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Research Paper

Fuzzy Model Tahani as Decision Support System for Employee Promotion

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Abstract

Human resources within organization is very important to support the progress and quality of companies in achieving goals. Increased position is a very important factor for employee career planning and also to rejuvenate a position of occupation to be occupied by someone who has appropriate criteria to occupy a proposed position based on objective assessment and appropriate criteria variables. For that required a system that can assist leaders in making decisions for promotion of positions in accordance with what is expected from the company, it is necessary to design a decision support system using fuzzy database model Tahani method to assist in promotion.

Keywords: *Human Resource, Fuzzy,Tahani, Tahani Model*

1. Introduction

Human resources is very important thing to support the progress and quality of the organization to achieve the goal [1]–[4]. Promotion is an achievement that is expected for employees within an organization based on the criteria that have been determined by top management. The promotion process of promotion and career planning is generally based on certain factors, such as education level and working period, but there are many other factors to assess a person for promotion of positions such as discipline, diligence and accuracy or expertise owned by an employee [5], [6] These factors can be managed by a system that can be helpful for the decision maker[7]–[9] Data processing using human labor is very vulnerable error[10]–[13], it can be happen because human capabilities are very limited. Reducing errors that may occur is very appropriate when using the computer[14] as a tool in data processing and presents the information necessary for various purposes[10], [15]–[18].Promotion in XYZ organization is still manual and requires implementation of information technology for data processing because an organization will be able to move quickly if the information obtained is also fast and accurate especially in making decisions [2], [19]–[27] Decision Support System (DSS) is one way that can be used for top management get recommendation promotion based on certain criteria, DSS with Fuzzy Tahani model method can help top management in making decision because this method is derived from artificial intelligence that do processing with factor certainty and uncertainty[8], [14], [28]–[31]. Fuzzy[30] database system is one of Fuzzy method that uses standard database. In standard databases, data are classified according to how the data is perceived by the user. Therefore in the standard data database is displayed will come out like the data has been stored. But in fact, if this happens, then should be used Fuzzy database system. Fuzzy database used here is the Tahani Fuzzy database system. This Tahani model still uses the standard relation, only this model uses Fuzzy set theory to get information.

2. Methodology

Decision is the activity of choosing a strategy or action in solving the problem[32]. The act of choosing a strategy or action that the manager believes will provide the best solution to something is called decision making. There are four phases in the decision making process[33], [34]:

a. Search (intelligence)

This stage is the process of searching and detection of the scope of problematic and the introduction of problems.

b. Design (design)

This stage is the process of discovering, developing, and analyzing alternatives that can be done. This stage is a process to understand the problem, find solutions and test the feasibility of the solution.

c. Choice (choice)

Selected among possible action alternatives, in this phase can be combined with search or matching algorithms such as KMP, Boyer-Moore, BFS and DFS[35]–[40]. The election results are then implemented in the decision-making process.

d. Implementation (implementation)

This stage is actually part of the election stage, this stage is the implementation of the decision taken.

Decision support system is an interactive information system that provides information, modeling and data manipulation. The system is used to assist decision making in semi-structured and unstructured situations, where no one knows exactly how decisions should be made. The DSS (Decision Support Systems) application has a component that is a subsystem of the DSS (Decision Support Systems) itself which consists of[34]:

a. Data management subsystem

The management data subsystem includes a database containing data that is for the situation and is managed by software called database management system (DBMS).

b. Model management subsystem

It is a software package that incorporates financial models, statistics, management sciences, or other quantitative models that provide the right analytical and management software capabilities.

c. Subsystem user interface

Users communicate with and govern DSS (Decision Support Systems) through this subsystem. The user is the considered part of the system. The researchers affirm that some of the unique contributions of DSS (Decision Support Systems) stem from intensive interaction between computers and decision makers. The Web browser provides a familiar and consistent graphical user interface structure for most DSS.

d. Knowledge-based management subsystem

This subsystem can support all other systems or act as an independent component. It provides intelligence to enlarge the knowledge of decision-making.

Research on fuzzy database have been found in journal and proceeding of publication result. One of fuzzy model is Tahani model[12]. The fuzzy Tahani model database still uses the standard relation, only this model uses fuzzy set theory to get information on its query. Most of the standard data bases are clarified based on how the data is perceived by users. Tahani model is composed of the following stages:

a. Describes Membership Function

The membership function is a curve showing the data entry point dot into its membership value having an interval between 0 and 1, one of which can be used to obtain membership value through a function approach. Some functions that can be used are Linear Curve Representation, Representation of Triangle Curve. Representation of the Trapezoidal Curve. Shoulder Shape Curve Representation, Representation of the S-Curve, Bell Curve Representation. Each of these functions, will produce values between 0 and 1 in different ways, according to the type of representation used.

b. Fuzzification

Fuzzification is the first phase of fuzzy calculation that is changing the firm value to the fuzzy value. The process is as follows: An analog quantity is entered as input (crisp input), then the input is inserted at the scope boundary of the membership function. Membership function is usually called membership input function. The output of this fuzzification process is a fuzzy input value or commonly called fuzzy input.

c. Query Fuzzification

Fuzzification Query is assumed to be a conventional (nonfuzzy) DBMS query that will try to create and implement a basic system of fuzzy query logic.

d. Zadeh Basic Operators for Fuzzy Setup Operations.

The membership value as of 2 fuzzy sets is known as Fire Strength or α-predicate. It is possible to use basic operators in the query process of AND and OR operators. α-predicate as a result of operation with the AND operator obtained by taking the smallest membership value between elements in the corresponding set, denoted: μA B = min (μA [x], μB [y]). As for the results of operations with the OR operator obtained by taking the largest membership value between elements in the corresponding set, denoted: μAUB = max (μA [x], μB [y]). The recommended alternative is an alternative that has a Fire Strength value or a level of conformity with the selection criteria above the number 0 (zero) to the number 1 (one).

3. Results and Discussion

Analysis of the promotion process aims to know the process of promotion in the company XYZ. The process of promotion in the company XYZ among others is the selection of employees through the criteria that will be applied to the database of the system to be designed that is fuzzy database model Tahani. The criteria used are as follows:

a. Age
b. Working Period
c. Ability
d. Discipline

In this study, the database used is Tahani database, the database structure used is the relational database structure. Fuzzy with model Tahani still using standard relation, only this model use fuzzy theory to get fuzzy on its query. Employee data used in the resolutions of this research as follows:

Table.1: Employee Data

ID	Name	Gender	Education	Discipline
E1	Alternative 1	Male	High School	55
E2	Alternative 2	Female	Undergraduate	65
E3	Alternative 3	Male	Diploma	60
E4	Alternative 4	Male	Diploma	70
E5	Alternative 5	Female	High School	65

The fuzzy set is specified for grouping data by language variables (linguistic variables) expressed in membership functions. Based on fuzzy variables above it can be determined fuzzy set for each variable as follows:

Table.2: Set on each variable

No	Variable	Set
1	Age	Young, Adult, Old
2	Working Period	New, Medium, Old
3	Disciplines	Less, Enough, Good
4	Skill	Low, Medium, High

Basically there is no specific provision in determining a membership function to be used in the fuzzification process, because each system can have different levels of conformity. In this study each fuzzy variable uses the membership function of the shoulders and triangle as an approach to obtain the degree of membership of each variable in a fuzzy set.

a. Age Membership Function

The variable of working period is divided into 3 fuzzy fruits: Young, Adult and Old. The Young and Old set uses a shoulder-shaped membership approach, while the Adult set uses a triangular membership function approach, here are the calculations.

$$\mu\text{Young}(w) = \begin{cases} 1; & w \le 30 \\ \dfrac{40-w}{10}; & 30 \le w \le 40 \\ 0; & w \ge 40 \end{cases}$$

$$\mu\text{Adult}(w) = \begin{cases} 0; & w \le 35 \text{ or } w \ge 50 \\ \dfrac{w-35}{10}; & 35 \le w \le 45 \\ \dfrac{50-w}{5}; & 45 \le w \le 50 \end{cases}$$

$$\mu\text{Old}(w) = \begin{cases} 0; & w \le 40 \\ \dfrac{w-40}{10}; & 40 \le w \le 50 \\ 1; & w \ge 50 \end{cases}$$

Table.3: Membership Degree of Age Variables

ID	Name	Age	Membership Degree (*w*)		
			Young	Adult	Old
E1	Alternative 1	37	0.3	0.2	0
E2	Alternative 2	33	0.7	0	0
E3	Alternative 3	39	0.1	0.4	0
E4	Alternative 4	27	1	0	0
E5	Alternative 5	28	1	0	0

b. Membership function Working period

Working variable is divided into 3 fuzzy sets: New, Medium, and Old. The New, Medium and Old set use the triangular membership function approach, here are the calculations.

$$\mu\text{New}(x) = \begin{cases} 0; & x \le 1, x \ge 20 \\ \dfrac{x-1}{10-1}; & 1 \le x \le 10 \\ \dfrac{20-x}{20-10}; & 10 \le x \ge 20 \end{cases}$$

$$\mu\text{Medium}(x) = \begin{cases} 0; & x \le 10, x \ge 40 \\ \dfrac{x-10}{20-10}; & 10 \le x \le 20 \\ \dfrac{40-x}{40-20}; & 20 \le x \ge 40 \end{cases}$$

$$\mu\text{Old}(x) = \begin{cases} 0; & x \le 20, x \ge 60 \\ \dfrac{x-20}{40-20}; & 20 \le x \le 40 \\ \dfrac{60-x}{60-40}; & 40 \le x \le 60 \end{cases}$$

Table.4: Membership Degree of Working Period

ID	Name	Period	Membership Degree (*w*)		
			New	Medium	Old
E1	Alternative 1	17	0.3	0.7	0
E2	Alternative 2	9	0.8	0	0
E3	Alternative 3	6	0.5	0	0
E4	Alternative 4	5	0.4	0	0
E5	Alternative 5	11	0.9	0.1	0

c. Function of Disciplinary Membership

The discipline variable is divided into 3 fuzzy sets: Less, Enough and Good. All sets use a triangular membership function approach, here is the calculation formula

$$\mu\text{Less}(y) = \begin{cases} 1; & y \le 25 \\ \dfrac{50-y}{25}; & 25 \le y \le 50 \\ 0; & y \ge 50 \end{cases}$$

$$\mu\text{Enough}(y) = \begin{cases} 0; & y \le 25 \text{ or } y \ge 50 \\ \dfrac{y-25}{25}; & 25 \le x \le 50 \\ \dfrac{75-y}{25}; & 50 \le x \ge 75 \end{cases}$$

$$\mu\text{Good}(y) = \begin{cases} 0; & y \le 50 \\ \dfrac{y-50}{50}; & 50 \le y \le 100 \\ 1; & y \ge 100 \end{cases}$$

Table.5: Membership Degree of Disciplinary

ID	Name	Discipline	Membership Degree (*w*)		
			Less	Enough	Good
E1	Alternative 1	55	0	0.8	0.1
E2	Alternative 2	65	0	0.4	0.3
E3	Alternative 3	60	0	0.6	0.2
E4	Alternative 4	70	0	0.2	0.4
E5	Alternative 5	65	0	0.4	0.3

d. Membership functionality skill

The class variables are divided into 3 fuzzy sets namely: Low, Medium and High. Set Low, Medium and high using a triangular-shaped membership function approach, here is the calculation formula.

$$\mu\text{Low}(z) = \begin{cases} 0; & z \le 3, z \ge 8 \\ \dfrac{z-1}{4-1}; & 1 \le z \le 4 \\ \dfrac{8-z}{8-4}; & 4 \le z \le 8 \end{cases}$$

$$\mu\text{Medium}(z) = \begin{cases} 0; & z \le 4, z \ge 12 \\ \dfrac{z-4}{8-4}; & 4 \le z \le 8 \\ \dfrac{12-z}{12-8}; & 8 \le z \le 12 \end{cases}$$

$$\mu\text{high}(z) = \begin{cases} 0; & z \le 8, z \ge 16 \\ \dfrac{z-8}{12-8}; & 8 \le z \le 12 \\ \dfrac{16-z}{16-12}; & 12 \le z \le 16 \end{cases}$$

Table.6: Membership Degree of Skill

ID	Name	Skill	Membership Degree (*w*)		
			Medium	Low	High
E1	Alternative 1	Medium	0	0.75	0.25
E2	Alternative 2	Medium	0	0.5	0.5
E3	Alternative 3	Low	0.75	0.25	0
E4	Alternative 4	High	0	0	1
E5	Alternative 5	High	0	0.25	0.75

To combine and modify the fuzzy set, there are some operations that are specifically defined. The membership value as a result of a 2-set operation is often known as fire strength or α-predicate. Actually there are 3 operators created by Zadeh, but in the application of decision support system of this promotion, the operator used is only Operator AND and Operator OR. Query Example

a. Search of Young Age Membership Degrees, New Working Period, High Class and Good Discipline.
b. Search Employee with Young Age with New Working Period or Employee of Young Age but already High Class.

Table.7: Query Result 1

ID	Name	Membership Degree (*w*)			
		Young Age	New Working Period	High Skill	Good Discipline
E1	Alternative 1	0.3	0.3	0.25	0.1
E2	Alternative 2	0.7	0.8	0.5	0.3
E3	Alternative 3	0.1	0.5	0	0.2
E4	Alternative 4	1	0.4	1	0.4
E5	Alternative 5	1	0.9	0.75	0.3

Table.8: Query Result 2

ID	Name	Membership Degree (*w*)		
		Young Age	New Working Period or High Skill	Young Age and New Working Period or High Skill
E1	Alternative 1	0.3	0.3	0.3
E2	Alternative 2	0.7	0.8	0.7
E3	Alternative 3	0.1	0.5	0.1
E4	Alternative 4	1	1	1
E5	Alternative 5	1	0.75	0.75

4. Conclusion

Based on the discussion drawn the conclusion that the process of promotion of positions running in the company XYZ which is still manual and takes a long time and with the use of decision support System using Fuzzy Model Tahani method on promotion can be a solution to provide recommendations in determining the appropriate employee for promotion efficiently.

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