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Utility Vectors to Fuzzy Preference Relations with Simple Additive Weighting (SAW) Method in New Employee Placement System

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ABSTRACT

To improve company performance, employees are one of the important elements in this regard, especially in the placement of new employees. The procedure for placing new employees in this case is carried out with Fuzzy Logic. The input parameters used are IQ Test, Psychological Test and Academic Test. To express the preferences of decision makers on the most desirable alternatives, it can be done by transforming the preference format of Utility Vectors to Fuzzy Preference Relation. Furthermore, choosing the SAW method to determine the weight value for each attribute, which is continued with the ranking process to select the best alternative, in this case it is a suitable alternative to determine the employee's work position in accordance with predetermined criteria. With this method, it is hoped that the assessment will be more precise and accurate because it is based on predetermined criteria and weights.

1. INTRODUCTION

1.1. Background

Employees are an important element in a company or institution, be it privately owned or government-owned. In an effort to improve the quality of a company, the quality of its employees must also have eligibility standards, especially in the placement of new employees. Every company certainly needs employees who have high loyalty and effectiveness to the company and expect their employees to work with high enthusiasm to achieve the company's goals that have been set. In order for employees to work with high enthusiasm and optimal work results, the company must place employee positions appropriately [1].

It is necessary to realise that the placement of employees is not a simple matter, because errors in placement will have a bad impact on the work unit

concerned and other work units, so it will interfere with the company's operations. Employees must be placed in a work position that is in accordance with their qualifications [2][3].

However, the standard of eligibility is sometimes still vague so that by utilising fuzzy logic everything becomes clear. To help the process of determining the work position of an employee in this study, the Utility Vectors to Fuzzy Preference Relations format can be used with the Simple Additive Weighting (SAW) method [4][5][6][7].

1.2. Purpose

The purpose of this study is to assist companies in determining the work position of their employees by using Utility Vectors to Fuzzy Preference Relations with the Simple Additive Weighting (SAW) method.

1.3. Benefits

By using this method, it is hoped that the process of determining the work position of employees in the company can be carried out properly, so that the right employee is obtained to occupy a position that is in accordance with the quality they have.

1.4 Theoretical Foundations

A. Utility Vectors to Fuzzy Preference Relations

In the decision-making process for multicriteria problems (MADM), decision makers often express their preference for alternatives that can be used to help rank alternatives or choose the most desirable (Chiclana et al, 1998). [8] There are several preferred formats from decision makers for several alternatives, including utility vectors and fuzzy preference relations. The preference format of utility vectors is: Uk = (uk1, uk2, ..., ukm) with uki∈[0,1]; with $1 \leq i \leq m$ where uki is the utility value given by the oak decision maker of the alternative Ai, i=1.2,...,m. For fuzzy relation preferences, decision-making preferences are described by the binary relation of fuzzy numbers P on S, where P is a mapping of S×S → [0, 1] and signifies the Pijkadar of the alternative preference Si over Sj.

The preference format can be transformed into the form of a fuzzy preference relation. Decision makers can use utility vectors to express preferences from alternative vectors utilities can be transformed into a fuzzy preference relationship between Ai and Aj alternatives as follows:

$$P_{ij}^{k} = \frac{\left(u\left|i^{k}\right.\right)^{2}}{\left(u\left|i^{k}\right.\right)^{2} + \left(u\left|i^{k}\right.\right)^{2}; 1 \leq i \neq j \leq m} (1)$$

B. Simple Additive Weighting

The Simple Additive Weighting (SAW) method is one of the most widely used simple methods to solve problems with multiple or multicriteria criteria (Basyaib, 2006). The basic concept of the SAW method is to look for weighted summation of the performance rating of each alternative on all attributes that require the decision maker to determine the weight for each attribute. So that the SAW method is also known as the weighted summation method (Fishburn, 1967). The total score for an alternative is obtained by summing all the multiplication results between ratings and weights of each attribute. The score of each alternative can be calculated by the formula:

$$Pi = \sum_{j=1}^{m} w_j \left(m_{ij}\right)_{normal} \quad (2)$$

where: wj is the weight of the matrix
mij normal is a matrix
normalisation of the base table.

In the Simple Additive Weighting (SAW) method, the alternative total score calculation process, the rating of each attribute must first pass the normalisation stage. The process of normalising the decision matrix (x) to a comparable scale with all existing alternative ratings is carried out by the following formula:

$$rij = \frac{x_i}{max\, x_i} \quad (3)$$

Where rij is the normalised performance rating of the alternative Ai on the Cij attribute; I=1, 2..., m and J=1, 2..., N. To determine the preference value of each alternative (Vi) is as follows:

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

Based on the above formula, a larger Vi value indicates that the alternative Ai is more selected.

2. METHODS

In the process of determining the employee's work position, a passing grade value table is made which is a reference for companies to determine a decent work position for their new employees after taking various tests that have been prepared as a condition for determining employee work positions. The passing grade value data will be displayed in the following table 1 [9][10]

Table 1. Passing Grade Value Table

No	Placement	Value
1	Production Manager	≥ 80
2	Marketing	≥ 70
3	Field Agent	≥ 60
4	Factory Workers	≥ 50
5	Store Distribution	≥ 40

In the process of employee placement discussed in this study, several criteria are needed for decision making. The criteria that are requirements in the placement of employees set by the company are IQ Test (P1), Psychological Test (P2) and Academic Test (P3) with the weight of the importance of criteria based on fuzzy numbers, shown in figure 1, namely:

Very Low (SR)=1, Low (R)=2, Sufficient (C)=3, High (T)=4 And Very High (ST)= 5.

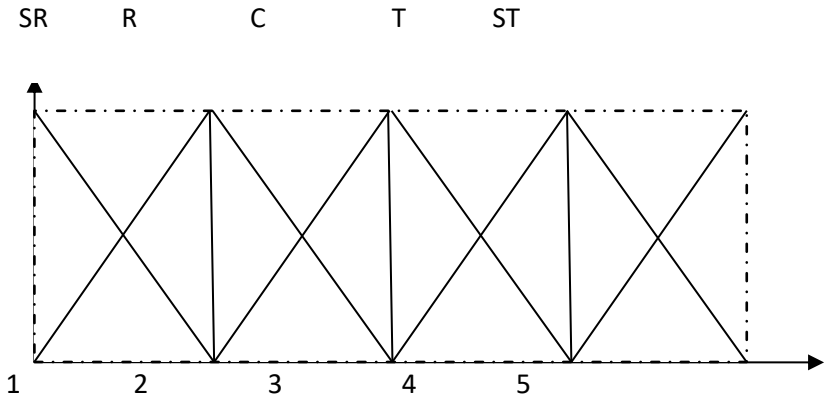

Figure 1. Weight Scale

Description:
SR = Very Low
R = Low
C = Sufficient
T = High
ST = Very High

Based on the criteria and matching rating of each alternative to the previously set criteria, the description of the weight of each criteria that has been converted with a description will be displayed in the following tables:

Table 2. IQ Test Criteria Weight Table

IQ Test Scores	Description	Value
≥ 90	Very Low	1
≥ 95	Low	2
≥100	Sufficient	3
≥105	High	4
≥110	Very High	5

Table 3. Weight Table of Psychological Test Criteria

Psychological Test Scores	Description	Value
≥ 60	Very Low	1
≥ 70	Low	2
≥ 80	Sufficient	3
≥ 90	High	4
100	Very High	5

Table 4. Weight Table of Academic Test Criteria

Academic Test Scores	Description	Value
≥ 60	Very Low	1
≥ 70	Low	2
≥ 80	Sufficient	3
≥ 90	High	4
100	Very High	5

3. RESULTS AND DISCUSSION

In the results and discussion about the placement of employees using Utility Vectors to Fuzzy Preference Relations with the Simple Additive Weighting (SAW) method, a new employee named Leo was used. Based on the results of the tests that have been carried out, Ishita gets the following scores:

- IQ Test (P1) = 108
- Psychological Test (P2) = 91
- Academic Test (P3) = 80

Based on the test results obtained, then to find out the job placement to be determined on Ishita, it is necessary to make a preference format for the results of the test obtained into the form of a vector utility u'={4, 4, 3} so that the format can be transformed in the form of relationships as follows:

P'1,2=4242+42=1632=0,5

P'1,3=4242+32=1625=0,64

P'2,1=4242+42=1632=0,5

P'2,3=4242+32=1625=0,64

P'3,1=3232+42=925=0,36

P'3,2=3232+42=425=0,36

So that the resulting fuzzy preference relationship is obtained, namely:

P'=

Next will be normalised the P' matrix as follows:

P1=4Max0,5;0,64=40,64=6,25

P2=4Max0,5;0,64=40,64=6,25

P3=3Max0,36;0,36=30,36=8,33

Thus obtained the normalised matrix R as follows:

R=6,25 6,25 8,33

The process of determining the value of preference is as follows:

V = (4)(6,25) + (4)(6,25) + (3)(8,33) = 74,99

Based on the results obtained when conducting the test, Ishita's Passing Grade value is 74.99 > 70 according to the predetermined passing grade value, then Ishita will be placed in a work position in the Production Manager section.

4. CONCLUSION

Based on the discussion above, it can be concluded as follows:

That the uniformization of preference formats with the transformation of Utility Vectors to Fuzzy Preference Relations by the SAW method can be applied to decision making involving multiple parties. The decision-making process also largely depends on the selected preference criteria.

For the perfection of the method used in this study, it is hoped that the input variables can be supplemented by involving other input values.

5. ACKNOWLEDGMENT

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