The Implementation of Fuzzy Multiple Attribute Decision Making by Using Weighted Product Algorithm in Evaluating Employees’ Performance

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Abstract. Fuzzy Logic used as an act to describe problem from input into expected output. One part of Fuzzy logic is Fuzzy multiple attribute decision making in deciding weighted alternative Score and importance criteria rating meanwhile Weighted product method is to evaluate so in deciding employee performance by multiplying to correlate with attribute rating, rating for each attribute must be powered by number with related weighted attribute and that process is same with normalization process. The result of implementation of Multiple Attribute Decision Making (FMADM) by using Weighted Product (WP) Algorithm in valuating employee performance which conducted once a year which obtained from performance valuation of system valuation at CV. Mulya Karya Baru. By conducting sample from data which obtained from data. This research can create and develop an application which can help user to rank the employee performance.

1. Introduction

Human resources (HR) has important role in an organization or company, the advance of age makes HR gives the best service and also a company/organization want employees based on company/organization standard. Performance is what is done or not done by employees and performance management from all activities which done to increase the company performance or organization, including each individual performance and group in that company.

As mentioned by Nurlaila, employee performance is an individual because each employee has different skill level in handling their task. Management unit can measure by valuating each employee. Performance is all results which produced on job function or specific activity in specific period. All performances in job is same with numbers or average of performance on important job function [9].

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The purpose of this research, CV. Mulya Karya Baru can easily decide employees who have high performance which evaluation based on job indicator, there are 6 indicators: 1) discipline, 2) attitude, 3) honesty, 4) communicative, 5) cooperative and 6) loyalty. The implementation of Fuzzy Multiple Attribute Decision Making (FMADM) to decide the weighted alternative Score and important criteria rating while Weighted Product Algorithm (WP) is to calculate employee performance at CV. Mulya Karya baru. Problem discussion in this research is how to implement Fuzzy Multiple Attribute
Decision Making (FMADM) by using Weighted Product Algorithm (WP) to evaluate employee performance.

2. Methodology

2.1. Fuzzy Logic

According to [1], Fuzzy logic is one of component construct soft, fuzzy logic was introduce for the first time by Prof. Lotfi A. Zadeh in 1965. Fuzzy logic basic is a collection of fuzzy theories, the role of member degree as a determiner of element existence in a group is very important. Membership Score or member degree or membership function becomes main characteristic in reasoning with that fuzzy logic [2].

In many ways, fuzzy logic is used as a way to describe problem from input into expected output. For examples [2]:

a. warehousing manager ask production manager about the good stock for this weekend, then production manager will specify number of good for tomorrow production.

b. An employee does his job with good performance, then his superior will give him reward based on employee performance.

There are some reasons using fuzzy logic, they are [2]:

- Fuzzy logic concept is easy to understand because fuzzy logic uses basic compilation of theories, so systematic concept as fuzzy logic base is easy to understand.
- Fuzzy logic is very flexible, it means can be adapted with changes and any uncertain thing which following the problems.
- Fuzzy logic has tolerance against incorrect data, if being given by a quite homogenic data and there is an exclusive data, then fuzzy logic has an ability to process the exclusive data.
- Fuzzy logic can remodel complicated nonlinear functions
- Fuzzy logic can create and implement experiences from experts directly without training process. In this part, it is known as Fuzzy Expert System as importance part.
- Fuzzy logic can cooperate with condition techniques conventionally. Generally, it occurs on applications on machine engineering also electrical engineering.
- Fuzzy logic based on natural language. Fuzzy logic uses daily language so it is easy to understand.

Process in fuzzy logic is fuzzification, reasoning and defuzzification [7]:

- Fuzzification is a process to obtain status of membership from input numerical Score (crisp).
- Reasoning: process to obtain output action from an input condition by following rules (IF-THEN rules) which called as inference/reasoning.
- Defuzzification: process to change back reason result from output level of membership into numeric variable.

Fuzzy logic is the exact way to describe an input room in an output room. This technique uses mathematic system of fuzzy compilation. Fuzzy logic related with uncertain as a human natural characteristic. Basic idea from fuzzy logic comes from uncertain principle. Fuzzy theory was created for the first time by using compilation theories. In conventional compilation (crisp), element of universe is a member or non-member from compilation. Because of this, membership from collections is constant [4]

2.2. Fuzzy Multiple Attribute Decision Making (FMADM)

Implementation of Fuzzy Multiple Attribute Decision Making (FMADM) is a method which used to find out optimize alternative from a set of alternatives with certain criteria [5]. The core of FMADM is to decide weighted Score for each attribute, then continued with rank process which will select given alternative. Basically, there are 3 approaches to find out weighted attribute Score, they are subjective approach, objective approach and integration Score between subjective and objective. Each approach has strength and weakness. On subjective approach, weighted Score is decided by subjectivity from
decision maker, so some factors from alternative rank process can be decided freely. Meanwhile on objective approach, weighted Score is counted systematically so it abandons subjectivity from decision maker [3].

2.3. Weighted Product (WP) Algorithm
Weighted Product method is a method in deciding a decision by multiplying to relate attribute rating, where each attribute rating must be powered with related weighted attribute. That process is as same as normalization process. Meanwhile \( \sum w_j = 1 \) also \( w_j \) is a powers number with positive Score for benefit and negative Score for cost attribute.

In this research which used FMADM WP method. The steps are [7]:

a. Deciding criteria which will be a references in taking decision, it is \( C_i \).

b. Deciding match rating for each alternative for each criteria.

c. Fix weight Score first by dividing weight with weight average, it is 100 where 100 is a number of needed percentages.

d. Whole Score of criteria attribute is powered with fixed weighted. For an alternative with weighted powered by positive for benefit attribute and negative rank weight on cost attribute.

e. All attribute Scores are multiplied by total available criteria for each alternative.

f. Multiply result is summed to obtained Score for each alternative.

g. Finding result Score by dividing with average from result Score for each multiplies.

h. Found the lowest score with best result as a decision.

2.4. Employee performance
Performance comes from performance job or actual performance which means job achievement or real achievement which obtained by someone. The meaning of performance (job performance) is a result of working by quality and quantity which reached by an employee in conducting his function as his responsibility which given to him. Factors which affect the performance such as, effectivity and efficiency, authority, discipline and initiative [9].

2.5. Data collecting technique
Data collecting technique in implementing fuzzy Multiple Attribute Decision making by using Weighted Product (WP) Algorithm in valuating employee performance are:

a. Interview method: data collecting method by conducting question-answer directly to information source or respondent who gave data according to research needed.

b. Observation method: collecting method which done by conducting observation directly in valuating employee performance system at CV. Mulya Karya baru Bengkulu city.

c. Discussion Group Forum (FGD): With this method, researcher obtained a description from problems in this case.

2.6. Research Flowchart
The steps of Research flow chart in this research described below:

a. First step is to decide problem source as the research purpose, there will be a description about why this research conducted.

b. Second step is to decide the purpose and scope of research. From this step, there will be a description about how Fuzzy Multiple Attribute Decision Making (FMADM) using Weighted Product (WP) Algorithm can be implemented, so the output can be obtained and researcher can limit the research based on scope.

c. At the third step, data are collected in the research like data about performance indicator, employee and domain parameter of Fuzzy compilation. Those data can be collected thru observation process and interview at CV. Mulya Karya Baru.

d. Fourth step is needed analysis process which decided by researcher consist of system need analysis.

e. Fifth step is to design fuzzy, in this step, there will be some steps such as creating fuzzy variable, fuzzy collection, fuzzy collection domain, fuzzy membership function and composition rule (fuzzy collection operator).
3. Results and Discussion

3.1. Implementation of Weighted Product (WP) Algorithm

Implementation of Fuzzy Multiple Attribute Decision Making (FMADM) method is to decide weighted alternative Score and importance criteria while Weighted Product (WP) algorithm is to conduct a counting so it can be decide the employee performance at CV. Mulya Karya Baru in processing employee performance Score at CV. Mulya Karya baru. There are 6 (six) criteria which submitted in decision making which can be seen in Table 1:

Table 1. Valuation Criteria of Employee performance

| Criteria Code | Criteria          |
|---------------|------------------|
| C1            | Discipline       |
| C2            | Attitude and personality |
| C3            | Honesty          |
| C4            | Communicative    |
| C5            | Cooperation      |
| C6            | Loyalty          |

From six criteria, it is continued by deciding weighted Score for each criterion, there are 5 Scores: SP for very important, P for important, CP for quite important, TP for not important, STP not necessary. So, there will be a weighted calculation based on Weighted variable fellowship like in Figure 1.

![Figure 1. Function of weighted Variable Fellowship](image)

From table 1, six each criterion for each sub criteria variable with weighted Score in Figures 2.

![Figures 2. Functions of Weighted Variable fellowship sub criteria](image)

From table 1 evaluation criteria of employee’s performance is continued with deciding step for weighted Score of preference for each criteria in table 2 and table 3 is Score for each sub criteria.

Table 2. Weighted Criteria Preference (1-5)

| Criteria Code | Criteria              | Weighted Preference |
|---------------|-----------------------|---------------------|
| C1            | Discipline            | 3                   |
| C2            | Attitude and personality | 4                  |
| C3            | Honesty               | 5                   |
| C4            | Communicative         | 3                   |
| C5            | Cooperation           | 4                   |
| C6            | Loyalty               | 5                   |
Table 3. Weighted Criteria Preference (1-5)

| Criteria Code | Criteria                  | Sub Criteria | Score |
|---------------|---------------------------|--------------|-------|
| C1            | Discipline                | Very good    | 5     |
|               |                           | Good         | 4     |
|               |                           | Fair         | 3     |
|               |                           | Not good     | 2     |
|               |                           | Poor         | 1     |
|               |                           | Very good    | 5     |
|               |                           | Good         | 4     |
| C2            | Attitude and personality  | Fair         | 3     |
|               |                           | Not good     | 2     |
|               |                           | Poor         | 1     |
|               |                           | Very good    | 5     |
|               |                           | Good         | 4     |
| C3            | Honesty                   | Fair         | 3     |
|               |                           | Not good     | 2     |
|               |                           | Poor         | 1     |
|               |                           | Very good    | 5     |
|               |                           | Good         | 4     |
| C4            | Communicative             | Fair         | 3     |
|               |                           | Not good     | 2     |
|               |                           | Poor         | 1     |
|               |                           | Very good    | 5     |
|               |                           | Good         | 4     |
| C5            | Cooperation               | Fair         | 3     |
|               |                           | Not Good     | 2     |
|               |                           | Poor         | 1     |
|               |                           | Very good    | 5     |
|               |                           | Good         | 4     |
| C6            | Loyalty                   | Fair         | 3     |
|               |                           | Not good     | 2     |
|               |                           | Poor         | 1     |

The implementation of FAMDM WP method in evaluating employee performance at CV. Mulya Karya Baru by taking 5 employees as sample (alternative) as mentioned at table 4

Table 4. Alternative Score

| Alternative (A)      | C1 | C2 | C3 | C4 | C5 | C6 |
|----------------------|----|----|----|----|----|----|
| Rian Andi Saputra    | 5  | 4  | 3  | 5  | 4  | 2  |
| Zurnia               | 5  | 4  | 5  | 4  | 2  | 3  |
| Rahmat Zul           | 4  | 3  | 5  | 4  | 4  | 3  |
| Budi                 | 5  | 4  | 4  | 5  | 4  | 5  |
| Sari Perianka        | 4  | 3  | 5  | 4  | 2  | 4  |

Step is continued by implementing WP algorithm from table 2 Weighted criteria preference (1-5) by conducting weighted correction, vector S calculation and vector V Score calculation as below:

\[
W_1 = \frac{3}{3 + 4 + 5 + 3 + 4 + 5}, \quad W_2 = \frac{4}{3 + 4 + 5 + 3 + 4 + 5}, \quad W_3 = \frac{5}{3 + 4 + 5 + 3 + 4 + 5}
\]

W1 = 0.125 | W2 = 0.167 | W3 = 0.208

After weighted is corrected, vector S Score will be calculated from data sample of employee performance, the result are:
After each vector S Score is calculated, the next steps is to calculate vector V.

\[
V_1 = \frac{3.4478}{18.8142} = 0.1833 \quad | \quad V_2 = \frac{3.6155}{18.8142} = 0.1922 \quad | \quad V_3 = \frac{3.7618}{18.8142} = 0.1999 \quad | \quad V_4 = \frac{4.4307}{18.8142} = 0.2355
\]

\[
V_5 = \frac{3.5584}{18.8142} = 0.1891
\]

| Employee Name (A) | Score   | Rank |
|-------------------|---------|------|
| Budi              | 0.2355  | 1    |
| Rahmat Zul        | 0.1999  | 2    |
| Zurnia            | 0.1922  | 3    |
| Sari Perianka     | 0.1891  | 4    |
| Rian Andi Saputra | 0.1833  | 5    |

According to implementation of FMADM WP algorithm in evaluating the employee performance at CV Mulya Karya Baru, the rank result shows that the best employee performance is Budi with the highest score 0.2355

4. Conclusion
The result of the implementation of Multiple Attribute Decision Making (FMADM) by using Weighted Product (WP) algorithm in evaluating employee performance can be conducted one a year which tested from test system at CV. Mulya Karya Baru. According to data in this research, it can be created and developed an application to help in ranking the employee performance.

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