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Training and Development Need Ranking of a Hotel Manager using Fuzzy Technique for Order Preference by Similarity to Ideal Solution

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Abstract

Regular training and development programs are necessary to learn or improve skills and knowledge of the employees, as it has long term positive effect on the prosperity or success of the organization. For this, organization searches out the employees to whom training may be given as per their need. As every organization has different needs, various criteria and alternatives are determined by the group of decision makers. In this paper, multi-criteria group decision making model is considered, where various training and development needs of a hotel manager have been identified by group of decision makers and ranked with simplified fuzzy technique for order preference by similarity to ideal solution (Fuzzy TOPSIS) method. Results are reported with application on the basis of closeness coefficient using triangular and trapezoidal fuzzy number. Results showed that the ranking by Fuzzy TOPSIS is same, by using triangular and trapezoidal fuzzy number and can be successfully used to rank the appropriate training and development need required by the manager of hotel.

Keywords: Training and development need; Ranking; Fuzzy TOPSIS; Manager; Hotel

MSC: 90B50, 90C29

1. Introduction

The performance of any organization depends on the employees working in it. Due to fierce competition, every organization is working hard to gain the competitive advantage. The success of the organization depends on the quality, ability, knowledge or skills of the employees (Matin et al. (2011)). This gives rise to a need of creating skillful human resources who will contribute in achieving this goal. Therefore, training and development of the employees becomes crucial in honing the skills of the employees. It is a challenging job to train the employees. The ultimate responsibility comes under the shoulder of managers of the organization, because manager is the person who carries out training and development programs. Before manager conducts these programs, he or she should get trained first.

Now days, hotel industry is evolving with a growth of new trends due to need of an hour. The focus of this industry is customers and their satisfaction. Hotels have to be flexible, where they have to give best services to the customers with latest trends. It is a tough job for them to satisfy the customers and to retain them in order to have returns on long term. In order to perform this challenging job, a compatible manager is required. Thus, manager needs to undergo few special training and development programs. Depending on the skills required by the manager, there are many training programs such as trainings related to decision making, communication, interpersonal relationship or quality management.

In this paper, the work of Kore et al. (2017) on FTOPSIS for multi-criteria group decision making scenario with triangular fuzzy number is modified. The FTOPSIS is modified by using trapezoidal fuzzy number and triangular fuzzy number with its application to the ranking of training and development need of the hotel manager by identifying four different criteria and four different alternatives under the guidance of group of decision makers. The technique is then applied to get the solution for both trapezoidal fuzzy number and triangular fuzzy number with their comparison.

Many researchers have worked on the FTOPSIS. The use of crisp data is not suitable when vagueness of the information is involved. Therefore, Chen (2000) extended TOPSIS method in fuzzy environment, where closeness coefficient for ranking the alternatives and vertex method for calculating distance between two triangular fuzzy numbers was described with example. Vagueness and subjectivity was managed under the fuzzy environment by TOPSIS in order to choose optimal initial training aircraft with real case study (Wang et al. (2007)).A fuzzy multi-criteria decision making was applied to evaluate the instructor's performance in universities. For this purpose, fuzzy set theory was used with analytic hierarchy process for getting criteria weight and finally ranking was done with TOPSIS technique (Ahmadi et al. (2009)). The alternative strategies of SWOT analysis are assessed with respect to criteria and importance weights using linguistic variables under fuzzy environment and most preferable strategy among all given strategies is chosen with technique for order preference by similarity to ideal solution technique in (Hatami-Marbini and Saati (2009)).

A fuzzy TOPSIS multiple attribute decision making for scholarship selection was introduced, where fuzzy TOPSIS and weighted product methods are discussed in order to select candidate for academic and non-academic scholarships (Uyun and Riadi (2011)). Matin et al. (2011) designed multi-criteria decision making model, where they applied fuzzy TOPSIS technique in order to select appropriate person for Padir company of Iran. A fuzzy multi-criteria decision making approach was used for a real warehouse location selection problem in a big company of Iran, wherein fuzzy TOPSIS technique was successfully applied (Ashrafzadeh et al. (2012)).

Kabir and Hasin (2012) illustrated comparative analysis between technique for order preference by similarity to ideal solution technique and fuzzy technique for order preference by similarity to ideal solution technique through practical application, which proved to be suitable for solving evaluation problem of travel website service quality. Paslari et al. (2014) assessed the quality performance of training classes and TOPSIS method was used to rank the classes with a comparison between them. An insight on the effectiveness of training and development in hotel industry is given in (Nischithaa and Rao (2014)) which explored the training needs of employees of hotel industry.

A fuzzy project network is subjected to identify the critical path with TOPSIS method along with trapezoidal fuzzy numbers. A new fuzzy distance measure is also proposed to select critical path with linguistic trapezoidal fuzzy numbers as activity times (Saradhi and Shankar (2015)). The hybrid method of Fuzzy AHP-TOPSIS was applied to select human resource manager in a prominent telecommunication company of Indonesia (Kusumawardani and Agintiara (2015)).

When uncertainties occur in ten different directions, the use of triangular or trapezoidal numbers will not be suitable. Therefore, decagonal fuzzy numbers with their arithmetic operations and vertex method for calculating the distance between these numbers was discussed by Arockiaraj and Sivasankari (2016). Various criteria were decided by the decision makers, in order to evaluate three yarn suppliers to identify the best one with the application of fuzzy TOPSIS method (Kargi (2016)).

The performance of hospital managers was assessed under various dimensions such as functional, professional, organizational, individual, and human with the help of fuzzy analytic hierarchy process and fuzzy technique for order preference by similarity to ideal solution (Shafii (2016)). The evaluation of TOPSIS and fuzzy TOPSIS is explored in the group decision making model by Dharmarajan and Mary (2016). A methodology of new distance measure in fuzzy TOPSIS by considering supply chain strategy in manufacturing organization is described for the evaluation of suppliers based on the balanced scorecard framework (Saradhi (2016)). The identification and evaluation of the factors that affect the safety conditions at construction sites was done using fuzzy TOPSIS. The method of AHP was applied to determine the weights of the criteria and fuzzy TOPSIS technique was applied to rank four companies for their safety performance (Basahel and Taylan (2016)).

The paper is organized into various sections. Section 1 is introductory in nature with review of literature. In section 2, some basic definitions related to the topic are given along with fuzzy TOPSIS method. Section 3 addresses the application of fuzzy TOPSIS which is followed by results and discussion. Next, section 5 presents conclusion including the scope for further study.

2. Some Basic Definitions and Fuzzy TOPSIS Method

In this section, we provide some of the basic definitions and fuzzy TOPSIS method.

2.1. Fuzzy Sets

In order to understand fuzzy TOPSIS, it is required to understand the fuzzy sets and fuzzy numbers. The concept of fuzzy sets was introduced by Zadeh (1965) for dealing with the problem, where ambiguity, uncertainty or vagueness of human thought is involved. Fuzzy sets and fuzzy logic are powerful mathematical tools that help to represent vague data in any area. Some basic definitions used in this paper are given as follows:

Definition 2.1.

A fuzzy set $\tilde{A}$ in the universe of discourse X is characterized by the membership function $\mu_{\tilde{A}}(x)$ that associates each element x in X to a real number in the interval [0, 1]. The value $\mu_{\tilde{A}}(x)$ represents grade of membership of x in $\tilde{A}$. The nearer the value of $\mu_{\tilde{A}}(x)$ to unity, the higher the grade of membership of x in $\tilde{A}$.

Definition 2.2.

A linguistic variable is a variable whose value is not a crisp number, but a word or sentence in natural language.

Definition 2.3.

A trapezoidal fuzzy number $\tilde{A}$ can be defined as (a,b,c,d) and the membership function is defined as

$$\mu_{\tilde{A}}(x) = \begin{cases} \dfrac{x-a}{b-a} & if\ a \le x \le b, \\ 1 & if\ b \le x \le c, \\ \dfrac{d-x}{d-c} & if\ c \le x \le d, \\ 0 & otherwise. \end{cases} \tag{1}$$

It can also be represented in Figure 1.

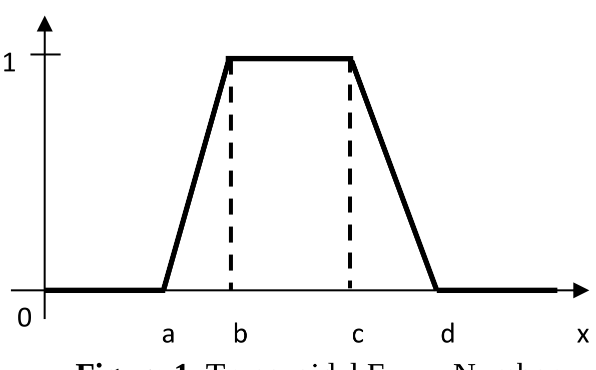

Figure 1. Trapezoidal Fuzzy Number

Definition 2.4.

A fuzzy number $\tilde{A} = (a_1, a_2, a_3)$ is said to be triangular fuzzy number or linear fuzzy number, if its membership function is given by equation (2) as follows:

$$\mu_{\tilde{A}}(x) = \begin{cases} \dfrac{x - a_1}{a_2 - a_1} & if \quad a_1 \le x \le a_2, \\ 1 & if \quad x = a_2, \\ \dfrac{a_3 - x}{a_3 - a_2} & if \quad a_2 \le x \le a_3, \\ 0 & otherwise. \end{cases} \qquad (2)$$

Definition 2.5.

Let $\tilde{A} = (a_1, a_2, a_3, a_4)$ and $\tilde{B} = (b_1, b_2, b_3, b_4)$ be two trapezoidal fuzzy numbers. Then, the vertex method can be defined to calculate the distance between these two numbers as follows:

$$d(\tilde{A}, \tilde{B}) = \sqrt{\frac{1}{4}[(a_1 - b_1)^2 + (a_2 - b_2)^2 + (a_3 - b_3)^2 + (a_4 - b_4)^2]}\,. \qquad (3)$$

For triangular fuzzy numbers of $\tilde{A} = (a_1, a_2, a_3)$ and $\tilde{B} = (b_1, b_2, b_3)$, the vertex method can be defined as follows:

$$d(\tilde{A}, \tilde{B}) = \sqrt{\frac{1}{3}[(a_1 - b_1)^2 + (a_2 - b_2)^2 + (a_3 - b_3)^2]}\,. \qquad (4)$$

2.2. Fuzzy TOPSIS Method

In this paper, Fuzzy Technique for Order Preference by Similarity to Ideal Solution (FTOPSIS) method is used to rank the training and development need of a hotel manager. The method is suitable for solving group decision making problem under fuzzy environment. There are several optimization methods to solve decision making problems, but when similar options are available to take decision, it is important to analyze several factors and alternatives under similar category. Therefore, Fuzzy TOPSIS method can be used to evaluate multiple alternatives against the selected criteria (Kore et al. (2017)). This method is based on the concept that the selected alternative is closest to the fuzzy positive ideal solution and farthest from the fuzzy negative ideal solution.

Suppose that D_k represents members of decision group. Let X_j be the set of n criteria and Y_i be the set of m alternatives. Various steps of Fuzzy TOPSIS are given as follows:

Step 1: Determine the trapezoidal fuzzy numbers for rating the criteria and alternatives.

Step 2: Determine the importance weights of various criteria. Ratings of the criteria are considered as linguistic variables.

Step 3: Construct the fuzzy decision matrix and select suitable linguistic variables for the alternatives against each of the criteria. A fuzzy multi criteria group decision making problem can be written in matrix form as follows:

$$\tilde{M} = \begin{matrix} & Y_1 & Y_2 & \ldots\ldots & Y_m \\ X_1 & x_{11} & x_{12} & \ldots\ldots & x_{1m} \\ X_2 & x_{21} & x_{22} & \ldots\ldots & x_{2m} \\ \ldots & \ldots\ldots & \ldots & \ldots\ldots & \ldots \\ X_n & x_{n1} & x_{n2} & \ldots\ldots & x_{nm} \end{matrix} . \quad (5)$$

Step 4: Compute the aggregate fuzzy ratings for criteria and alternatives. Suppose, fuzzy rating given by all decision makers is trapezoidal fuzzy number $\tilde{x}_{ijk} = (a_{ijk}, b_{ijk}, c_{ijk}, d_{ijk})$, i=1, 2, ..., m, j=1, 2, …, n, then the aggregated fuzzy rating of the alternative is $\tilde{x}_{ij} = (a_{ij}, b_{ij}, c_{ij}, d_{ij})$, where

$$a_{ij} = \min_k \{a_{ijk}\}, \quad b_{ij} = \frac{1}{K}\sum_{k=1}^{K} b_{ijk}, \quad c_{ij} = \frac{1}{K}\sum_{k=1}^{K} c_{ijk}, \quad d_{ij} = \max_k \{d_{ijk}\}. \quad (6)$$

Similarly, aggregated fuzzy weights of each criteria is given as $\tilde{w}_j = (w_{j1}, w_{j2}, w_{j3}, w_{j4})$,

where

$$w_{j1} = \min_k \{w_{jk1}\}, \quad w_{j2} = \frac{1}{K}\sum_{k=1}^{K} w_{jk2}, \quad w_{j3} = \frac{1}{K}\sum_{k=1}^{K} w_{jk3}, \quad w_{j4} = \max_k \{w_{jk4}\}. \quad (7)$$

Step 5: Normalized the aggregated fuzzy decision matrix for the alternatives, as some criteria are benefit criteria and some are cost criteria. The normalized aggregated fuzzy decision matrix is written as,

$$\tilde{N} = [\tilde{z}_{ij}]_{m\times n} \quad , i=1, 2, \ldots, m, j=1, 2, \ldots, n, \quad (8)$$

where

$$\tilde{z}_{ij} = \left(\frac{a_{ij}}{d_j^*}, \frac{b_{ij}}{d_j^*}, \frac{c_{ij}}{d_j^*}, \frac{d_{ij}}{d_j^*} \right) \text{ and } d_j^* = \max_i d_{ij} \text{ (Benefit criteria)}, \quad (9)$$

$$\tilde{z}_{ij} = \left(\frac{\bar{a}_j}{d_{ij}}, \frac{\bar{a}_j}{c_{ij}}, \frac{\bar{a}_j}{b_{ij}}, \frac{\bar{a}_j}{a_{ij}} \right) \text{ and } \bar{a}_j = \min_i a_{ij} \text{ (Cost criteria)}. \quad (10)$$

Step 6: Calculate weighted normalized fuzzy decision matrix $\tilde{S}$ by multiplying weights $\tilde{w}_j$ with normalized fuzzy decision matrix as follows:

$$\tilde{S} = [\tilde{s}_{ij}]_{m \times n} \ , \ i=1, 2, ..., m, j=1, 2, ..., n,$$

where

$$\tilde{s}_{ij} = \tilde{z}_{ij} \times \tilde{w}_j . \tag{11}$$

Step 7: Find Fuzzy Positive Ideal Solution (FPIS) and Fuzzy Negative Ideal Solution (FNIS) as follows:

$$F^+ = [\tilde{s}_1^*, \tilde{s}_2^*, ..., \tilde{s}_n^*], \quad \text{where } \tilde{s}_j^* = \max_i \{s_{ij4}\}, \ i=1, 2, ..., m, j=1, 2, ..., n, \tag{12}$$

$$F^- = [\tilde{s}_1^-, \tilde{s}_2^-, ..., \tilde{s}_n^-], \quad \text{where } \tilde{s}_j^- = \min_i \{s_{ij1}\}, \ i=1, 2, ..., m, j=1, 2, ..., n. \tag{13}$$

Step 8: Compute the distance of each alternative from FPIS and FNIS as,

$$d_i^* = \sum_{j=1}^{n} d(\tilde{s}_{ij}, s_j^*), \ i=1, 2, ..., m, \tag{14}$$

$$d_i^- = \sum_{j=1}^{n} d(\tilde{s}_{ij}, s_j^-), \ i=1, 2, ..., m, \tag{15}$$

where $d(\tilde{s}_{ij}, s_j^*)$ and $d(\tilde{s}_{ij}, s_j^-)$ are the distances between two fuzzy numbers which are calculated using equation (3) and (4).

Step 9: After calculating the distances to the fuzzy positive ideal solution and fuzzy negative ideal solution, the closeness coefficient CC_i are calculated for each alternative. From CC_i values, ranking of the alternatives can be decided. It is calculated as,

$$CC_i = \frac{d_i^-}{d_i^+ + d_i^-}, \ i=1, 2, ..., m. \tag{16}$$

Step 10: In the final stage, rank the alternatives according to the value of closeness coefficient in the decreasing order. Best alternative will have highest value of CC_i and will be closest to the FPIS and farthest from FNIS.

3. Application

For promoting the performance of organization and for improving quality of services, manager of organization plays important role. In order to achieve the vision determined by the policy makers of organization, some skills and knowledge must be possessed by the manager. For better performance of the given assignments and for creating a potential for performing future assignments as per the need of the competition, training and development of the manager becomes crucial (Nischithaa and Rao (2014)). Depending on the knowledge require, various skill training needs should be imparted. Which type of trainings should be given or which training is important for particular knowledge, is a problem of multi-criteria decision making (MCDM) model which involves human judgment. Human judgment is characterized by vagueness, ambiguity or uncertain information. Also, there are various optimization techniques to solve the MCDM problems, but when decision is based on similar options; it becomes necessary to evaluate various factors, alternatives under the similar category. Therefore, technique for order preference by similarity to ideal solution under fuzzy environment is used for systematic evaluation that can help to evaluate and rank various training and development needs by minimizing vagueness.

In this paper, work of Kore et al. (2017) is modified by making use of trapezoidal fuzzy numbers and triangular fuzzy numbers for ranking training and development needs of a hotel manager against the various criteria chosen by the group of decision makers. Depending on the knowledge required, various criteria have been decided by the two decision makers namely (D_1) and (D_2) from one of the hotels. These criteria are management knowledge (X_1), customer relationship management knowledge (X_2), financial knowledge (X_3) and marketing knowledge (X_4). We have a set of four skills training required by the manager. These skill trainings represent four alternatives namely, communication (Y_1), interpersonal relationship (Y_2), decision making (Y_3), quality control management (Y_4). Using fuzzy TOPSIS methodology mentioned above, these alternatives will be ranked in following steps:

Step 1: Determination of trapezoidal fuzzy numbers for criteria and alternatives

For this, a scale of 1-9 is used and intervals are so chosen to have uniform representation of triangular fuzzy numbers for the linguistic variables.

Table 1: Trapezoidal Fuzzy Ratings for Linguistic Variables

Trapezoidal Fuzzy Number	Linguistic variables for Alternatives	Linguistic variables for Criteria
(1,1,2,3)	Very Poor(VP)	Very Low(VL)
(1,2,4,5)	Poor(P)	Low(L)
(3,4,6,7)	Average(A)	Medium(M)
(5,6,8,9)	Good(G)	High(H)
(7,8,9,9)	Very Good(VG)	Very High(VH)

Step 2: Deciding the weights of the criteria

Now, the weights given to the criteria by decision makers are given in table 2.

Table 2: Criteria Weightage by Decision Makers

Criteria	D_1	D_2
X_1	VH	H
X_2	VH	H
X_3	M	L
X_4	H	H

Step 3: Determining the ratings of the alternatives

Ratings given by the decision makers to the alternatives against each of the criteria are given in table 3.

Table 3: Alternative Ratings by Decision Makers

Criteria	Y_1		Y_2		Y_3		Y_4	
	D_1	D_2	D_1	D_2	D_1	D_2	D_1	D_2
X_1	G	G	G	G	VG	VG	A	A
X_2	G	G	VG	G	G	A	VG	G
X_3	P	A	P	VP	VG	G	P	A
X_4	G	A	G	G	G	A	G	G

Step 4: Construct fuzzy decision matrix by applying fuzzy numbers

A matrix is constructed by applying fuzzy numbers to the alternative ratings and criteria ratings using table 1, table 2 and table 3.

Table 4: Alternative Rating using Trapezoidal Fuzzy Numbers

Crit-eria	Y_1		Y_2		Y_3		Y_4	
	D_1	D_2	D_1	D_2	D_1	D_2	D_1	D_2
X_1	(5,6,8,9)	(5,6,8,9)	(5,6,8,9)	(5,6,8,9)	(7,8,9,9)	(7,8,9,9)	(3,4,6,7)	(3,4,6,7)
X_2	(5,6,8,9)	(5,6,8,9)	(7,8,9,9)	(5,6,8,9)	(5,6,8,9)	(3,4,6,7)	(7,8,9,9)	(5,6,8,9)
X_3	(1,2,4,5)	(3,4,6,7)	(1,2,4,5)	(1,1,2,3)	(7,8,9,9)	(5,6,8,9)	(1,2,4,5)	(3,4,6,7)
X_4	(5,6,8,9)	(3,4,6,7)	(5,6,8,9)	(5,6,8,9)	(5,6,8,9)	(3,4,6,7)	(5,6,8,9)	(5,6,8,9)

Table 5: Criteria Weightage using Trapezoidal Fuzzy Numbers

Criteria	D_1	D_2
X_1	(7,8,9,9)	(5,6,8,9)
X_2	(7,8,9,9)	(5,6,8,9)
X_3	(3,4,6,7)	(1,2,4,5)
X_4	(5,6,8,9)	(5,6,8,9)

Step 5: Constructing aggregated fuzzy decision matrix for alternative and criteria

An aggregated fuzzy decision matrix is formed for alternative and criteria using equations (6) and (7) respectively. From equation (6) and table 4, we write table 6, which represents aggregated fuzzy decision matrix for alternative.

Table 6: Aggregated Fuzzy Decision Matrix for Alternative

Criteria	Y_1	Y_2	Y_3	Y_4
X_1	(5,6,8,9)	(5,6,8,9)	(7,8,9,9)	(3,4,6,7)
X_2	(5,6,8,9)	(5,7,8.5,9)	(3,5,7,9)	(5,7,8.5,9)
X_3	(1,3,5,7)	(1,1.5,3,5)	(5,7,8.5,9)	(1,3,5,7)
X_4	(3,5,7,9)	(5,6,8,9)	(3,5,7,9)	(5,6,8,9)

Similarly, using equation (7) and table 5, aggregated fuzzy decision matrix for criteria weightage is given in table 7.

Table 7: Aggregated Fuzzy Decision Matrix for Criteria Weightage

Criteria	Aggregated Weightage
X_1	(5,7,8.5,9)
X_2	(5,7,8.5,9)
X_3	(1,3,5,7)
X_4	(5,6,8,9)

Step 6: Process of Normalizing

Using equation (9) and table 6, the aggregated fuzzy decision matrix for alternative is normalized in table 8.

Table 8: Normalized Aggregated Fuzzy Decision Matrix for Alternative

Criteria	Y_1	Y_2	Y_3	Y_4
X_1	(0.556,0.667, 0.889,1)	(0.556,0.667, 0.889,1)	(0.778,0.889, 1,1)	(0.429,0.571, 0.857,1)
X_2	(0.556,0.667, 0.889,1)	(0.556,0.778,0. 944,1)	(0.333,0.556,0. 778,1)	(0.556,0.778, 0.944,1)
X_3	(0.143,0.429, 0.714,1)	(0.2,0.3,0.6, 1)	(0.556,0.778,0. 944,1)	(0.143,0.429, 0.714,1)
X_4	(0.333,0.556, 0.778,1)	(0.556,0.667, 0.889,1)	(0.333,0.556,0. 778,1)	(0.556,0.667, 0.889,1)

Step 7: Construction of weighted normalized fuzzy decision matrix

Using table 7, table 8 and equation (11), the weighted normalized fuzzy decision matrix is calculated in table 9.

Table 9: Weighted Normalized Aggregated Fuzzy Decision Matrix

Criteria	Y_1	Y_2	Y_3	Y_4
X_1	(2.78,4.669, 7.557,9)	(2.78,4.669, 7.557,9)	(3.89,6.223, 8.5,9)	(2.145,3.997, 7.285,9)
X_2	(2.78,4.669, 7.557,9)	(2.78,5.446, 8.024,9)	(1.665,3.892, 6.613,9)	(2.78,5.446, 8.024,9)
X_3	(0.143,1.287, 3.57,7)	(0.2,0.9,3,7)	(0.556,2.334, 4.72,7)	(0.143,1.287, 3.57,7)
X_4	(1.665,3.336, 6.224,9)	(2.78,4.002, 7.112,9)	(1.665,3.336, 6.224,9)	(2.78,4.002, 7.112,9)

Step 8: Calculation of FPIS and FNIS

Here, fuzzy positive ideal solution F^+ and fuzzy negative ideal solution F^- are calculated using equation (12) and (13) respectively.

$$F^+ = [\tilde{s}_1^*(9,9,9,9), \tilde{s}_2^*(9,9,9,9), \tilde{s}_3^*(7,7,7,7), \tilde{s}_4^*(9,9,9,9)]. \tag{15}$$

$$\begin{aligned} F^- = [&\tilde{s}_1^-(2.145,2.145,2.145,2.145), \tilde{s}_2^-(1.665,1.665,1.665,1.665), \\ &\tilde{s}_3^-(0.143,0.143,0.143,0.143), \tilde{s}_4^-(1.665,1.665,1.665,1.665,)] \end{aligned}. \tag{16}$$

Step 9: Computation of distance of each alternative from FPIS and FNIS

The distance of each alternative from fuzzy positive ideal solution and fuzzy negative ideal solution is calculated in table 10 with the help of equations (15) and (16) and using vertex method given in equation (3).

Table 10: Distance of Each Alternative from FPIS and FNIS

Criteria	$d_1^*(F^+)$	$d_1^-(F^-)$	$d_2^*(F^+)$	$d_2^-(F^-)$	$d_3^*(F^+)$	$d_3^-(F^-)$	$d_4^*(F^+)$	$d_4^-(F^-)$
X_1	3.858	4.577	3.858	4.577	2.919	5.173	4.329	4.383
X_2	3.858	4.970	3.615	5.239	4.626	4.562	3.615	5.239
X_3	4.781	3.875	4.986	3.734	4.138	4.270	4.781	3.875
X_4	4.837	4.398	4.100	4.748	4.837	4.398	4.100	4.748
	d_1^* =17.334	d_1^- =17.82	d_2^* =16.559	d_2^- =18.298	d_3^* =16.52	d_3^- =18.403	d_4^* =16.825	d_4^- =18.245

Step 10: Computation of Closeness Coefficient CC_i

Using equation (16), the closeness coefficient of each alternative is calculated in table 11.

Table 11: Closeness Coefficient for Each Alternative

Closeness Coefficient (CC_i)	**Value by Trapezoidal Fuzzy Number**	**Value by Triangular Fuzzy Number**
CC_1	0.507	0.511
CC_2	0.525	0.527
CC_3	**0.527**	**0.530**
CC_4	0.520	0.523

Step 11: Ranking of the alternatives

In the last step, we rank the alternatives as per the value of closeness coefficient. From table 10, we observed that, using both triangular and trapezoidal fuzzy number, the alternative 3 is ranked as 1 as it has the highest closeness coefficient value, then alternatives 2, 4, 1 are ranked as 2, 3, 4 respectively.

4. Results and Discussion

In (Kore et al. (2017)), simplified FTOPSIS is proposed for ranking two alternatives against four criteria using triangular fuzzy number. This work is modified in this paper by applying the technique in order to identify and rank training and development needs of hotel manager with trapezoidal fuzzy numbers and triangular fuzzy number. Here, four alternatives are assessed and ranked against mentioned four criteria determined by the decision makers group. Under this, a group of decision makers determined four criteria namely management knowledge (X_1), customer relationship management knowledge (X_2), financial knowledge (X_3) and marketing knowledge (X_4). Four alternatives of communication (Y_1), interpersonal relationship (Y_2), decision making (Y_3) and quality control management (Y_4) are evaluated against each of the criteria.

The closeness coefficient of each of the alternative is calculated in table 10. Depending on its values, ranking of the alternatives is done. The alternative Y_3 has highest closeness coefficient value of 0.527 using trapezoidal fuzzy number and 0.530 using triangular fuzzy number. So, the alternative of decision making is ranked as one. As decision taken by the manager has long term impact on various activities, employees and the organization, decision making is most important for the manager. Next to Y_3, the alternative Y_2 of interpersonal relationship has highest closeness coefficient of 0.525 using trapezoidal fuzzy number and 0.527 using triangular fuzzy number, so it is designated with rank 2. The closeness coefficients of alternatives Y_4 of quality control management is 0.520, using trapezoidal fuzzy number and 0.523, using triangular fuzzy number. Therefore, this alternative is ranked as third. The alternative Y_1 of communication with closeness coefficient value of 0.507 using trapezoidal fuzzy number and 0.511 using triangular fuzzy number is ranked as fourth. It is observed that, the closeness coefficients value of each of the alternatives are nearly same for both triangular and trapezoidal fuzzy number and hence ranking of the alternatives is also same. It is also seen from all these values that, there is a slight difference in the values of closeness coefficients, which means that all the training and development needs are almost nearly important for hotel manager.

5. Conclusion

Due to fierce competition, every organization is focusing on giving best service to the customers, in order to enhance the goodwill of the organization. To meet this organizational requirement, proper growth and synchronization of change in customers' requirements should be planned. This is possible with the proper planning of training and development programs. As every organization has different needs, various criteria and alternatives are determined by the group of decision makers, where uncertainty is involved. In this study, we applied simplified fuzzy TOPSIS method for ranking various training and development needs of a hotel manager in multi-criteria decision making model using trapezoidal and triangular fuzzy number. Results are compared for both fuzzy numbers. Under this approach, the alternatives of decision making, interpersonal relationships, quality control management and communication skill trainings are ranked as first, second, third and fourth respectively, depending on their values of closeness coefficient for both trapezoidal and triangular fuzzy number. Results are same for both fuzzy numbers. There are various MCDM methods such as AHP, SAW, PROMETHEE, ELECTRE, VIKOR for solving the problem, but TOPSIS method is chosen, as it is one of the most actual MCDM methods, which is easy to apply and gives simple solution to a multi-criteria decision making model.

The results of the study motivate to consider other best factors that will help the industry to improve the performance of manager, thereby improving the name of the industry. For future research work, it will be interesting to extend and apply the fuzzy TOPSIS model for selection or performance evaluation of an employee, by considering criteria and alternatives as per the requirement of the organization in any sector. It can be integrated with analytic hierarchy process or with other methods for concentrating on other applications and the comparison of their results can also be done.

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