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Study Approach of Simple Additive Weighting For Decision Support System

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ABSTRACT

Decision making is the process of selecting alternative actions to achieve specific goals or objectives. In a decision-making process, decision makers often faced with various problems derived from the multi-criteria. Decision support systems can be used in the processing of data to facilitate decision-making process, combined with Simple Additive Weighting method (SAW) in the system. After alpha and beta testing, it could be deduced that the useful Simple Additive Weighting method can produce the expected results

Keywords: Decision Support System, Simple Additive Weighting, Multi-criteria, Decision Process

I. INTRODUCTION

One form of the settlement that can be done is to use decision support system by applying certain methods [1] [2] [3], the use of decision support system is expected to facilitate the completion of the decision-making process based on existing criteria [1], and one of the methods that can be used is the Simple Additive Weighting method.

The Simple Additive Weighting (SAW) method also known as a weighted summation method [4]. The basic concept Simple Additive Weighting method is finding a weighted sum of the performance on each alternative on each attribute. Simple Additive Weighting method suggested completing a settlement in the decision-making system of multi-process. Simple Additive Weighting method is a method that is widely used in making decisions that have a lot of attributes, so that by applying the method of SAW on decision support systems the completion of various decision-making processes can be easily [4], this research testing Simple Additive Weighting method to the case of the easiest to do and with the dynamic criteria that can be applied to different cases quickly.

II. THEORY

Decision support system is generating system information aimed at a specific problem to be solved by the manager and can assist managers in making decisions [5] [6]. Decision support systems are an integral part of the totality of the organization's overall system. An organizational system includes physical systems, decision systems, and information systems [1] [7].

Based on the thought above, the natural smoothness is strongly influenced by regulatory mechanisms undertaken. The arrangement structure of a physical system management system is nothing but a system that produces the necessary decisions to ensure the smooth physical system. Therefore, this management system resulted in some decisions; it is often called the system management system decision [2].

Based on the above, the system's decision cannot be separate from physical systems and information systems. The complexity of natural systems requires complex decision systems. The main characteristic of a decision support system is its ability to resolve issues that are not structured. The decision support system is a further development of a computerized management system that

is designed in a way that is interactive with the user. This interactive nature intended to facilitate integration between the various components in the process of decision-making procedures, policy, technical, analytical and managerial experience and insight to establish a framework that is flexible decision [2] [7].

Advantages of Decision Support System

Decision Support System can provide a benefit or advantage to the users. The advantage is of which contain [1] [2]:

1. Decision Support System extends the capabilities of decision makers in processing the data/information to the wearer.
2. Decision Support System to help decision-makers regarding saving the time needed to solve problems, especially problems that are complex and unstructured.
3. Decision Support System can produce solutions faster and more reliable results.
4. Although a Decision Support System, may not be able to solve the problems faced by decision-makers, it can be a stimulant for policy makers in understanding the problem.
5. Decision Support System can provide additional evidence to justify so as to strengthen decision-making positions.

Simple Additive Weighting

Simple Additive Weighting (SAW) is one method used to solve the problem of multi-attribute decision making. The basic concept SAW method is to find the sum of the weighted performance rating for each alternative on all attributes [4]. SAW method requires a process of normalizing the decision matrix (X) to a scale that can be compared with all the ratings of existing alternatives.

$$r_{ij} = \frac{x_{ij}}{Max(x_{ij})} \quad (1)$$

$$r_{ij} = \frac{Min(x_{ij})}{x_{ij}} \quad (2)$$

If j is an attribute benefit then using the formula number one. If the attribute j cost then using the formula number two:

$$w = \frac{C1}{C1+\cdots+Cn} x\ 100\% \quad (3)$$

$$V_i = \sum_{j-1}^{n} = 1\ w_j\ r_{ij} \quad (4)$$

The weights of all criteria are obtained by using the formula number three. With *rij* is the normalized performance rating of alternatives on attribute Ci Ai; i = 1,2, ..., n and j = 1,2, ..., n. Preference value alternative (vi) using the formula number four.

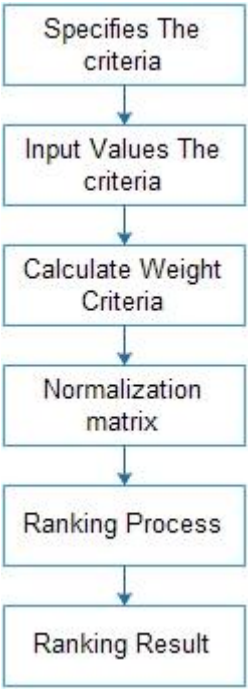

Fig 1. Simple Additive Weighting Chart

III. RESULT AND DISCUSSION

SAW method testing could be analyzed in the following example with the criteria, and alternative concepts are dynamic and can be customized for a variety of different cases, the first step is to determine the following criteria:

TABLE I Criteria Name

No	Criteria Name	Type
1	C1	Benefit
2	C2	Benefit
3	C3	Cost
4	C4	Benefit

Weighting criteria in the SAW method are determined by the decision makers, in other words, policy makers

must decide the weight preference in advance for each criterion, in this analysis criteria weight is divided into five (5) options for each criterion:

TABLE II C1 Criteria

Criteria	Weight	Value
C1	Incomplete	1
	Less complete	2
	Quite complete	3
	Complete	4
	very Complete	5

TABLE III C2 Criteria

Criteria	Weight	Value
C2	Incomplete	1
	Less complete	2
	Quite complete	3
	Complete	4
	very Complete	5

TABLE IV C3 Criteria

Criteria	Weight	Value
C3	Incomplete	1
	Less complete	2
	Quite complete	3
	Complete	4
	very Complete	5

TABLE V C4 Criteria

Criteria	Weight	Value
C4	Incomplete	1
	Less complete	2
	Quite complete	3
	Complete	4
	very Complete	5

Testing performed using the following alternative 5

1. The first alternative (A1).
2. The second alternative (A2).
3. The third alternative (A3).
4. The fourth alternative (A4).
5. The fifth alternative (A5).

Based on the above alternative made following table preference value as the test data:

TABLE VI Alternative Value

No	Alternative	C1	C2	C3	C4
1	A1	4	3	5	4
2	A2	2	4	3	3
3	A3	4	4	2	3
4	A4	4	3	4	3
5	A5	5	4	3	5

Next is to determine the value of the preference given to the decision makers value W = (5, 4, 3, 1), and process of calculating normalization matrix according to the formula

$$r_{ij} = \left\{ \frac{x_{ij}}{Max_i x_{ij}} \right\} \text{ dan } r_{ij} = \left\{ \frac{Min_i x_{ij}}{x_{ij}} \right\}$$

Here is the calculation of the above equation:

$$r_{11} = \frac{4}{\max(4,2,4,4,5)} = 0,8 \qquad r_{12} = \frac{3}{\max(3,4,4,3,4)} = 0,75$$

$$r_{21} = \frac{2}{\max(4,2,4,4,5)} = 0.4 \qquad r_{22} = \frac{4}{\max(3,4,4,3,4)} = 1$$

$$r_{31} = \frac{4}{\max(4,2,4,4,5)} = 0,8 \qquad r_{32} = \frac{4}{\max(3,4,4,3,4)} = 1$$

$$r_{41} = \frac{4}{\max(4,2,4,4,5)} = 0,8 \qquad r_{42} = \frac{3}{\max(3,4,4,3,4)} = 0,75$$

$$r_{51} = \frac{5}{\max(4,2,4,4,5)} = 1 \qquad r_{52} = \frac{4}{\max(3,4,4,3,4)} = 1$$

$$r_{13} = \frac{\min(5,3,2,4,3)}{5} = 0,4 \qquad r_{14} = \frac{4}{\max(4,3,3,3,5)} = 0,8$$

$$r_{23} = \frac{\min(5,3,2,4,3)}{3} = 0,66 \qquad r_{24} = \frac{3}{\max(4,3,3,3,5)} = 0,6$$

$$r_{33} = \frac{\min(5,3,2,4,3)}{2} = 1 \qquad r_{34} = \frac{3}{\max(4,3,3,3,5)} = 0,6$$

$$r_{43} = \frac{\min(5,3,2,4,3)}{4} = 0,5 \qquad r_{44} = \frac{3}{\max(4,3,3,3,5)} = 0,6$$

$$r_{53} = \frac{\min(5,3,2,4,3)}{3} = 0,66 \qquad r_{54} = \frac{5}{\max(4,3,3,3,5)} = 1$$

After doing the whole calculation the value above, and the result matrix as follows

$$R = \begin{bmatrix} 0,8 & 0,75 & 0,4 & 0,8 \\ 0,4 & 1 & 0,66 & 0,6 \\ 0,8 & 1 & 1 & 0,6 \\ 0,8 & 0,75 & 0,5 & 0,6 \\ 1 & 1 & 0,66 & 1 \end{bmatrix}$$

Next is process of calculating preference (V) by using the following equation:

$$V_i = \sum_{j=1}^{n} w_j r_{ij}$$

1. V_1=(5)(0,8) + (4)(0,75) + (3)(0,4) + (1)(0,8)
   = 4 + 3 + 1.2 + 0.8
   = 9
2. V_2=(5)(0,4) + (4)(1) + (3)(0,66) + (1)(0,6)
   = 2 + 4 + 1.98 + 0.6
   = 8.58
3. V_3=(5)(0,8) + (4)(1) + (3)(1) + (1)(0,6)
   = 4 + 4 + 3 + 0.6
   = 12.6
4. V_4=(5)(0,8) + (4)(0,75) + (3)(0,5) + (1)(0,6)
   = 4 + 3 + 1.5 + 0.6
   = 9.1
5. V_5=(5)(1) + (4)(1) + (3)(0,66) + (1)(1)
   = 5 + 4 + 1.98 + 1
   = 11.98

V larger value indicates that the alternative V3 is the best alternative, in other words, A3 were the best alternative decision using Simple Additive Weighting method.

IV. CONCLUSION

Based on the analysis that has been doing we got the result that a decision support system using Simple Additive Weighting capable of displaying results of the weighting and calculation based on the criteria in an easy and straightforward, and for testing with different cases can be done quickly and easily due to the simple calculation.

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