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Quality Cement Bricks Selection Using Apex Angle and Fuzzy Linguistic Information

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Abstract This Study Describes Technique for Selecting Good Quality Cement-Bricks. Brick is an essential material in the construction industry. Cement-Bricks are created locally, therefore it is essential to determine which ones are of the highest quality cement-bricks. Cement bricks have almost the same rigidity as Red Bricks. They are also made locally so it needs to identify which ones are the best quality ones. Poor quality bricks can be broken easily or even cause cracks during construction. Under stresses, they are often stronger than ordinary bricks. However, this is highly dependent on the quality of their manufacturing and individual elements. To aggregate individual decision maker's opinions into a collective opinion, the intuitionistic fuzzy averaging operator is utilized. Six criteria are used for the screening process, and they are based on expert opinions. The categories are as follows: hardness, pigment, shape, brick strength, cost and carrying cost. The majority of significant choices in industries are made by a group of specialists. Preferences and other human judgments are frequently ambiguous and cannot be quantified in precise numerical values. This research provides a fuzzy technique inside a linguistic framework to find the best answer for Multi Criteria Decision Making issues. An apex angle technique based on fuzzy trapezoidal numbers is presented to accomplish this.

Keywords Cement Bricks, Fuzzy Set, Aggregation Operators, Apex Angle, Multiple Criteria Decision Making, Intuitionistic Fuzzy Set, Linguistic Variables, Fuzzy Decision Matrix

1. Introduction

Multiple criteria decision making is a very good branch of the Operations Research Discipline. The decision maker first defined the decision, and then created the alternatives, identified the criteria, associated weights, and assigned values to each alternative in each criterion. It may be applied in a variety of applications, such as computer science Engineering, Mechanical Engineering, Production Engineering, Agricultural, Financial, Medical services and data science.

The procedure for deciding on the best choice among the available options is known as decision making. This technique should consider a variety of factors. The purpose of this research is to create new method for choosing high-quality cement bricks based on linguistic information.

Cement Bricks are the most widely used type of construction built by middle-class people. The reason for using them is that they are cheaper than other bricks and easily available in all seasons. Crushed stone is used in the cement bricks and it is this crushed stone that gives them

their strength. Cement bricks have a high level of durability. They are usually less expensive than clay bricks. Cement bricks are resistant to wind and water.

Aggregation is the process of trying to combine n-tuples of objects from the same set into a single object. An aggregation operator in this context is simply a function that assigns a real number y to any n-tuple. The operations that aggregate numerous fuzzy numbers to form a single fuzzy number are known as aggregation operations on fuzzy numbers.

A linguistic variable is an important notion that is commonly employed in practical applications. A linguistic variable in general has values that are words, and the meanings of these words are fuzzy sets in a certain universe whose value is given through natural or artificial language words or phrases. Positive trapezoidal fuzzy numbers can be used to express these linguistic variables.

2. Literature Review

Items that make up intuitionistic fuzzy sets have varying degrees of membership and non-membership. Krassimir Atanassov (1983) presented Intuitionistic fuzzy sets as an extension of Lotfi Zadeh's idea [5] of fuzzy set, which extends the conventional notion of a set. Adam Borovička [1] created a mechanism for estimating criterion weights based on language phrases indicating criteria significance. Harshit Varshney [2] characteristics of hollow blocks, qualities of hollow blocks constructed from various material sizes and proportions in the mix have been explored. Huimin Zhang [3] defines a scoring function, compares two linguistic fuzzy values and suggests aggregation techniques for linguistic intuitionistic fuzzy information based on t-norm and t-conorm. Kalyan Mondal and Surapati Pramanik [4] presented an intuitionistic fuzzy multi-criteria method for selecting Bricks using the concepts of acceptance and rejection. M. Babanli [6] suggested a different approach for material selection in the Z-environment using Z-numbers that takes partial dependability into consideration. Manju Pandey [7][8] presented a new aggregate of triangular fuzzy numbers using the arithmetic mean of the slopes and also discussed a new aggregate of TrFNs-based apex angles. Manoj Mathew [9] has provided the interval extension of the CODAS approach as well as a flexible manufacturing system selection issue. Manoj Mathew and Sagar Sahu [10] describe how innovative multi-criteria decision-making approaches were used to solve problems with autonomous guided vehicles and conveyors. Minxia Luo and Huifeng [11] created a trapezoidal fuzzy number with a picture fuzzy transformation, picture fuzzy multiplication, power operation and picture fuzzy weighted geometric aggregation operator approach. P. Bharathi [12] finds the best solution for Multi Criteria Decision Making and a fuzzy technique was proposed inside the linguistic frame work. S. Das, M. B. Kar, S. Kar, T. Pal [13] developed an adjustable approach to decision making using soft sets. Salim Rezvani [14] proposed the idea of using apex angles to rank trapezoidal fuzzy integers as an aggregation operator. Seyit Ali Erdogan [15] in this paper highlights the construction management difficulties and describes how to solve them using multi-criteria methodologies. Soroush and Saghafian [16] presented modified procedures in the TOPSIS technique when a fuzzy number exceeds or equals another fuzzy number. The VIKOR approach was used to determine the environment school ranking problem [17]. Thangaraj Beaula [18] has addressed the least cost transport problem based on the apex angle, trapezoidal fuzzy numbers. Dr. A Thiruppathi. and Dr. C. K. Kiruba-sankar [19][20][25][26] developed a new fuzzy ranking system in various fuzzy number. Tushar Prakash Prabhu [21] uses PROMETHEE in combination with the Analytic Hierarchy Process to offer an efficient decision-making approach for new product ideation selection. Wang Jianqiang & Zhang Zhong [22] defined the operational laws of intuitionistic trapezoidal fuzzy numbers. On the basis of these, an intuitionistic trapezoidal fuzzy multi-criteria decision-making method is developed. In this study, Wang Jianqian [23] defines operations on trapezoidal fuzzy soft set and extends classical fuzzy soft based on trapezoidal fuzzy numbers. Zhikang Lu and Jun Ye [24] presented a clay-brick selection method in this paper making use of the intuitionistic fuzzy subtraction operational weighted arithmetic averaging operator. The following is how the paper is organized. Section 3 talks some essential prerequisites. The proposed approach was developed in section 4. Section 5 provides an example of the brick selection process, while section 6 addresses some results for future research.

3. Preliminaries

3.1. Trapezoidal Fuzzy Number

A trapezoidal fuzzy number is defined as $(\xi_1, \xi_2, \xi_3, \xi_4)$ in the diagram (Fig. 1), with the membership function $\mu_\xi(x)$ as follows.

$$\mu_\xi(x) = \begin{cases} 0 & x < \xi_1 \\ \frac{x-\xi_1}{\xi_2-\xi_1} & \xi_1 \le x \le \xi_2 \\ 1 & \xi_2 \le x \le \xi_3 \\ \frac{x-\xi_4}{\xi_3-\xi_4} & \xi_3 \le x \le \xi_4 \\ 0 & x > \xi_4 \end{cases} \quad (1)$$

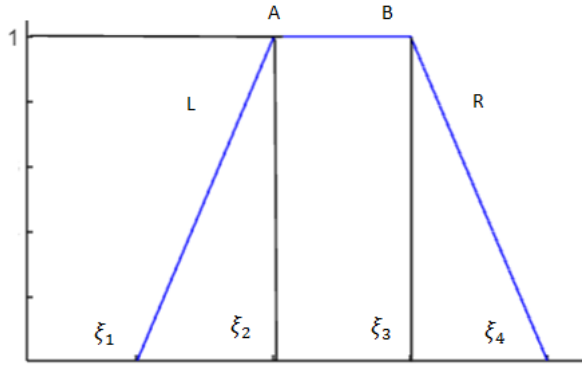

Figure 1. Trapezoidal Fuzzy Number

The membership function of a trapezoidal fuzzy number is piecewise linear and trapezoidal, reflecting the ambiguity of those linguistic evaluations as seen in Fig. 2. Let us consider the example. The linguistic variable "Medium low (ML)" is represented as (0.2, 0.3, 0.4, 0.5) the membership function of which is

$$\mu_{\text{Medium low}}(x) = \begin{cases} 0 & x < 0.2 \\ \frac{x-0.2}{0.3-0.2} & 0.2 \le x \le 0.3 \\ 1 & 0.3 \le x \le 0.4 \\ \frac{x-0.5}{0.4-0.5} & 0.4 \le x \le 0.5 \\ 0 & x > 0.5 \end{cases} \quad (2)$$

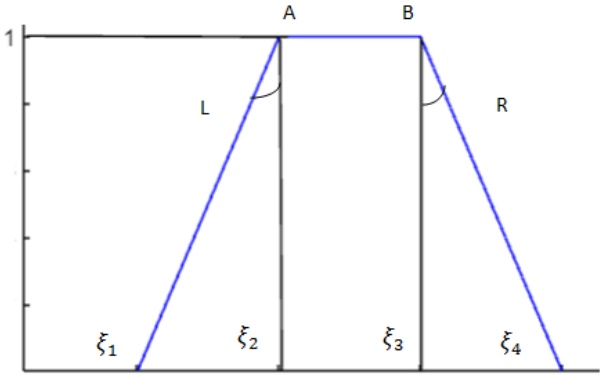

Figure 2. Apex angle of Trapezoidal Fuzzy Number

3.2. Linguistic Fuzzy Number

Let X be a universal set. An IFS A in X is given by [4]

$$A = \{(x, \mu_A(x), \mu_B(x))/x \in X\}$$

where the function $\mu_A(x): X \to [0,1]$ and $\mu_B(x) \to [0,1]$ stand for the degree of membership and nonmember ship to the element x to A respectively. Any $x \in X$ meets the condition $0 \le \mu_A(x) + \mu_B(x) \le 1$

3.3. Apex Angle Trapezoidal Fuzzy Number

Consider the Trapezoidal Fuzzy Number $(\xi_1, \xi_2, \xi_3, \xi_4)$. μ= 1 when the interval of Trapezoidal [Fig.2] Fuzzy Number is $[\xi_2, \xi_3]$ on left side apex angle $\angle\xi_1 A\xi_2$, on right side apex angle $\angle\xi_3 B\xi_4$. The apex angles subtended to the left and the right of the interval $[\xi_2, \xi_3]$ are referred to as left and right sides apex angle.

3.4. Method to Find Ranking Aggregated Trapezoidal Fuzzy Numbers Based on Apex Angles. [7][8][9]

Let $\xi = (\alpha, \beta, \gamma, \delta)$ trapezoidal fuzzy numbers, and then use the following steps to find the aggregated fuzzy rating

$$\bar{\beta} = \sqrt[n]{\beta_1 \times \beta_2 \times \beta_3 \times \beta_4 \times \dots \dots \beta_n} \quad (3)$$

$$\bar{\gamma} = \sqrt[n]{\gamma_1 \times \gamma_2 \times \gamma_3 \times \gamma_4 \times \dots \dots \gamma_n} \quad (4)$$

$$\bar{\alpha} = \bar{\beta} - \tan^{-1}\left(\sqrt[n]{\begin{matrix}\tan^{-1}(\beta_1 - \alpha_1) \times \\ \tan^{-1}(\beta_2 - \alpha_2) \times \\ \dots \times . \tan^{-1}(\beta_n - \alpha_n)\end{matrix}}\right) \quad (5)$$

$$\bar{\delta} = \bar{\gamma} + \tan^{-1}\left(\sqrt[n]{\begin{matrix}\tan^{-1}(\delta_1 - \gamma_1) \times \\ \tan^{-1}(\delta_2 - \gamma_2) \times \\ \dots \times . \tan^{-1}(\beta_n - \alpha_n)\end{matrix}}\right) \quad (6)$$

So the aggregated trapezoidal fuzzy number is

$$\bar{\xi} = (\bar{\alpha}, \bar{\beta}, \bar{\gamma}, \bar{\delta})$$

Ranking aggregated Trapezoidal Fuzzy Numbers Based on Apex Angles

$$\rho(\xi) = \sqrt{\begin{matrix}[(\bar{\beta} - \tan(\tan^{-1}(\bar{\beta} - \bar{\alpha})]^2 + \\ [\bar{\gamma} + \tan(\tan^{-1}(\bar{\delta} - \bar{\gamma})]^2\end{matrix}} \quad (7)$$

4. Proposed Method

Assume that a panel of professional decision makers wants to choose the best Cement Bricks among various choices based on some criteria.

STEP 1

Decision-makers who are experts examine alternatives in terms of all linguistic factors (Table-1) according to all requirements.

Table 1. Linguistic frame work

Linguistic Variable (Cement Brick Quality)	IFNS
(LCQ7) Very low (VL)	(0.0, 0.0, 0.1, 0.2)
(LCQ6) Low (L)	(0.05, 0.15, 0.25, 0.35)
(LCQ5) Medium Low (ML)	(0.2, 0.3, 0.4, 0.5)
(LCQ4) Medium (M)	(0.35, 0.45, 0.55, 0.65)
(LCQ3) Medium high (MH)	(0.5, 0.6, 0.7, 0.8)
(LCQ2) High (H)	(0.65, 0.75, 0.85, 0.95)
(LCQ1) Very high (VH)	(0.8, 0.9, 1,1)

Construct an evaluation table. The criteria are $C1, C2, C3, C4, C5$ and $C6$ .The possibilities are as follows: $A1, A2, A3, A4$ and $A5$. $P1, P2, P3, P4\ and\ P5$ make the decisions. Cement Brick Quality linguistic factors include LCQ1, LCQ2, LCQ3, LCQ4, LCQ5, LCQ6, and LCQ7.

STEP 2

Replace each linguistic variable with a fuzzy integer to construct a fuzzy decision matrix.

STEP 3

Use the formula, and aggregate the fuzzy numbers in columns depending on criterion C1, C2, C3, C4, C5.

$$\bar{\beta} = \sqrt[n]{\beta_1 \times \beta_2 \times \beta_3 \times \beta_4 \times \dots \dots \beta_n}$$

$$\bar{\gamma} = \sqrt[n]{\gamma_1 \times \gamma_2 \times \gamma_3 \times \gamma_4 \times \dots \dots \gamma_n}$$

$$\bar{\alpha} = \bar{\beta} - \tan^{-1}\left(\sqrt[n]{\begin{matrix}\tan^{-1}(\beta_1 - \alpha_1) \times \\ \tan^{-1}(\beta_2 - \alpha_2) \times \\ \dots \times . \tan^{-1}(\beta_n - \alpha_n)\end{matrix}}\right)$$

$$\bar{\delta} = \bar{\gamma} + \tan^{-1}\left(\sqrt[n]{\begin{matrix}\tan^{-1}(\delta_1 - \gamma_1) \times \\ \tan^{-1}(\delta_2 - \gamma_2) \times \\ \dots \times . \tan^{-1}(\beta_n - \alpha_n)\end{matrix}}\right)$$

So we get that the aggregated trapezoidal fuzzy number is $\bar{\xi} = (\bar{\alpha}, \bar{\beta}, \bar{\gamma}, \bar{\delta})$

STEP 4

Using the same approach, aggregate fuzzy numbers depend on decision makers P1, P2, P3, P4 and P5. Based on choices A1, A2, A3, A4 and A5, we obtain aggregate fuzzy numbers.

STEP 5

Use the aggregated Trapezoidal Fuzzy Numbers Based on Apex Angles, and determine the ranking of fuzzy numbers.

$$\rho(\xi) = \sqrt{\begin{matrix}[(\bar{\beta} - \tan(\tan^{-1}(\bar{\beta} - \bar{\alpha})]^2 + \\ [\bar{\gamma} + \tan(\tan^{-1}(\bar{\delta} - \bar{\gamma})]^2\end{matrix}}$$

STEP 6

The fuzzy numbers with maximum values come first in ranking order.

5. An Example of the Brick Selection Process

For instance, let us consider erecting a building by a small company. The primary step is to collect quality raw material and Cement Bricks from the best brick manufacturers. After analysis, they end up with choosing top five manufacturers - A1, A2, A3, A4 and A5. Executive committee with members P1, P2, P3, P4, P5 are assigned to make the final decision as who is the best among A1, A2, A3, A4 and A5 with the categories hardness (C1), pigment (C2), shape (C3), brick strength (C4), brick cost (C5), and carrying cost (C6). Decision maker uses linguistic variable to assess the grades of the given bricks namely LCQ1- Very high (VH), LCQ2- High(H) , LCQ3- Medium high(MH) , CQ4- Medium(M) , LCQ5- Medium Low(ML) , LCQ6- Low(L) , LCQ7- Very low(VL).

STEP 1

Decision-makers who are experts examine alternatives in terms of all linguistic factors, according to all requirements. Construct an evaluation Table-2. The criteria are C1, C2, C3, C4, C5, and C6. These possibilities are as follows: A1, A2, A3, A4, and A5. P1, P2, P3, P4, and P5 make the decisions. Cement Brick Quality linguistic factors include LCQ1, LCQ2, LCQ3, LCQ4, LCQ5, LCQ6 and LCQ7.

Table 2. Decision matrix

		C1	C2	C3	C4	C5	C6
P1	A1	LCQ1	LCQ2	LCQ2	LCQ3	LCQ3	LCQ5
	A2	LCQ1	LCQ3	LCQ2	LCQ2	LCQ5	LCQ6
	A3	LCQ2	LCQ3	LCQ3	LCQ3	LCQ4	LCQ6
	A4	LCQ2	LCQ3	LCQ3	LCQ2	LCQ5	LCQ3
	A5	LCQ2	LCQ2	LCQ3	LCQ3	LCQ5	LCQ3
		C1	C2	C3	C4	C5	C5
P2	A1	LCQ1	LCQ2	LCQ2	LCQ3	LCQ5	LCQ4
	A2	LCQ2	LCQ3	LCQ1	LCQ3	LCQ3	LCQ5
	A3	LCQ2	LCQ2	LCQ1	LCQ3	LCQ3	LCQ6
	A4	LCQ1	LCQ1	LCQ1	LCQ2	LCQ5	LCQ6
	A5	LCQ2	LCQ2	LCQ3	LCQ3	LCQ3	LCQ3
		C1	C2	C3	C4	C5	C5
P3	A1	LCQ2	LCQ3	LCQ2	LCQ4	LCQ4	LCQ5
	A2	LCQ2	LCQ3	LCQ3	LCQ4	LCQ5	LCQ6
	A3	LCQ3	LCQ2	LCQ3	LCQ5	LCQ5	LCQ6
	A4	LCQ3	LCQ5	LCQ3	LCQ5	LCQ5	LCQ3
	A5	LCQ2	LCQ2	LCQ3	LCQ5	LCQ3	LCQ3
		C1	C2	C3	C4	C5	C5
P4	A1	LCQ2	LCQ2	LCQ3	LCQ3	LCQ5	LCQ6
	A2	LCQ3	LCQ2	LCQ3	LCQ4	LCQ5	LCQ6
	A3	LCQ2	LCQ3	LCQ2	LCQ4	LCQ4	LCQ3
	A4	LCQ2	LCQ3	LCQ2	LCQ3	LCQ4	LCQ5
	A5	LCQ3	LCQ3	LCQ3	LCQ4	LCQ5	LCQ5
		C1	C2	C3	C4	C5	C5
P5	A1	LCQ1	LCQ3	LCQ2	LCQ3	LCQ3	LCQ5
	A2	LCQ2	LCQ3	LCQ4	LCQ3	LCQ4	LCQ3
	A3	LCQ2	LCQ2	LCQ4	LCQ4	LCQ5	LCQ5
	A4	LCQ3	LCQ3	LCQ2	LCQ4	LCQ4	LCQ5
	A5	LCQ2	LCQ3	LCQ2	LCQ4	LCQ4	LCQ5

STEP 2

Replace each linguistic variable with a fuzzy integer to construct a fuzzy decision matrix.

Replace each linguistic variable with a fuzzy integer. Make use of the formula (3), (4), (5) and (6) and aggregate the fuzzy numbers in columns depending on criterion C1, C2, C3, C4 and C5. Then the aggregated fuzzy ratings of alternatives are calculated through Simple Additive geometric mean aggregation method. The results are shown in Table 3. In this step, we have normalized the fuzzy decision matrix. Because of the scale selected for linguistic variables, the normalized matrix is the same as the one given in Table 1.

Make use of the formula (3), (4), (5) and (6), and aggregate the fuzzy numbers in columns depending on criterion P1, P2, P3, P4, and P5 and find the ranking Using (7) aggregated Trapezoidal Fuzzy Numbers Based on Apex Angles.

Table 3. Aggregate fuzzy numbers depending on criteria

		$C1$	$C2$	`$C3$	$C4$	$C5$	$C6$	*Aggregate the fuzzy numbers in column depending on* $(C1, C2, C3, C4, C5.)$	
P1	$A1$	(0.8,0.9,1,1)	(0.65,0.75,0.85,0.95)	(0.65,0.75,0.85,0.95)	(0.5,0.6,0.7,0.8)	(0.5,0.6,0.7,0.8)	(0.2,0.3,0.4,0.5)	(0.5161, 0.6161, 0.7220, 0.7220)	$(P1A1)$
	$A2$	(0.8,0.9,1,1)	(0.5,0.6,0.7,0.8)	(0.65,0.75,0.85,0.95)	(0.65,0.75,0.85,0.95)	(0.2,0.3,0.4,0.5)	(0.05,0.15,0.25,0.35)	(0.3890, 0.4890, 0.6081, 0.6081)	$(P1A2)$
	$A3$	(0.65,0.75,0.85,0.95)	(0.5,0.6,0.7,0.8)	(0.5,0.6,0.7,0.8)	(0.5,0.6,0.7,0.8)	(0.35,0.45,0.55,0.65)	(0.05,0.15,0.25,0.35)	(0.3711, 0.4711, 0.5850, 0.6850)	$(P1A3)$
	$A4$	(0.65,0.75,0.85,0.95)	(0.5,0.6,0.7,0.8)	(0.5,0.6,0.7,0.8)	(0.65,0.75,0.85,0.95)	(0.2,0.3,0.4,0.5)	(0.5,0.6,0.7,0.8)	(0.4758, 0.5758, 0.6803, 0.7803)	$(P1A4)$
	$A5$	(0.65,0.75,0.85,0.95)	(0.65,0.75,0.85,0.95))	(0.5,0.6,0.7,0.8)	(0.5,0.6,0.7,0.8)	(0.2,0.3,0.4,0.5)	(0.5,0.6,0.7,0.8)	(0.4758, 0.5758, 0.6803, 0.7803)	$(P1A5)$
P2	$A1$	(0.8,0.9,1,1)	(0.65,0.75,0.85,0.95)	(0.65,0.75,0.85,0.95)	(0.5,0.6,0.7,0.8)	(0.2,0.3,0.4,0.5)	(0.35,0.45,0.55,0.65)	(0.4872, 0.5872, 0.6935, 0.6935)	$(P2A1)$
	$A2$	(0.65,0.75,0.85,0.95)	(0.5,0.6,0.7,0.8)	(0.8,0.9,1,1)	(0.5,0.6,0.7,0.8)	(0.5,0.6,0.7,0.8)	(0.2,0.3,0.4,0.5)	(0.4936, 0.5936, 0.6990, 0.6990)	$(P2A2)$
	$A3$	(0.65,0.75,0.85,0.95)	(0.65,0.75,0.85,0.95)	(0.8,0.9,1,1)	(0.5,0.6,0.7,0.8)	(0.5,0.6,0.7,0.8)	(0.05,0.15,0.25,0.35)	(0.4489, 0.5489, 0.6679, 0.6679)	$(P2A3)$
	$A4$	(0.8,0.9,1,1)	(0.8,0.9,1,1)	(0.8,0.9,1,1)	(0.65,0.75,0.85,0.95)	(0.2,0.3,0.4,0.5)	(0.05,0.15,0.25,0.35)	(0.4393, 0.5393, 0.6631, 0.6631)	$(P2A4)$
	$A5$	(0.65,0.75,0.85,0.95)	(0.65,0.75,0.85,0.95)	(0.5,0.6,0.7,0.8)	(0.5,0.6,0.7,0.8)	(0.5,0.6,0.7,0.8)	(0.5,0.6,0.7,0.8)	(0.5463, 0.6463, 0.7468, 0.8468)	$(P2A5)$
P3	$A1$	(0.65,0.75,0.85,0.95)	(0.5,0.6,0.7,0.8	(0.65,0.75,0.85,0.95)	(0.35,0.45, 55,0.65)	(0.35,0.45,0.55,0.65)	(0.2,0.3,0.4,0.5)	(0.4232, 0.5232, 0.6278, 0.7278)	$(P3A1)$
	$A2$	(0.65,0.75,0.85,0.95)	(0.5,0.6,0.7,0.8	(0.5,0.6,0.7,0.8)	(0.35,0.45, 55,0.65)	(0.2,0.3,0.4,0.5)	(0.05,0.15,0.25,0.35)	(0.3197, 0.4197, 0.5329, 0.6220)	$(P3A2)$
	$A3$	(0.5,0.6,0.7,0.8)	(0.65,0.75,0.85,0.95)`.	(0.5,0.6,0.7,0.8)	(0.2,0.3,0.4,0.5)	(0.2,0.3,0.4,0.5)	(0.05,0.15,0.25,0.35)	(0.2923, 0.3923, 0.5054, 0.5944)	$(P3A3)$
	$A4$	(0.5,0.6,0.7,0.8)	(0.2,0.3,0.4,0.5)	(0.5,0.6,0.7,0.8)	(0.2,0.3,0.4,0.5)	(0.2,0.3,0.4,0.5)	(0.5,0.6,0.7,0.8)	(0.3243, 0.4243, 0.5292, 0.6292)	$(P3A4)$
	$A5$	(0.65,0.75,0.85,0.95)	(0.65,0.75,0.85,0.95)	(0.5,0.6,0.7,0.8)	(0.2,0.3,0.4,0.5)	(0.5,0.6,0.7,0.8)	(0.5,0.6,0.7,0.8)	(0.4758, 0.5758, 0.6803, 0.7803)	$(P3A5)$
P4	$A1$	(0.65,0.75,0.85,0.95)	(0.65,0.75,0.85,0.95)	(0.5,0.6,0.7,0.8)	(0.5,0.6,0.7,0.8)	(0.2,0.3,0.4,0.5)	(0.05,0.15,0.25,0.35)	(0. 3570, 0.4570, 0.5730, 0.6621)	$(P4A1)$
	$A2$	(0.5,0.6,0.7,0.8)	(0.65,0.75,0.85,0.95)	(0.5,0.6,0.7,0.8)	(0.35,0.45,0.55,0.65)	(0.2,0.3,0.4,0.5)	(0.05,0.15,0.25,0.35)	(0.3197, 0.4197, 0.5329, 0.6220)	$(P4A2)$
	$A3$	(0.65,0.75,0.85,0.95)	(0.5,0.6,0.7,0.8)	(0.65,0.75,0.85,0.95)	(0.35,0.45,0.55,0.65)	(0.35,0.45,0.55,0.65)	(0.5,0.6,0.7,0.8)	(0.4872, 0.5872, 0.6891, 0.7891)	$(P4A3)$
	$A4$	(0.65,0.75,0.85,0.95)	(0.5,0.6,0.7,0.8)	(0.65,0.75,0.85,0.95)	(0.5,0.6,0.7,0.8)	(0.35,0.45,0.55,0.65)	(0.2,0.3,0.4,0.5)	(0.4489, 0.5489, 0.6535, 0.7535)	$(P4A4)$
	$A5$	(0.5,0.6,0.7,0.8)	(0.5,0.6,0.7,0.8)	(0.5,0.6,0.7,0.8)	(0.35,0.45,0.55,0.65)	(0.2,0.3,0.4,0.5)	(0.2,0.3,0.4,0.5)	(0.3539, 0.4539, 0.5580, 0.6580)	$(P4A5)$
P5	$A1$	(0.8,0.9,1,1)	(0.5,0.6,0.7,0.8)	(0.65,0.75,0.85,0.95)	(0.5,0.6,0.7,0.8)`	0.5,0.6,0.7,0.8)`	(0.2,0.3,0.4,0.5)	(0.4936,0.5936, 0.6990, 0.6990)	$(P5A1)$
	$A2$	(0.65,0.75,0.85,0.95)	(0.5,0.6,0.7,0.8)	(0.35,0.45, 55,0.65)	(0.5,0.6,0.7,0.8)	(0.35,0.45,0.55,0.65)	0.5,0.6,0.7,0.8)`	(0.4658, 0.5658, 0.6672, 0.7672)	$(P5A2)$
	$A3$	(0.65,0.75,0.85,0.95)	(0.65,0.75,0.85,0.95)	(0.35, 0.45, 5,0.65)	(0.35,0.45,0.55,0.65)	(0.2,0.3,0.4,0.5)	(0.2,0.3,0.4,0.5)	(0.3661, 0.4661, 0.5718, 0.6718)	$(P5A3)$
	$A4$	(0.5,0.6,0.7,0.8)	(0.5,0.6,0.7,0.8)	(0.65,0.75,0.85,0.95)	(0.35,0.45,0. 55,0.65)	(0.2,0.3,0.4,0.5)	(0.2,0.3,0.4,0.5)	(0.4041, 0.5041, 0.6078, 0.7078)	$(P5A4)$
	$A5$	(0.65,0.75,0.85,0.95)	(0.5,0.6,0.7,0.8)	(0.65,0.75,0.85,0.95)	(0.35,0.45,0.55,0.65)	(0.2,0.3,0.4,0.5)	(0.2,0.3,0.4,0.5)	(0.4232, 0.5232, 0.6278, 0.7278)	$(P5A5)$

Table 4. Aggregate fuzzy numbers depending on decision makers

	P1	P2	P3	P4	P5	Aggregate fuzzy numbers depending on decision makers P1, P2, P3, P4, and P5.	Ranking of Bricks $\rho(\xi)$ Using the formula (7)	Ranking
A1	P1A1	P2A1	P3A1	P4A1	P5A1	(0.4522, 0.5522, 0.6607, 0.6607)	0.8006	2
A2	P1A2	P2A2	P3A2	P4A2	P5A2	(0.3923, 0.4923, 0.6042, 0.6042)	0.7204	4
A3	P1A3	P2A3	P3A3	P4A3	P5A3	(0.3883, 0.4883, 0.6000, 0.6000)	0.7147	5
A4	P1A4	P2A4	P3A4	P4A4	P5A4	(0.4156, 0.5156, 0.6243, 0.6243)	0.7500	3
A5	P1A5	P2A5	P3A5	P4A5	P5A5	(0.4512, 0.5512, 0.6555, 0.7555)	0.8800	1

The ranking order of the five alternatives is $A3 > A2 > A4 > A1 > A5$. Based on the above results (Table-4), we observe that the fuzzy numbers with maximum values that are close to one come first in ranking order, hence, the best alternative is A5.

6. Conclusions

Standard Brick depends on various other factors such as color, size, absorb capacity, compressive strength, the percentage of soluble salts, the thermal conductivity of brick, choice of type of cement, non-flammable and combustible. Nearly all countries produce their own different types of cement. No single type of cement is the best under all circumstances. So the selection of cement is important. India produces 33, 43, 53 grades Portland cement.

Depending on a variety of factors, one of the most significant jobs is to choose high-quality cement bricks. Because most of these criteria are incompatible, alternative vendors should be thoroughly inspected. As a result, certain strategies have been created to achieve this goal. To achieve this, an apex angle technique based on trapezoidal fuzzy numbers is described. The created method will be expanded to other disciplines. Perhaps in the future, this method may be used in image processing, medical equipment selection agricultural Machinery selection etc.

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