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Research Paper

Technique for Order Preference by Similarity to Ideal Solution as Decision Support Method for Determining Employee Performance of Sales Section

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Abstract

Employees are the backbone of corporate activities and the giving of bonuses, job titles and allowances to employees to motivate the work of employees is very necessary, salesman on the company very much and to find the best salesman cannot be done manually and for that required the implementation of a system in this decision support system by applying the TOPSIS method, it is expected with the implementation of TOPSIS method the expected results of top management can be fulfilled.

Keywords: *Decision Support System, TOPSIS, Selection Sales*

1. Introduction

Selection is an activity of the company to select the right employees to occupy a particular position offered by management[1]–[3]. At the same time as a tool to eliminate or to not choose other employees who seek to occupy the position offered and tailored to a job within the organization or company [4], [5]. The selection process is a systematic process undertaken to ensure that those who are accepted are deemed most appropriate, either by established criteria or by the amount required[6]–[10]. Weak selection process implemented in the company will result in low morale, work discipline, and loyal attitude of employees in implementing the company's goals[11]–[13].

PT. XYZ is a company that acts as a distributor of Drug Products from several drug suppliers, limitations faced by PT. XYZ is choosing an accomplished salesman among those who deserve to get the achievement title for promotion and bonuses. To perform and simplify the selection process, then applied method of decision support system. One method of decision support system that can be applied is TOPSIS method that apply the concept of completion with Fuzzy Multi Criteria Decision Making[14], [15]. Fuzzy Multi Criteria Decision Making is a decision making process contained in the TOPSIS method considering several alternatives and criteria in a fuzzy situation[16]–[20].

2. Methodology

Basically Decision Support System (DSS) is a further development of computerized management information system designed in such a way that is interactive with the wearer[15], [21], [22]. This interactive nature is intended to facilitate the integration between the various components in the decision-making process such as procedures, policies, analytical techniques, and experience and managerial insight to establish a flexible decision framework[23], [24].

Decision Support System is a computer-based information system that generates various decision alternatives to assist management in handling various structured or unstructured problems using data and models [25]–[33]. Computer-based word is a keyword, because it is almost impossible to build a DSS without using a computer as a tool, especially for storing data and managing models. Here are the characteristics and capabilities of decision support systems obtained from various references[20], [34], [35]:

a. Decision Support System Characteristics
   1) Support all organizational activities
   2) Support multiple interacting decisions
   3) Can be used repeatedly and is constant
   4) There are two main components, namely data and models
   5) Use both external and internal data
   6) Have the ability of What-if Analysis and Goal Seeking Analysis
   7) Using some quantitative models
b. Decision Support System capabilities
   1) Supporting management decision making in handling problems semi structured and unstructured.
   2) Assist managers at various levels of management, ranging from upper management to lower level management.
   3) Supports group and individual decision making.
   4) Supports interdependent and consecutive decision-making.
   5) Supporting the stages of decision-making include intelligence, design, choice, and implementation.

6) Support the various forms of decision-making and decision-making processes.
7) Ability to adapt at any time and be flexible.
8) Ease of system interaction.
9) Improving effectiveness in decision-making rather than efficiency.
10) Easy to develop by expert users.
11) Modeling ability and decision-making analysis.
12) Ease of accessing various sources and data formats.

In addition to the various Characteristics and Abilities as noted above, DSS also has some limitations as follows:

a. There are some management abilities and human talents that cannot be modeled, so the models that exist in the system do not all reflect the real problem.
b. The ability of a DSS is limited to the knowledge that it possesses (basic knowledge and basic model).
c. The processes that can be performed by the DSS usually depend also on the software capabilities it uses.
d. DSS does not have the ability of intuition as it is owned by humans. Because no matter how sophisticated a DSS is, it's just a collection of hardware, software and operating systems not equipped with the ability to think.

The TOPSIS method is based on the concept that the best chosen alternative not only has the shortest distance from the ideal solution, but also has the longest distance from the ideal solution. This concept is widely used in some MADM models to solve practical decision problems[36], [37].

This is because the concept is simple and easy to understand, computing is efficient, and has the ability to measure the relative performance of decision alternatives in simple mathematical form. As for the steps in solving a Multi Attribute Decision Making (MADM) case with TOPSIS[38]:

a. Make a normalized decision matrix.
b. Make a decision matrix that is normally weighted.
c. Determine the matrix of positive ideal solutions and the matrix of the ideal solution.
d. Determine the distance between the value of each alternative with a matrix of positive ideal solutions and the ideal negative solution matrix.
e. Determine the preference value for each alternative. TOPSIS requires performance rating of each alternative Ai on loyal C_j normalized criteria.

3. Results and Discussion

The process of applying the Fuzzy Multi Criteria Decision Making method in performing alternative performance appraisal as follows:

a. Weighting Criteria

Determining the ranking of each alternative, then the first determination of the importance weight of each criterion (W_j). The determination of the importance weight of each criterion (W_j) is formed in Table 1 below.

Table.1: Criteria Weight Value (W_j)

Criteria	Weight Value
Data Sales	4
Absence	3
Number of Visits	2

b. Initial Data of each alternative

From the criterion data already started, the next step is to determine the match rating as Table 2 below:

Table.2: Alternative

Alternative	Criteria		
	C1	C2	C3
Alternative 1	3	2	3
Alternative 2	2	2	3
Alternative 3	4	1	3

After the initial data obtained from each alternative, then begins calculation of Fuzzy Multi Criteria Decision Making method by building a decision matrix. In the decision matrix, the matrix column expresses the attributes of the existing criteria, while the matrix line represents the alternative. The decision matrix refers to the alternative m that will be evaluated on the basis of n criteria. Decision matrix can be seen in table 3 that is:

Table.3: Decision Matrix

Alternative	Criteria		
	C1	C2	C3
Alternative 1	X_{11}	X_{12}	X_{13}
Alternative 2	X_{21}	X_{22}	X_{23}
Alternative 3	X_{31}	X_{32}	X_{33}

Next is to create a normalized R decision matrix whose function is to minimize the range of data, with the aim of making it possible to calculate Fuzzy Multi Criteria Decision Making.

Table.4: Matrix Normalized

	Criteria		
	C1	C2	C3
A1	$\frac{x_{11}}{\sqrt{x_{11}^2+x_{21}^2+x_{31}^2}}$	$\frac{x_{12}}{\sqrt{x_{12}^2+x_{22}^2+x_{32}^2}}$	$\frac{x_{13}}{\sqrt{x_{13}^2+x_{23}^2+x_{33}^2}}$
A2	$\frac{x_{21}}{\sqrt{x_{11}^2+x_{21}^2+x_{31}^2}}$	$\frac{x_{22}}{\sqrt{x_{12}^2+x_{22}^2+x_{32}^2}}$	$\frac{x_{23}}{\sqrt{x_{13}^2+x_{23}^2+x_{33}^2}}$
A3	$\frac{x_{31}}{\sqrt{x_{11}^2+x_{21}^2+x_{31}^2}}$	$\frac{x_{32}}{\sqrt{x_{12}^2+x_{22}^2+x_{32}^2}}$	$\frac{x_{33}}{\sqrt{x_{13}^2+x_{23}^2+x_{33}^2}}$

So the result of normalized matrix is seen in the following calculation:

A1 (Criteria 1)

$$\frac{3}{\sqrt{3^2+2^2+4^2}}$$
$$\frac{3}{\sqrt{9+4+16}}$$
$$\frac{3}{\sqrt{29}}$$
$$\frac{3}{5.385}$$
$$\mathbf{0.56}$$

(Criteria 2)

$$\frac{2}{\sqrt{2^2+2^2+1^2}}$$
$$\frac{2}{\sqrt{4+4+1}}$$
$$\frac{2}{\sqrt{9}}$$
$$\frac{2}{3}$$
$$\mathbf{0.67}$$

(Criteria 3)

$$\frac{3}{\sqrt{3^2+3^2+3^2}}$$
$$\frac{3}{\sqrt{9+9+9}}$$
$$\frac{3}{\sqrt{27}}$$
$$\frac{3}{5.196}$$
$$\mathbf{0.58}$$

A2 (Criteria 1)

$$\frac{2}{\sqrt{3^2+2^2+4^2}}$$
$$\frac{2}{\sqrt{9+4+16}}$$
$$\frac{2}{\sqrt{29}}$$

$$\frac{2}{5.385}$$
$$\mathbf{0.37}$$

(Criteria 2)
$$\frac{2}{\sqrt{2^2 + 2^2 + 1^2}}$$
$$\frac{2}{\sqrt{4+4+1}}$$
$$\frac{2}{\sqrt{9}}$$
$$\frac{2}{3}$$
$$\mathbf{0.67}$$

(Criteria 3)
$$\frac{3}{\sqrt{3^2 + 3^2 + 3^2}}$$
$$\frac{3}{\sqrt{9+9+9}}$$
$$\frac{3}{\sqrt{27}}$$
$$\frac{3}{5.196}$$
$$\mathbf{0.58}$$

A3 (Criteria 1)
$$\frac{4}{\sqrt{3^2 + 2^2 + 4^2}}$$
$$\frac{4}{\sqrt{9+4+16}}$$
$$\frac{4}{\sqrt{29}}$$
$$\frac{4}{5.385}$$
$$\mathbf{0.74}$$

A3 (Criteria 2)
$$\frac{1}{\sqrt{2^2 + 2^2 + 1^2}}$$
$$\frac{1}{\sqrt{4+4+1}}$$
$$\frac{1}{\sqrt{9}}$$
$$\frac{1}{3}$$
$$\mathbf{0.33}$$

(Criteria 3)
$$\frac{3}{\sqrt{3^2 + 3^2 + 3^2}}$$
$$\frac{3}{\sqrt{9+9+9}}$$
$$\frac{3}{\sqrt{27}}$$
$$\frac{3}{5.196}$$
$$\mathbf{0.58}$$

After the decision matrix has normalized the next step is to create a weighted normalized matrix V whose elements are determined by the formula:

Table.5: Weight Matrix Normalized

No	Alternative	Criteria		
1	A1	$4 * 0.56$	$3 * 0.67$	$2 * 0.58$
2	A2	$4 * 0.37$	$3 * 0.67$	$2 * 0.58$
3	A3	$4 * 0.74$	$3 * 0.33$	$2 * 0.58$

So the results of calculations on weighted normalized matrices can be seen in table 6.

Table.6: Results of normalized Matrices are weighted

No	Alternative	Criteria		
1	A1	2.23	2.00	1.15
2	A2	1.49	2.00	1.15
3	A3	2.97	1.00	1.15

After performing the above stages then the next stage determines the ideal positive solution matrix (A +) and the ideal solution (A-). The A + value is derived from the highest value of each criterion while the A-value is derived from the lowest value. The second criterion, there are 3 values that are 2.23, 1.49 and 2.97, then the highest value is 2.97 while the lowest value is 1.49, means for the second criterion, A + = 2.97 and A- = 1.49.

The distance of the positive ideal solution is the total distance difference between each normalized weighted matrix value with its maximum value while the ideal negative solution distance is the total distance difference between each weighted normalized matrix with its minimum value. Then obtained the value of S + and S- of each alternative as follows:

A^+1
$$\sqrt{(v_{11} - v_1^+)^2 + (v_{12} - v_2^+)^2 + (v_{13} - v_3^+)^2}$$
$$\sqrt{(2.23 - 2.97)^2 + (2-2)^2 + (1.15 - 1.15)^2}$$
$$\sqrt{(-0.74)^2 + 0^2 + (0)^2}$$
$$\sqrt{0.5476 + 0 + 0}$$
$$\sqrt{0.5476}$$

A^-1
$$0.74$$
$$\sqrt{(v_{11} - v_1^-)^2 + (v_{12} - v_2^-)^2 + (v_{13} - v_3^-)^2}$$
$$\sqrt{(2.23 - 1.49)^2 + (2-1)^2 + (1.15 - 1.15)^2}$$
$$\sqrt{(0.74)^2 + 1^2 + (0)^2}$$
$$\sqrt{0.5476 + 1 + 0}$$
$$\sqrt{1.5476}$$
$$=1{,}24$$

A^+2
$$\sqrt{(v_{21} - v_1^+)^2 + (v_{22} - v_2^+)^2 + (v_{23} - v_3^+)^2}$$
$$\sqrt{(1.49 - 2.97)^2 + (2-2)^2 + (1.15 - 1.15)^2}$$
$$\sqrt{(-1.48)^2 + 0^2 + (0)^2}$$
$$\sqrt{2{,}1904 + 0 + 0}$$
$$\sqrt{2{,}1904}$$
$$=1.48$$

A^-2
$$\sqrt{(v_{21} - v_1^-)^2 + (v_{22} - v_2^-)^2 + (v_{23} - v_3^-)^2}$$
$$\sqrt{(1.49 - 1.49)^2 + (2-1)^2 + (1.15 - 1.15)^2}$$
$$\sqrt{(0)^2 + 1^2 + (0)^2}$$

$$\sqrt{0+1+0}$$

$$\sqrt{1}$$

$$=1$$

A+3 $$\sqrt{(v_{31}-v_1^+)^2+(v_{32}-v_2^+)^2+(v_{33}-v_3^+)^2}$$

$$\sqrt{(2.97-2.97)^2+(1-2)^2+(1.15-1.15)^2}$$

$$\sqrt{(0)^2+(-1)^2+(0)^2}$$

$$\sqrt{0+1+0}$$

$$\sqrt{1}$$

$$=1$$

A-3 $$\sqrt{(v_{31}-v_1^-)^2+(v_{32}-v_2^-)^2+(v_{33}-v_3^-)^2}$$

$$\sqrt{(2.97-1.49)^2+(1-1)^2+(1.15-1.15)^2}$$

$$\sqrt{(1.48)^2+(0)^2+(0)^2}$$

$$\sqrt{2.1904+0+0}$$

$$\sqrt{2.1904}$$

$$=1{,}48$$

After calculating S + and S- then the next step is calculating the proximity relative to the ideal solution (C), so the result of the C value of each alternative can be calculated as follows:

A1 $$C_{1=\frac{1.24}{1.24+0.74}}$$

$$1=\frac{1.24}{1.98}$$

$$=0.63$$

A2 $$C_{2=\frac{1}{1+1.48}}$$

$$2=\frac{1}{2.48}$$

$$=0.40$$

A3 $$C_{3=\frac{1.48}{1.48+1}}$$

$$3=\frac{1.48}{2.48}$$

$$=0.60$$

So at the value of each alternative can be sorted to know which alternative is best.

4. Conclusion

The application of TOPSIS method to determine the best salesman can run well, positive and negative ideal concept can give comparison between each alternative of each criterion, this research is far from good and the results obtained also only based on one method only and for further development can be combined or compared with other methods to obtain varying results

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