Inventory Model of Deteriorating Items based on ABC Analysis for Ranking of Triangular Fuzzy Numbers

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ABSTRACT
In the modern corporate world, the capacity of an organization to effectively manage its inventory is crucial. Organisations that keep hundreds of inventory items are obviously unable to affordably create an inventory management strategy for each item in their inventory. Inventory control called ABC-Fuzzy categorization, which incorporates management expertise and judgement into inventory categorization and should be easily adopted, In an effort to manage variables that have a feature, this study proposes a novel technique to inventory control known as ABC–Fuzzy classification, which integrates management experience and judgement into inventory categorization, and Should be simply implemented. An ABC analysis is a relatively easy classification that offers excellent cost control over the company's whole inventory. Ultimately, a comparison analysis of these real-world instances shows that, when it comes to handling a variety of genuine application challenges, the innovative similarity measures are more adaptable and reliable than the existing similarity measures. It also gives you authority over trivial issues. The problem in this case solved both Fuzzy and Crisp values.

Keywords: Inventory Model, Ranking function, Triangular Fuzzy, ABC analysis, deteriorating items.

INTRODUCTION

Determining suitable control levels for each inventory is the main goal of the inventory categorization based on this method. Category, the question of whether the inventory categorization is based on the single ABC criteria will be brought up. Analysis will be able to satisfy every need of the company's inventory management system. Consequently, the companies are able to implement appropriate control procedures by determining the best categorization criteria for their inventory. The following are some of the Control of inventory techniques: The analysis includes ABC, XYZ, HML, VED, FSN, SDF, GOLF, and SOS. For inventory management, several inventory control strategies are available. These methods are suggested for particular applications in the literature since they are employed for the right criteria. While other important inventory control approaches are also addressed, the current study concentrates on the ABC analysis of inventory management techniques. The many research papers on ABC, the combined idea of both, as well as their varied applications in various fields, are reviewed in this review. ABC analysis is a basic material classification method that classifies things based on their value and frequency of use.

In ABC analysis, each item is classified into three categories: A,B,and C. This makes it easy to apply strict rules to specific categories. To help businesses choose or create approaches that meet their needs, companies often accumulate spare parts for their operations as they expand. These parts can restrict large sums of money and result in significant costs from duplication, write-offs, and insurance costs. Businesses. An organisation can divide its stock keeping units into three categories using the ABC categorization system: A is for extremely important, B is for important, and C is for least important. The proportionate significance of each item should determine how much time, energy, and resources are allocated to inventory control. Items have typically been categorised into categories A, B, & C, using a single criterion. The yearly monetary consumption of the item is frequently the criterion for inventory goods. Other factors, nonetheless, can stand for additional crucial management concerns.

These factors include the importance of the product, its obsolescencerate, its rarity, its substitutability in case of shortage, the required order quantity, the lead time for delivery, etc. Therefore, it is generally accepted that traditional ABC analysis does not provide an accurate classification of inventory items in practice [14],[16],[15].Frequently lose out on chances to make the best use of their inventory. Sometimes this is because they fear the business will be in jeopardy if spare parts are unavailable, and other times it's because of operational, software, or even accounting errors. Considering For inventory, there are three categories items classes—A, B, and C—ABC analysis always refers to the best control analysis. Inventory class items are continuously monitored as future demand and a steady turnover are managed throughout time. This is readily predicted. Products in Category Y exhibit demand volatility to some degree based on seasonality, product life cycle, competitive landscape, and economic conditions. An EOQ is a well-known and traditional method that may be effectively utilised to determine how much inventory a company needs at any one moment and when to place an order [12].

LITERATURE REVIEW

The outcomes of applying multiple criterion Using ABC analysis, the storage inventory is categorized. were published in a paper Title "The application of multiple criteria ABC analysis" that was presented in 1987. The research done for this paper's investigations demonstrates that managers may classify warehouse inventory using both "cost criteria" and "non-cost criteria," and they can create customised rules by utilising various criteria to manage warehouse inventory[1].An optimisation approach is proposed about the issues with inventory classification at the times when it makes sense to classify inventory items according to one or more objectives, like minimising annual consumption costs, maximising the rate of inventory turnover, in an article titled "Particle Swarm Optimisation" that was presented in 2008[2].An article titled "The inventory control by combining ABC approach and fuzzy classification" was delivered in 2008. The purpose of this study is to provide A work of literature method of stock management known as "ABC fuzzy classification"[3].There is a vast array of research being conducted in the topic of inventory management. T

he ABC and XYZ models of inventory control procedures, which are applied in several fields, are the main subject of this study of the literature. The findings from the application of multi-criteria ABC analysis were presented in a 1987 paper titled "Application of Multi-criteria ABC Analysis"[4]. "Inventory Management and Its Control Techniques at Wheels India Limited" is the title of an article published in 2012. The tools used to measure the variables in this study are economic order quantity, commercial batch quantity and correlation analysis, trend analysis and stock ratio, ABC analysis, efficiency of inventory control system.

A paper titled "ABC: Evolution of, Implementation Issues and Organizational Variables" was published in 2012. He focused on the development of the ABC model while emphasizing the results of the implementation process[6]." ABC: Evolution, Implementation Issues, and Organizational Variables" is the title of an article published in 2012. The study focuses on the development of the ABC model and emphasizes the impact of the implementation process[7]. The authors identified three organizational variables that companies need to master to be successful with ABC:activity-based costing, process factors, and contextual factors[5]. A mathematical model for deteriorating inventory systems focuses on cases where demand follows a quadratic pattern [25-29]. Traditionally, most inventory models assume that products have an indefinite shelf life, meaning they remain unchanged and fully usable for future demand. However, when deterioration is significant, it must be explicitly accounted for in inventory management, as ignoring it can lead to inaccurate models. Studies on inventory models with stock-dependent demand are explored in [30-37]. An interesting area of research within inventory theory is the modelling of deteriorating items with variable demand rates [38-54]. Some optimal inventory models under fuzzy environments are discussed in [55-64]. The deterioration rate, which describes how items degrade over time, is a key factor in analyzing deteriorating inventory systems. Different scenarios arise depending on the nature of deterioration rates. Additionally, various optimization techniques and supply chain models are examined in [65-69].

ABC Classification

Business organisations frequently Make use of ABC inventory analysis as a tool for inventory management. This well-known strategy is called as "always better management." Several commodities, including completed goods, inventory, and even clients, are divided into three divisions for the ABC categorization process. As seen in Figure 1 [9]–[11],With this strategy, the stock is divided based on various strategies, with Class A representing a variable percentage of consumption ranging from 70% to

80%. The remaining amount, or 65-75%, is for the "C" goods and represents (5–10%) of the overall consumption. This means that 15–20% of the "B" items constitute (5–10%) of the overall amount consumed. Articles in classes A, B, & C have intermediate values; articles in class "A" have a high value, while articles in class "C" have a low value. Every one of these article categories has a store or buy policy; articles in categories "A" and "B" receive more thorough reviews, while articles in categories "C" and "D" receive less thorough reviews and revisions [10]–[11].
Table 1 (Cokoy, 2013)[16] illustrates how closely class A goods are monitored, how data is preserved, how low the safety stock level is, and how frequently tiny amounts of stock are evaluated. Class B items, on the other hand, are regularly monitored, data is appropriately stored, the safety stock level is moderate, and they are periodically evaluated in moderate amounts. However, class C items are easily tracked, data is retained in an equally easy manner, the safety level of stocks is high, andis reviewed periodically (every 1-2 years) in high quantities.

Table 1: Qualities of the ABC System of Classification [17]

Cluster	financial Percentage	Quantity Percentage	Control degree	Record type	level of safety stock	Ordering method
A	70-80%	10-20%	Tight	Proper	Low	continuous in small amounts
B	15-20%	30-40%	Normal	Proper	Middle	Sometimes in moderate amounts
C	5-10%	40-50%	Simple	Simple	High	Occasionally in large amounts

Mathematical Modelling
Basic Sketch
For the fuzzy critical route issue, we use the relevant definitions and theorems provided by Zadeh[18]. This section goes over some essential background information and concepts related to fuzzy set theory.

Definition 1
Fuzzy Set
Let X = {x} be the discourse world. Given X, fuzzy set A is mapping that gives a real number in the region [0,1] to each element x ∈ X that represents x's membership in ~A.

Definition 2
Role of Membership Function
The function of membership, The grade of membership of x in ~A is represented by μ, which may be written as follows: μ_A: X → [0,1], or ~ x(μ_A, for every x ∈ X).

Comparison Of Triangular Fuzzy Numbers
This rule provides an answer to the question of which of two fuzzy numbers is bigger as well as the extent to which one fuzzy number exceeds the other.
Considering that triangular fuzzy integers of The definitions of A and B are A=(a1, a2, a3) and B=(b1, b2, b3). The extent to which A exceeds B is indicated by R(A≥B) and calculate as follows:
$R(A\geq B) = \frac{1}{4}\{(a_1+2a_2+a_3) - (b_1+2b_2+b_3)\}$
Define three relations between A and B using this degree.
If A≥B then $R(A\geq B) \geq 0$
If A>B then $R(A>B) > 0$
If A = B then $R(A \geq B) = R(B \geq A) = 0$
If the equation $A \geq B$ if $R(A \geq B) \geq 0$, holds, says that A is weakly greater than or equal to B.
$(\mathbf{a_1}, \mathbf{a_2}, \mathbf{a_3})$TheTriangular Fuzzy Number
If a fuzzy number A in R satisfies the following properties in its membership function, μA: R→[0,1], it is considered afuzzy triangular number.
A fuzzy number $A = (a_1, a_2, a_3)$ where $a_1 \geq a_2 \geq a_3$it is stated taking to be a fuzzy triangular number if its membership function is given by

$$\mu_{\widetilde{A}}(x) = \begin{cases} 0, & \text{for} -\infty < x < a_1 \\ \dfrac{x - a_1}{a_2 - a_1}, & \text{for } a_1 \le x < a_2 \\ \dfrac{a_3 - x}{a_3 - a_2}, & \text{for } a_2 \le x < a_3 \\ 0, & \text{for } a_3 \le x < \infty \end{cases}$$

(Gupta and Kaufmann 1985) A fuzzy triangular number
(a_1, a_2, a_3) Representation of Fuzzy Triangular Numbers
Definition (Gupta and Kaufmann, 1985). A fuzzy number, If $\widetilde{A}$ = (a_1, a_2, a_3) it is stated taking to a fuzzy triangular number if its membership function is given by

$$\mu_{\widetilde{A}}(x) = \begin{cases} 0, & \text{for} -\infty < x \le a_1 \\ \dfrac{x - a_1}{a_2 - a_3}, & \text{for } a_1 \le x < a_2 \\ \dfrac{a_3 - x}{a_3 - a_2}, & \text{for } a_2 \le x < a_3 \\ 0, & \text{for } a_3 \le x < \infty \end{cases}$$

(Gupta and Kaufmann 1985). A fuzzy triangular number $\widetilde{A}$ = (a_1, a_2, a_3) it is stated taking to be zero fuzzy triangular number if and only if $a_1 = 0, a_2 = 0, a_3 = 0$.
(Gupta and Kaufmann 1985). A fuzzy triangular number $\widetilde{A}$ = (a_1, a_2, a_3) it is stated taking to be zero non negative fuzzy triangular number if and only if $a \ge 0$.
(Gupta and Kaufmann 1985). Two fuzzy triangular number $\widetilde{A}$ = (a_1, a_2, a_3)and $\widetilde{B}$ = (b_1, b_2, b_3)fuzzy triangular number if and only if $a_1=b_1, a_2=b_2, a_3=b_3$.
(m,α, β) The Representation of Fuzzy Triangle-Based Numbers
A fuzzy triangular number $\widetilde{A}$ = (a_1, a_2, a_3), described and may also be represented as $\widetilde{A}$ = (m,α, β), where $m = a_2$, $\alpha = a_2 - a_1 \ge 0$, $\beta = a_3 - a_2 \ge 0$.
Prade and Dubois 1980. A fuzzy period $\widetilde{A}$ = (m,α, β)is regarded to have a fuzzy triangular number if one of the following describes its membership function:

$$\mu_{\widetilde{A}}(x) = \begin{cases} 0, & \text{for} -\infty < x \le m - \alpha \\ 1 - \dfrac{m - x}{\alpha}, & \text{for } m - \alpha \le x < m \\ 1 - \dfrac{x - m}{\beta}, & \text{for } m \le x < m + \beta \\ 0, & \text{for } m + \beta \le x < \infty \end{cases}$$

Prade and Dubois, 1980.It is stated that a fuzzy triangular number$\widetilde{A} = (m, \alpha, \beta)$
Zero fuzzy triangular number iff m = 0, α = 0, β = 0.
Prade and Dubois 1980 A fuzzy triangular number $\widetilde{A} = (m, \alpha, \beta)$it has been stated taking to be non negative fuzzy triangular number if m - α ≥0.
Prade and Dubois 1980 Two fuzzy triangular numbers $\widetilde{A} = (m_1, \alpha_1, \beta_1)$ and $\widetilde{B} = (m_2, \alpha_2, \beta_2)$are regarded as equivalentas $\widetilde{A} = \widetilde{B}$ if and only if $m_1 = m_2, \alpha_1 = \alpha_2, \beta_1 = \beta_2$.

Operations with Arithmetic

Under this segment of operations involving addition and multiplication between two fuzzy triangular integers are
Arithmetic operation between (a_1, a_2, a_3) Type triangular fuzzy numbers
Let $\widetilde{A_1}$ = (a_1, a_2, a_3) and $\widetilde{A_2}$ = (b_1, b_2, b_3)if there were two fuzzy triangular numbers,

(i) $\widetilde{A_1} \oplus \widetilde{A_2} = (a_1 + b_1, a_2 + b_2, a_3 + b_3)$, and
(ii) $\widetilde{A_1} \otimes \widetilde{A_2} = (a_1, a_2, a_3)$, where a = minimum ($a_1b_1, a_1b_3, a_3b_1, a_3b_3$), $b = a_2b_2$, c = maximum ($a_1b_1, a_1b_3, a_3b_1, a_3b_3$)

Arithmetic operations between (m, α, β)type triangular fuzzy numbers
Let Let $\widetilde{A_1} = (m_1, \alpha_1, \beta_1)$ and $\widetilde{A_2} = (m_2, \alpha_2, \beta_2)$be two fuzzy triangular numbers, then

(i) $\widetilde{A_1} \oplus \widetilde{A_2} = (m_1 + m_2, \alpha_1 + \alpha_2, \beta_1 + \beta_2)$, and
(ii) $\widetilde{A_1} \otimes \widetilde{A_2} = (m, \alpha, \beta)$where $m = m_1m_2, \alpha = m -$ minimum(d), $\beta =$ maximum(d) -m and d = $(m_1m_2 - m_2\alpha_2 - m_2\alpha_1 + \alpha_1\alpha_2,\ m_1m_2 + m_1\beta_2 - m_2\alpha_1 - \alpha_1\beta_2,\ m_1m_2 - m_1\alpha_2 - m_2\beta_1 - \beta_1\alpha_2, m_1m_2 + m_1\beta_2 + m_2\beta_1 + \beta_1\beta_2)$

Ranking of Triangular Fuzzy Number

Ranking Fuzzy number is a crucial technique for artificial intelligence decision-making and other uses. For this goal, several studies have been recommended. It is an essential step in many applications when the numbers are not precise. The survey is straightforward ranking algorithms [24].

Ranking Function

An efficient approach to compare fuzzy images by applying ranking functions. Liou and Wang, 1992, $\mathfrak{R}: F(R) \longrightarrow R$, where F® is a set of fuzzy numbers defined on a collection of real numbers, which maps each fuzzy number in to the real line, where a natural order exists.

Let (a_1, a_2, a_3) be a fuzzy triangular number then $\mathfrak{R}$(a_1, a_2, a_3) =$\frac{a_1+2a_2+a_3}{4}$.Also, let (m, α, β) be a fuzzy triangular number then,$\mathfrak{R}(m, \alpha, \beta) = m + \frac{\beta-\alpha}{4}$.

Solution Algorithm

Step 1: Find out how many units were utilized or sold in the previous time frame.
Step 2: For every item, ascertain the unit cost standard.
Step 3: By multiplying the annual consumption by the unit price, you may find the worth of each consumed item.
Step 4: Sort these products according to the consumption value that was calculated before.
Step 5: Count the number of items and the use value cumulatively.
Step 6: Calculate the percentages of the grand totals based on the accumulated totals of the number of items and usage values.

Proposed Method

To our knowledge, no technique for figuring out the optimal fuzzy solution to ABC analysis has been published in the literature, in this section, we present a new approach to determine the fuzzy optimal solution of ABC analysis.
The steps of the proposed method are as follows:
Step 1: Write the ABC problem as described in Section 1 and use a specific type of triangular fuzzy to represent all of the problem's parameters.
Step 2: Using an appropriate ranking technique, we convert the ambiguous objective function into an unambiguous objective function form.
Step 3: Use the arithmetic operations to transform all of the fuzzy requirements and limitations.
Step 4: Using software (Excel, and Minitab), determine the best solution to the acquired crisp ABC Analysis.
Step 5: Apply the crisp optimum solution from Step 4 to find the fuzzy optimal solution.
Step 6: Use the fuzzy optimal solution from step1 to convert the total cumulative percentage.

Numerical Examples:1

We are given the number of units sold in the past 12 months as well as the unit cost standard for each item. Multiply annual consumption of each item by its unit price and then ranking the items in the descending order of the usage values so determined, the following table is obtained:
We now determine the cumulative total number of items and their usage values and convert the accumulated totals in terms of percentage of the grand total. The following ABC classification is, obtained:

Table 1: Annual Consumption(in pieces)

Model	Annual consumption	Unit price(in paise)	Usage value	Ranking	Model	Cumulative usage	Cumulative %
501	30,000	10	3,000	6	502	42,000	48
502	2,80,000	15	42,000	1	506	64,000	73
503	3,000	10	300	9	509	73,000	83
504	1,10,000	5	5,500	4	504	78,500	90
505	4,000	5	200	10	508	82,500	94
506	2,20,000	10	22,000	2	501	85,500	98
507	15,000	5	750	8	510	86,300	98.6
508	80,000	5	4,000	5	507	87,050	99.4
509	60,000	15	9,000	3	503	87,350	99.6
510	8,000	10	800	7	505	87,550	100

For the above table 1 the consumption value of the type items have more annual consumption i.e., A as 73%, B as 25% and C as 2%. In EOQ

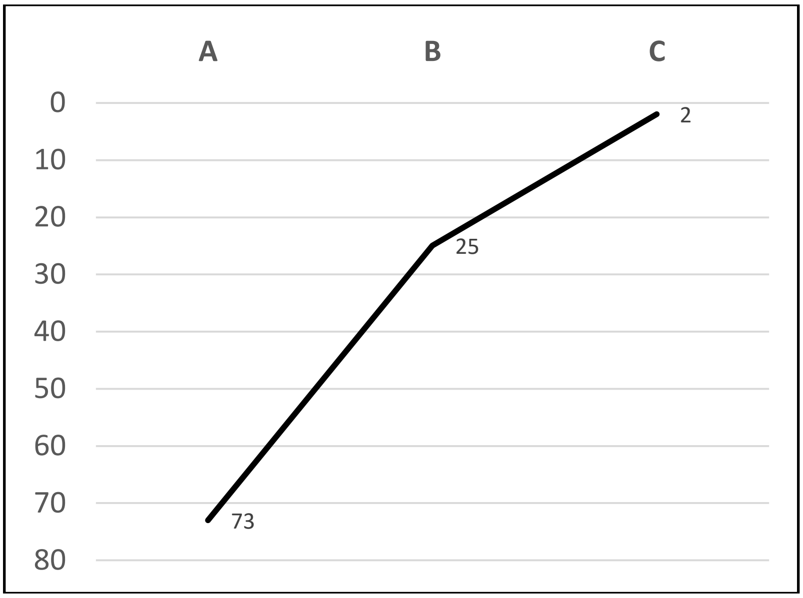

Figure 1: ABC Analysis

Illustration of A, B, C to show the given basis for classification, accordingly we have the classification as, A = a_1, B = a_2, C = a_3.$(73,\ 25, 2)$Consider as Triangular Fuzzy Number where A > B > C If the objective of its membership is,

Section 1
Ranking of Triangular Fuzzy Number
$(73,\ 25, 2)$The Representationof Triangular Fuzzy Numbers
A fuzzy number, If $\tilde{A}$ = $(73,\ 25, 2)$is attributed to a triangular fuzzynumber if the function of its membership is provided by

$$\mu_{\tilde{A}}(x) = \begin{cases} 0, & for - \infty < x \leq 73 \\ \dfrac{x-73}{25-2}, & for\ 73 \leq\ x < 25 \\ \dfrac{2-x}{2-25}, & for\ \ 25 \leq x < 2 \\ 0, & for\ 2 \leq x < \infty \end{cases}$$

A fuzzy triangular number $\tilde{A}$ = $(73,\ 25, 2)$ it has been stated taking to be zero fuzzy triangular number if and only if $a_1 = 0$, $a_2 = 0$, $a_3 = 0$.
A fuzzy triangular number $\tilde{A}$ = $(73,\ 25, 2)$it has been stated taking to be zero non negative fuzzy triangular number if and only if $a \geq 0$.
Two fuzzy triangular number $\tilde{A}$ = (73, 25,2)and $\tilde{B}$ = $(73,\ 25, 2)$ $fuzzy$triangular number iff $a_1=b_1$, $a_2=b_2$, $a_3=b_3$.
(m,α, β) The Representation of Fuzzy Triangular Numbers
Afuzzy triangular number $\tilde{A}$ = $(73,\ 25, 2)$, as stated in the part (1) could alternatively be shown as $\tilde{A}$ = (m,α, β), where m = 25, $\alpha = 25 - 73\ \leq 0$, $\beta = 2 - 25 \leq 0$.
A fuzzy number $\tilde{A}$ = (m,α, β)It has been stated that In the situation that it receives its membership function from, it is a fuzzy triangle.

$$\mu_{\tilde{A}}(x) = \begin{cases} 0, & for - \infty < x \leq 73 \\ 1 - \dfrac{25-x}{-48}, & for\ 73 \leq x < 25 \\ 1 - \dfrac{x-25}{-23}, & for\ 25 \leq x < 2 \\ 0, & for\ 2 \leq x < \infty \end{cases}$$

A fuzzy triangular number $\widetilde{A}\ = (m, \alpha, \beta)$it has been stated to bezero fuzzy triangular number iff m = 0, α = 0, β = 0.

A fuzzy triangular number $\widetilde{A} = (m, \alpha, \beta)$it has been stated taking to be nonnegative fuzzy triangular number if m - α ≥0.
Two fuzzy triangular numbers $\widetilde{A} = (m_1, \alpha_1, \beta_1)$ and $\widetilde{B} = (m_2, \alpha_2, \beta_2)$ are stated to be equal i.e$\tilde{A} = \tilde{B}$ if and only if $m_1 = m_2, \alpha_1 = \alpha_2, \beta_1 = \beta_2$.

Ranking Function

Let $(73, 25, 2)$be triangularfuzzy number then $\Re(73, 25, 2) = \frac{73+2*25+2}{4} = 31.25$. Also, let $(25, -48, -23)$ be triangular fuzzy number then , $\Re(25, -48, -23) = 25 + \frac{(-23+48)}{4}$=31.25.

Example 2: For Crisp data

Large number of firms has to maintain several types of inventories. As a result, the company ought to focus exclusively on the things with the highest value. Therefore, the company should exercise caution when deciding how to regulate investment in different kinds of inventories. Inventory management is the same as the ABC analysis. Strategy that evaluates each inventory item based on its worth inside the company. 'A' products are the highest valued things in the category. The moderately valued things are labeled as "B" items, while the lowest valued items are classified into a "C" category. Moreover, Not every one of these things will be consumed. strict control is used for item A because it is highly expensive, fair control is used for item B, and there is no control at all for item C because it is low value. For high-value items, strict control may be used, whereas control over low-value things may be comparatively relaxed. The company maximizes its investment's profitability by controlling by exception and importance.
According to the graphical depiction, items A represent 60% of the overall value even though they only make up 16% of the whole sumof units of each item. On the other hand, although making up half of the total, the value of the "C" products is only 20%, while the "B" items are in the middle. Because "A" items have high values, management must exercise extreme caution when scheduling, arranging, checking, and keeping, delivering, etc. Any negligence on their side could result in significant losses.

Table 2: Stock In Units

S. No.	**No. of Units**	**% of Total quantity**	**Number Cumulative%**	**Unit Price**	**Total Value**	**% of Total Value**	**Cumulative %**
1	1000	10	15	10	10000	19.15	
2	500	5		50	25000	47.89	67.06
3	1600	16	35	3	4800	9.19	
4	1900	19		4	7600	14.55	23.76
5	3000	30		1.2	3600	6.89	
6	1000	10	50	0.5	500	0.95	9.18
7	1000	10		0.7	700	1.34	
Total	10000	100	100	0	52200	100	100

Additionally, stocks are categorized into three groups: Vital, Essential, and Desirable. This makes inventory planning, control, and other decisions easier. ones in the Vital category are given higher priority than Essential or Desirable ones. The management is also assisted in properly managing the inventory by the separation of commodities according to consumption patterns. The inventory objects are separated into three groups using this method: non-moving, slow-moving, and fast-moving. When it comes to inventory, judgments about "not moving items" are made very carefully. However, when it comes to quickly shifting items, a manager can make decisions more easily because any mistakes made won't have a significant impact on the company.
Fast-moving products carry less danger since they can be eaten more rapidly than non-moving items, which are kept in the godowns for longer periods of time. Inventory selections must be made carefully so as not to negatively impact the business, as there is a high degree of risk associated with slow-moving and non-moving items.

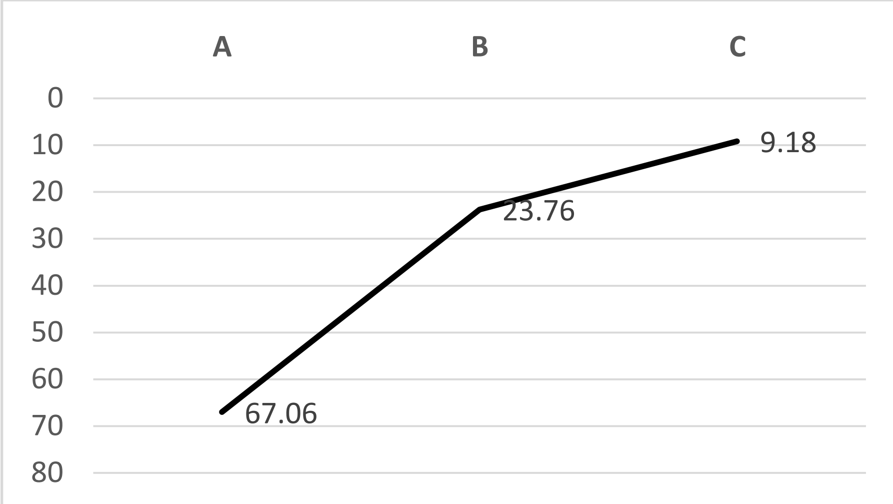

Figure 2: ABC Analysis

Illustration of A, B, C to show the given basis for classification, accordingly we have the classification as, A = a_1, B = a_2, C = a_3.$(67.06,\ 23.76, 9.18)$Consider as Fuzzy Triangular Number where A > B > CIf the objective of its membership is,

Section 1

Ranking of Fuzzy Triangular Number

$(67.06,\ 23.76, 9.18)$**The Representation of Fuzzy Triangular Numbers**

A fuzzy number, If $\tilde{A}$ = $(67.06,\ 23.76, 9.18)$is said to a fuzzy triangular number if the function of its membership is provided by

$$\mu_{\tilde{A}}(x) = \begin{cases} 0, & for -\infty < x \leq 67.06 \\ \dfrac{x-67.06}{23.76-9.18}, & for\ 67.06 \leq\ x < 23.76 \\ \dfrac{9.18-x}{9.18-23.76}, & for\ \ 23.76 \leq x < 9.18 \\ 0, & for\ 9.18 \leq x < \infty \end{cases}$$

A fuzzy triangular number $\tilde{A}$ = $(67.06,\ 23.76, 9.18)$it has been stated to be zero fuzzy triangular number iff $a_1 = 0, a_2 = 0, a_3 = 0$.

A fuzzy triangular number $\tilde{A}$ = $(67.06,\ 23.76, 9.18)$it has been stated taking on nonnegative zero value of fuzzy triangular number if and only if $a \geq 0$.

Two fuzzy triangular number $\tilde{A}$ = $(67.06,\ 23.76, 9.18)$and $\tilde{B}$ = $(67.06,\ 23.76, 9.18)$ $fuzzy$triangular number iff $a_1=b_1$, $a_2=b_2$, $a_3=b_3$.

(m,α, β) The Representation of Fuzzy Triangular Numbers

Afuzzy triangular number $\tilde{A}$ = $(67.06,\ 23.76, 9.18)$, described in the section (1) may also be represented as $\tilde{A}$ = (m,α, β), where as m = 23.76, $\alpha = 23.76 - 67.06\ \leq 0,\ \beta = 9.18 - 23.76 \leq 0$.

A fuzzy number $\tilde{A}$ = (m,α, β)It has been stated that In the event that it receives its membership function from, it is a fuzzy triangle.

$$\mu_{\tilde{A}}(x) = \begin{cases} 0, & \text{for} -\infty < x \leq 67.06 \\ 1 - \dfrac{23.76 - x}{-43.3}, & \text{for } 67.06 \leq x < 23.76 \\ 1 - \dfrac{x - 23.76}{-14.58}, & \text{for } 23.76 \leq x < 9.18 \\ 0, & \text{for } 9.18 \leq x < \infty \end{cases}$$

A fuzzy triangular number $\widetilde{A}\ = (m, \alpha, \beta)$it has been stated to bezero fuzzy triangular number iff m = 0, α = 0, β = 0.

A fuzzy triangular number $\widetilde{A}\ = (m, \alpha, \beta)$it has been stated taking on nonnegative valuesfuzzy triangular number if m - α ≥0.

Two fuzzy triangular numbers $\widetilde{A}\ = \left(m_1\ , \alpha_1, \beta_1\right)$ and $\widetilde{B}\ = \left(m_2\ , \alpha_2, \beta_2\right)$ are stated to be equal i.e$\widetilde{A} = \widetilde{B}$ if and only if $m_1\ =\ m_2, \alpha_1\ =\ \alpha_2, \beta_1\ =\ \beta_2$.

Ranking Function

Let $(67.06,\ 23.76, 9.18)$be afuzzy triangular number then $\Re(67.06,\ 23.76, 9.18)$ $=\frac{67.06+2*23.76+9.18}{4}=30.94$. Also, let $(23.76, -43.3, -14.58)$ be a fuzzy triangular number then , $\Re(23.76, -43.3, -14.58) = 23.76 + \frac{(-14.58+43.3)}{4}$=30.94.

CONCLUSION

In the paper, we suggested various approaches to identify a ranking function of triangular fuzzy numbers. The concept is introduced for the first time and follows an easy methodology. The aforementioned approach is demonstrated by solving many numerical cases. Linguistic decision making and other fuzzy application systems, such operations research and management, depend heavily on the sequence of arranging fuzzy numbers in order. Numerous approaches have been put out to address ranking fuzzy numbers. Additionally, a new form for triangular fuzzy numbers is put forth, and it is demonstrated that using this new representation is preferable. The technique ranks of all triangular fuzzy numbers, unless they are equal, which is an essential quality.

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