his colleagues in one work unit or other work unit :

Table 5: Cooperation

Weight	Range	Criteria
Collaboration	>80% (Good)	0.6
	50%-79% (Moderate)	0.3
	<49% (Not Good)	0.1

- **Skills:** The indicators used in determining the best employee based on the skill of the employee in solving the given work problem.

Table 6: Skills

Weight	Range	Criteria
Skills	>80% (Good)	0.6
	50%-79% (Moderate)	0.3
	<49% (Not Good)	0.1

In determining the best employee at Dharmawangsa University using the Simple Additive Weighting (SAW) method based on the above criteria data, the following results are obtained:

Table 7: Assessment Results for each Criterion

No	Name	Position	C1	C2
1	Yulia	Sekretaris WR 2	1	0.57
2	Armansyah	Pegawai BAAK	0.25	1
3	M. Yunus	LPM	0.62	0.57
4	Neni	Keuangan	0.62	0.57
5	Aidil	LPM	0.25	0.57

C3	C4	C4	C5	C6
0,5	0,57	0,57	0,5	0,75
0,5	0,57	0,57	0,5	0,75
0,5	0,57	0,57	1	1
1	0,57	0,57	0,5	0,75
1	1	1	0,5	0,75

2. **Ranking results using the Divide and Conquer method:** The following is a table of the results of calculating the best employees at Dharmawangsa University using the Simple Additive Weighting (SAW) Method:

Table 8: Calculation results of the SAW method

No	Name	Rating result
1	Yulia	0.65
2	Armansyah	0.601786
3	M. Yunus	0.74375
4	Neni	0.64375
5	Aidil	0.673214

Based on the data above, it is necessary to do a ranking to determine the best employee at Dharmawangsa University so that the divide and conquer algorithm is used in sorting. The divide and conquer method is solving the problem by dividing it into smaller forms and then solving the problem.

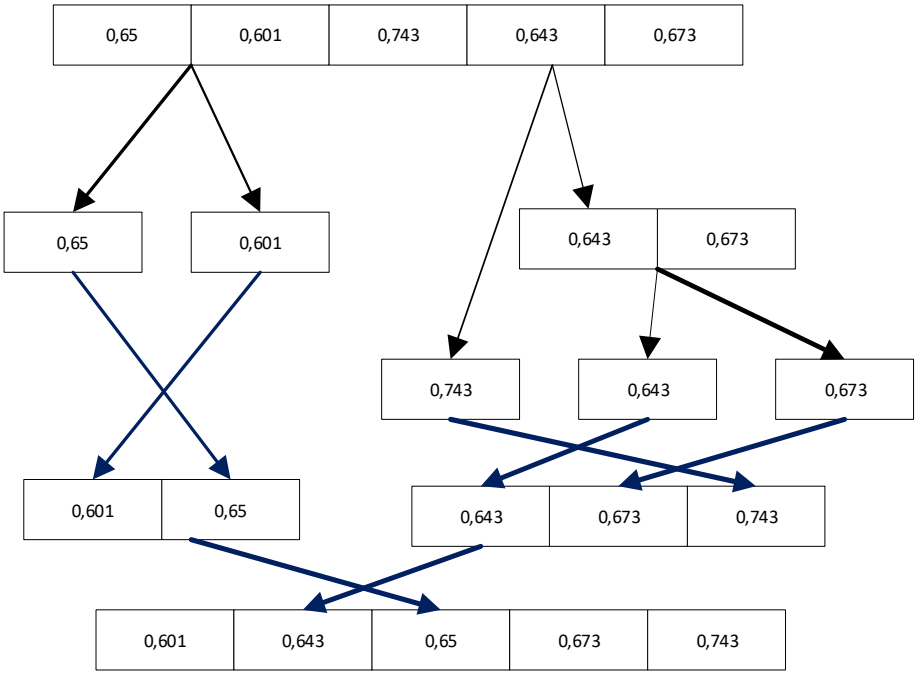

Figure 1: The sorting process uses the divide and conquer method

In the picture above the black arrows indicate the divide condition while the blue color indicates the conquer and combine conditions. Based on the results of sorting using the divide and conquer method, the one with the maximum score is the employee who gets the best rating, so the following conclusions can be drawn:

Table 9: Employee Ranking Results

No	Name	Rating result	Ranking
1	Yulia	0.743	1
2	M. Yunus	0.673	2
3	Neni	0.65	3
4	Aidil	0.643	4
5	Armansyah	0.601	5

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