A Legitimate Productive Repertoire Replica Betwixt Envirotech Outlay Towards Fragile Commodities Using Trapezoidal Neutrosophic Fuzzy Number

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Abstract

This present contemplate confers a productive repertoire replica in which ultimatum is appraised as a basis of medical utilization of fragile commodities by the juvenile diabetes. Abundant embalming mechanisms are drawn on to preserve the Confectionary from putrefaction over time. It is consequential to ascertain that greenhouse gas emissions by virtue of transportation, production and storage of Confectionary is susceptible to putrefaction that has to be steered up. This contemplate recommends an optimal productive repertoire replica considering the production and inventory components for commodities contingent to decline in fuzzy sense using trapezoidal neutrosophic fuzzy number. To determine the minimal overall cost, a comparative study of different cases is authenticated by working out numerical examples using models.

Keywords: Production inventory model; Greenhouse gas emission; Embalming mechanisms; Anthropocene; Confectionary; Juvenile diabetes; Trapezoidal neutrosophic fuzzy number

1. Introduction:

Owing to Anthropocene all over the world, almost all countries are aiming to take the edge off the greenhouse gas emissions at all places of production confining of greenhouse gas emissions, environmental investment etc. In addition to this, the prime mover in inventory model is the decay of commodities. The exorbitant decay rate makes it arduous to all the manufacturers and suppliers to store the commodities in intact without perishing for long term. Presently, as the manufacturers and the suppliers are facing this issue. Many researchers have put forth articles on inventory model to pivot on greenhouse gas emission and environmental investments of which not many articles explored the study of inventory system for Envirotech and conservation outlay for fragile commodities. Hence, this contemplate signifies on renewable productive repertoire system of sweet commodities for diabetic people in association with Envirotech and conservation outlay. But sweets are extremely fragile commodities. To check upon the above issues, a few conservations mechanization need to be applied at different period of product delivery of sweet items and on the excessive quantity of greenhouse gas emissions. So, it is mandatory to concentrate on regulation of environmental investment using the neutrosophic fuzzy model.

2. Literature Review:

In an effort to reduce production costs, Goyal and Nebebe [1] selected a single vendor and buyer. Sana [2] examined an inventory model to determine the optimal parameter for product reliability and variable production rate in the manufacturing process of defective items. Ghosh et al. [3] expanded an inventory model for imperfect manufacturing by included the instrument's crash at any time and the repair of defective goods in the equation. This led to a more optimal total profit. A manufacturing inventory model in which products were made from raw materials and remanufactured from returned items was examined by Khara et al. [4]. A supply chain model was created by Manna et al. [5] for a manufacturing company and a collection of merchants that were thinking about fixing defective products. An integrated system was created by Modibbo et al. [6] to reduce production, shipping, and delivery time costs. Under a two-echelon trade credit method, Mahato and Mahata [7] examined a model of non-instantaneously degrading products with price-dependent order and time-dependent degradation. Retailers made investments in preservation technologies to stop things from decaying in addition to decreasing the rate of

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product deterioration. An inventory model for the manufacturing of food products using preservation techniques was covered by Rahman et al. [8].

Mishra et al. [9] have examined a carbon tax and carbon cap model for green cost-effective production size in order to reduce carbon emissions through investments in green technology under various scarcity scenarios. In their study, Tiwari et al. [10] looked into sustainable inventory management, which accounts for faulty and deteriorating quality items as well as carbon emissions. A model for an inventory system where demand was reliant on price and shortages for defective quality items grew over time was provided by De-La-Cruz-MaŠquez et al. [11]. In a closed-loop supply chain system comprising a manufacturer and a retailer operating in a stochastic environment with reduced carbon emissions and minimised combined total cost, Jauhari et al. [12] examined a two-echelon inventory model. A green supply chain inventory system was proposed by Yadav et al. [13] to maximise profit after batch size, production, shipment, and preservation technology were optimised to minimise waste. By varying the cross-price elasticity of demand and the amount of carbon released from different stages such as transportation, setup, waste management, and stock keeping, they examined the model involving two suppliers and a retailer.

The amount of resources used depends significantly on the size and growth of the population. Numerous scholars have endeavoured to develop models of population and logistic expansion. Wei et al. [14] examined two distinct models of population growth and made an effort to determine an appropriate technique for predicting population growth. Using logistically and exponentially growing population growth models, Mwakisisile and Mushi [15] produced a model for Tanzania's population growth. An inventory model for the best production of agricultural products was created by Bhattacharjee et al. [16] by taking into account the average consumption by a certain population.

3. Preliminaries:

3.1 Neutrosophic Set:

Let U be a universal set. A neutrosophic set on U is denoted by the relation as $B=\left[T_B(u), I_B(u), F_B(u): u \in U\right]$ where $T_B(u), I_B(u), F_B(u): U \rightarrow -]0,1[+$ portraits the level of enrollment, indeterministic and non-participation of the component $u \in U$ with the condition that $-0 \leq T_B(u)+I_B(u)+F_B(u) \leq 3+ \forall u \in U$.

3.2 Neutrosophic Fuzzy Number:

A neutrosophic set B defined by the complete ordering of real numbers R is considered a neutrosophic number if, in the remote possibility that it possesses the following characteristics:

(i) B is normal if $\exists u_0 \in R$ such that $T_B(u_0)=I_B(u_0)=F_B(u_0)$.

(ii) B is an convex set for the truth function with the condition that the set, $T_B(\mu u_1+(1-\mu)u_2) \geq \min\left(T_B(u_1), T_B(u_2)\right) \forall u_1, u_2 \in R, \mu \in [0,1]$.

(iii) B is an convex set for the indeterministic and falsity function with the condition such that the set has $I_B(\mu u_1+(1-\mu)u_2) \geq \max\left(I_B(u_1), I_B(u_2)\right) \forall u_1, u_2 \in R, \mu \in [0,1]$ and $F_B(\mu u_1+(1-\mu)u_2) \geq \max\left(F_B(u_1), F_B(u_2)\right) \forall u_1, u_2 \in R, \mu \in [0,1]$.

3.3 Trapezoidal Neutrosophic Fuzzy Number:

A trapezoidal neutrosophic fuzzy number $B=\left(b_1, b_2, b_3, b_4, u_B, v_B, w_B\right)$ in R with the following truth, indeterminacy and falsity function as,

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$$T_{\tilde{B}}(u)=\begin{cases}0; & u\prec b_1\, or\, u\succ b_1\\ \dfrac{u-b_1}{b_2-b_1}u_B; & b_1\le u\le b_2\\ u_B; & b_2\le x\le b_3\\ \dfrac{b_4-u}{b_4-b_3}u_B; & b_3\le u\le b_4\\ 1; & otherwise\end{cases}$$

$$I_{\tilde{B}}(u)=\begin{cases}0; & u\prec b_1\, or\, u\succ b_1\\ \dfrac{b_2-u}{b_2-b_1}v_B; & b_1\le u\le b_2\\ v_B; & b_2\le x\le b_3\\ \dfrac{b_4-u}{b_4-b_3}v_B; & b_3\le u\le b_4\\ 1; & otherwise\end{cases}$$

$$F_{\tilde{B}}(u)=\begin{cases}0; & u\prec b_1\, or\, u\succ b_1\\ \dfrac{b_2-u}{b_2-b_1}w_B; & b_1\le u\le b_2\\ w_B; & b_2\le x\le b_3\\ \dfrac{b_4-u}{b_4-b_3}u_B; & b_3\le u\le b_4\\ 1; & otherwise\end{cases}$$

3.4 Score Function Of Trapezoidal Neutrosophic Fuzzy Number:

Let $B=\left\{\left[T^L,T^U\right],\left[I^L,I^U\right],\left[F^L,F^U\right]\right\}$ be an interval valued neutrosophic fuzzy number, then its score function is drawn as, $S(B)=\dfrac{T^L+T^U}{2}+1-\dfrac{I^L+I^U}{2}+\dfrac{F^L+F^U}{2}$.

3.5 Geometric Programming Problem:

Primal program:

Primal Geometric programming problem is

$$\text{Minimize } g_0(x)=\sum_{k=1}^{T_o}C_{0k}\prod_{j=1}^{m}at_j^{\,b_{0kj}}$$

$$\text{subject to } \sum_{k=1}^{T_0}C_{rk}\prod_{j=1}^{m}at_j^{\,b_{rkj}}\le 1,\ r=1,2,,,,I;\ j=1,2,....m;\ t_j\succ 0$$

$$C_{0k}\succ 0;\ k=1,2,,,,,,T_0$$

where C_{rk} and b_{rk} are real numbers. The above mentioned is a constrained posynomial problem in which the number of each term in the constrained function varies. It is denoted by T for each $r=0,1,2,\ldots.$ Let

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$T = T_0 + T_1 + ...T_m$ be the total number of terms in the primal program then the degree of difficulty is $T-(m+1)$.

Dual program:

Maximize: $\prod_{r=0}^{l}\sum_{k=1}^{T_r}\left(\frac{C_{rk}}{\delta_{rk}}\right)^{\delta_{rk}}\left(\sum_{S=1+T_{r+1}}^{T}(\delta_{rs})\right)^{\delta_{rk}}$

subject to: $\sum_{k=1}^{T_0}\delta_{0k} = 1$ (Normality condition)

$$\sum_{r=o}^{l}\sum_{k=1}^{T_r} b_{rk_j}\delta_k = 0 \quad \text{(Orthogonality condition)}$$

$$\delta_{rk} \succ 0 \quad \text{(Positive constant)}$$

4. Assumptions:

Following assumptions are considered in the inventory model during the production of Confectionary at the time of festive seasons.

1. Lead interim is zero.
2. n^n denotes the sum total of non-diabetic persons who may become diabetic an $n^n \succ 0$ as non-diabetic person are in excess than diabetic persons.
3. The claim for confectioneries is $r(t) = s_i X(t)$.
4. While environmental investment is contemplated $e^{-a'G^t}$,time cost of greenhouse emissions diminishes at which $0 \prec a' \prec 1$ will be the susceptivity of environmental investment.
5. A boundless outlining purview is regarded.
6. Demand rate is less than the production rate.
7. If conservation mechanization is given due to consideration, then the cost of decay is personified as $d^c \alpha e^{-\omega' P^t}$ where $0 \prec \omega' \prec 1$ is the cost of conservation susceptivity.
8. The estimate of minimized decay is considered as $f(\alpha) = 1 - \frac{1}{1+\gamma' P^t}, \gamma' \succ 0$ that which is augmenting, continual and incurvate function of conservation mechanization outlay ‘ P^t ’.

5. Notations:

$X(t)$ – Size of Juvenile diabetes at given time t

$d_i^p(t)$ – Inceptive Juvenile diabetes

ρ – Increase in rate of Juvenile diabetes where $0 \prec \rho \prec 1$

n^n – Number of non-juvenile diabetic people who are in the state of developing juvenile diabetes

s_i – Average amount of confectionery consumed by an individual

$I_i(t)$ – Net quantity of confectionery produced at given time t

α – Rate of downturn where $0 \le \alpha \prec 1$

$f(\alpha)$ – Proportion of drop in the downturn rate, $0 \le f(\alpha) \le 1$.

s^u – Setup cost for an order

d^c – Downturn cost per unit per annum

t^c – Conveyance cost per unit per annum

f^p – Moored manufacturing rate per unit per annum

m^c – Cost of manufacturing the items

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h^u – Holding cost of confectionery for a unit manufactured per annum
d_{ce} – Downturn interallied with the emission of carbon
m_{ce}^c – Manufacturing cost associated with outrush of carbon
h_{ce}^u – Holding cost related to the release of carbon
t_{ce}^c – Cost of transporting the confectionery analogous to the carbon emission
c^t – Carbon tax for unit released per annum
G^t – Investment in cleantech environment
P^t – Amount invested in preservation technology
T – Duration of cycle in years
m^r – Manufacturing rate
f^f – Moored rate for manufacturing a flyer
v^f – Unit level cost for manufacturing a flyer
n^f – Number of employees engaged in distributing a flyer
e^c – Cost per employee
t^d – Distance travelled
f^t – Moored cost per trip
v^t – Unit level cost per trip
f^a – Moored cost for each time the advertisement is broadcasted
v^a – Unit level cost for advertising the announcement every time
n^a – Number of times the advertisement is broadcasted
o^a – Cost for broadcasting the advertisement once

6. Mathematical Conceptualization:

6.1 Crisp Paradigm:

With an initial state of $X(0) = d_i^p(t)$, the growth of the diabetes population number is represented as $\frac{dX(t)}{dt} = \rho X(t) + n^n$ across the time interval $[0, T]$. Therefore, the number of people with diabetes at time t is $X(t) = d_i^p(t)e^{\rho t} + \frac{n^n}{\rho}\left(e^{\rho t} - 1\right)$. Let s_i be the average rate of consumption of sweets per individual in an unit time t, then the total amount of sweets consumed by all diabetic patient is $r(t) = s_i\left[d_i^p(t)e^{\rho t} + \frac{n^n}{\rho}\left(e^{\rho t} - 1\right)\right]$. The differential equation $\frac{dI_i(t)}{dt} + \alpha I_i(t) = m^r - r(t)$ represents the inventory model for production across the time span $[0, T]$, with the initial $s_i d_i^p(t)$ inventory level at the moment $t = 0$. At this moment, the production of gross sweets aimed at the diabetic population over the time interval t is

$$I_i(t) = \frac{1}{\rho\alpha(\rho+\alpha)}\Big\{\Big(-\rho e^{-\alpha t}\left(m^r - \rho d_i^p(t)\alpha\right)\rho - \rho d_i^p(t)\alpha^2 + \alpha\left(m^r - \rho d_i^p(t)\right) + n^n s_i\Big) - s_i\alpha e^{\rho t}\left(\rho d_i^p(t) + n^n\right) + \left(\rho+\alpha\right)\left(n^n s_i + m^r\rho\right)\Big\}$$

The following model looks at six distinct models, each of which relates to a distinct scenario.

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Prototype 1:

The following expenses are pertinent during the interval $[0,T]$ when confectioneries are not preserved and are not given straight to retailers.

Cost for placing an order is given by s^u

Rate at which downturn occurs is $d^c\alpha\int_0^T I_i(t)dt$

Manufacturing fee is $f^p m^r T\int_0^T r(t)dt$

Conveyance charge to carry the confectioneries are $t^c\int_0^T r(t)dt$

Moored rate for manufacturing a flyer, unit level cost for manufacturing a flyer, number of employees engaged in distributing a flyer and the cost per employee are given by f^f, v^f, n^f, e^c respectively.

The average total expense for making confectioneries is deliberated by,

$$T_1^c = \frac{1}{T}\left\{\begin{array}{l} s^u + d^c\alpha\left(\frac{s_i d_i^p(t)}{\rho}\left(e^{-\rho T}-1\right)+\frac{m^r}{\rho^2}\left(1-T\rho-e^{-\rho T}\right)+s_i\left(\begin{array}{l}\frac{d_i^p(t)}{\alpha+\rho}\left(\frac{e^{\rho T}-1}{\rho}+\frac{e^{-\alpha T}-1}{\alpha}\right)+\\ \frac{n^n}{\rho}\left(\frac{e^{\rho T}-1}{(\alpha+\rho)\rho}-\frac{T}{\alpha}+\frac{\rho(1-e^{-\alpha T})}{(\alpha+\rho)\alpha^2}\right)\end{array}\right)\right)+ \\ f^p m^r T+\left(\frac{m^c}{m^r}+t^c\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i\left(e^{\rho T}-1\right)+n^n\left(e^{\rho T}-\rho T-1\right)\right)+f^f+v^f+n^f+e^c \end{array}\right\}$$

Here m^r and T are decision variables and their values are obtained by finding the partial derivative of the total cost with respect to m^r and T.

Prototype 2:

The added expense of storing the manufactured confectioneries in the warehouse before to delivering it to the retailer is,

Cost of holding the confectioneries is $h^u\int_0^T I_i(t)dt$

Moored cost for broadcasting the advertisement each time, Unit level cost for advertising the announcement every time, Number of times the advertisement is broadcasted and Cost for broadcasting the advertisement once are given by f^a, v^a, n^a, o^a respectively.

The average total expense is delined by,

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$$T_2^c=\frac{1}{T}\left\{\begin{array}{l} s^u+\left(d^c\alpha+h^u\right)\left(\frac{s_i d_i^p(t)}{\rho}\left(e^{-\rho T}-1\right)+\frac{m^r}{\rho^2}\left(1-T\rho-e^{-\rho T}\right)+s_i\left(\begin{array}{l}\frac{d_i^p(t)}{\alpha+\rho}\left(\frac{e^{\rho T}-1}{\rho}+\frac{e^{-\alpha T}-1}{\alpha}\right)+\\ \frac{n^n}{\rho}\left(\frac{e^{\rho T}-1}{(\alpha+\rho)\rho}-\frac{T}{\alpha}+\frac{\rho(1-e^{-\alpha T})}{(\alpha+\rho)\alpha^2}\right)\end{array}\right)\right)+\\ f^p m^r T+\left(\frac{m^c}{m^r}+t^c\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i\left(e^{\rho T}-1\right)+n^n\left(e^{\rho T}-\rho T-1\right)\right)+f^f+v^f+n^f+e^c+f^a+v^a+n^a+o^a \end{array}\right\}$$

In this case, m^r and T are decision variables and their values are obtained by finding the partial derivative of the total cost with respect to m^r and T.

Prototype 3:

When confectioneries are manufactured, transported, stored and eventually when they deteriorate carbon is released. Therefore, all expenses related to carbon emissions are subject to a carbon tax.

The price of carbon emissions from inventory storage is, $HC^E=h_{ce}^u\int_0^T I_i(t)dt$

Price of carbon emissions incurred by moving inventory is, $FT^E=t_{ce}^c\int_0^T r(t)dt$

Price of carbon acquired during the production process is, $PP^E=f^p m^r T+\frac{m_{ce}^c}{m^r}\int_0^T r(t)dt$

Costs of carbon emissions resulting from depreciating stock is, $DT^E=d_{ce}\alpha\int_0^T I_i(t)dt$

Distance travelled, moored cost per trip and unit level cost per trip are given by t^d, f^t, v^t respectively.

Hence, the total expense is given by,

$$T_3^c=\frac{1}{T}\left\{\begin{array}{l} s^u+\left(d^c\alpha+h^u+c^t\left(d_{ce}\alpha+h_{ce}^u\right)\right)\times\\ \left(\frac{s_i d_i^p(t)}{\rho}\left(e^{-\rho T}-1\right)+\frac{m^r}{\rho^2}\left(1-T\rho-e^{-\rho T}\right)+s_i\left(\begin{array}{l}\frac{d_i^p(t)}{\alpha+\rho}\left(\frac{e^{\rho T}-1}{\rho}+\frac{e^{-\alpha T}-1}{\alpha}\right)+\\ \frac{n^n}{\rho}\left(\frac{e^{\rho T}-1}{(\alpha+\rho)\rho}-\frac{T}{\alpha}+\frac{\rho(1-e^{-\alpha T})}{(\alpha+\rho)\alpha^2}\right)\end{array}\right)\right)+\\ f^p m^r T\left(1+c^t\right)+\left(\frac{m^c}{m^r}+t^c+c^t\left(t_{ce}+\frac{m_{ce}^u}{m^r}\right)\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i\left(e^{\rho T}-1\right)+n^n\left(e^{\rho T}-\rho T-1\right)\right)+\\ f^f+v^f+n^f+e^c+f^a+v^a+n^a+o^a+t^d+f^t+v^t \end{array}\right\}$$

where m^r and T are decision variables and their values are obtained by finding the partial derivative of the total cost with respect to m^r and T.

Prototype 4:

The investor makes some investment in green technologies in order to lower carbon emissions from four carbon-emitting sectors such as: creating, transporting, storing, and decaying of sweets. Reduced carbon emission cost after green technology investment is computed as,

$$t_{ce}^c=c^t e^{-a'G^t}\left[HC^E+FT^E+PP^E+DT^E\right]$$

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$$T_4^c = \frac{1}{T}\left\{\begin{array}{l} s^u + G^t + \left(d^c\alpha + h^u + c^t e^{-a'G^t}\left(d_{ce}\alpha + h_{ce}^u\right)\right)\times \\ \left(\frac{s_i d_i^p(t)}{\rho}\left(e^{-\rho T}-1\right) + \frac{m^r}{\rho^2}\left(1 - T\rho - e^{-\rho T}\right) + s_i\left(\begin{array}{l}\frac{d_i^p(t)}{\alpha+\rho}\left(\frac{e^{\rho T}-1}{\rho} + \frac{e^{-\alpha T}-1}{\alpha}\right) + \\ \frac{n^n}{\rho}\left(\frac{e^{\rho T}-1}{(\alpha+\rho)\rho} - \frac{T}{\alpha} + \frac{\rho(1-e^{-\alpha T})}{(\alpha+\rho)\alpha^2}\right)\end{array}\right)\right) + \\ f^p m^r T\left(1 + c^t e^{-a'G^t}\right) + \left(\frac{m^c}{m^r} + t^c + c^t e^{-a'G^t}\left(t_{ce} + \frac{m_{ce}^u}{m^r}\right)\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i\left(e^{\rho T}-1\right) + n^n\left(e^{\rho T} - \rho T - 1\right)\right) + \\ f^f + v^f + n^f + e^c + f^a + v^a + n^a + o^a + t^d + f^t + v^t \end{array}\right\}$$

Here m^r, T and G^t are decision variables and their values are obtained by finding the partial derivative of the total cost with respect to m^r, T and G^t.

Prototype 5:

The inventory level for the current model at the time $t = 0$ is determined by the differential equation $\frac{dI_2'(t)}{dt} + \alpha(1 - f(\alpha))I_2'(t) = m^r - r(t)$ with an initial $s_i d_i^p(t)$ inventory level at the time $t = 0$. At this point, the gross confectionery output to reach the juvenile diabetic population is,

$$I_2'(t) = d_i^p(t)e^{-\alpha(1-f(\alpha))t} + \frac{m^r\rho + s_i n^n}{\rho\alpha(1-f(\alpha)}\left(1 - e^{-\alpha(1-f(\alpha))t}\right) - \left(\frac{\rho s_i d_i^p(t) + s_i n^n}{\rho\left(\rho + \alpha(1-f(\alpha))\right)}\right)\left(e^{\rho t} - e^{-\alpha(1-f(\alpha))t}\right)$$

The following are some pertinent production system costs:

Downturn rate is obtained to be $d^c\alpha e^{-\omega' p^t}\int_0^T I_2'(t)dt$

Holding cost is found to be $h^u\int_0^T I_2'(t)dt$

Investment in preservation technology is, $p^t T$

In this context, the total expense is outlaid by,

$$T_5^c = \frac{1}{T}\left\{\begin{array}{l} s^u + \left(d^c\alpha e^{-\omega' p^t} + h^u\right)\times \\ \left(\frac{e^{-\alpha(1-f(\alpha))T}-1}{-\alpha(1-f(\alpha))}\left(\begin{array}{l}\left(s_i - \frac{m^r\rho + s_i n^n}{\rho\alpha(1-f(\alpha)} + \frac{s_i\left(\rho d_i^p(t) + n^n\right)}{\rho\left(\rho+\alpha(1-f(\alpha))\right)}\right) + T\frac{m^r\rho + s_i n^n}{\rho\alpha(1-f(\alpha)} - \\ \frac{s_i\left(\rho d_i^p(t) + n^n\right)}{\rho\left(\rho+\alpha(1-f(\alpha))\right)}\frac{e^{\rho T}-1}{\rho}\end{array}\right)\right) + \\ f^p m^r T + \left(\frac{m^c}{m^r} + t^c c^t e^{-a'G^t}\left(t_{ce} + \frac{m_{ce}^u}{m^r}\right)\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i\left(e^{\rho T}-1\right) + n^n\left(e^{\rho T} - \rho T - 1\right)\right) + f^f + v^f + n^f + \\ e^c + f^a + v^a + n^a + o^a + t^d + f^t + v^t + p^t T + G^t \end{array}\right\}$$

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Here m^r, T and p^t are decision variables and their values are obtained by finding the partial derivative of the total cost with respect to m^r, T and p^t.

Prototype 6:

Investments in green technology and preservation technology will lower carbon emissions and the pace of downturn respectively. Here are a few additional expenses related to carbon emissions resulting from sustaining inventory and depreciating inventory:

The price of carbon emissions from holding inventory is $HC^E_{P,G^t} = h^u_{ce}\int_0^T I_2'(t)dt$

The price of carbon emissions resulting from depreciating stock is $DC^E_{P,G^t} = d_{ce}\alpha\int_0^T I_2'(t)dt$

The slumped expense of carbon emissions is obtained to be summing up the following notations, $c^t e^{-a'G^t}\left[HC^E_{P,G^t} + DC^E_{P,G^t} + FT^E + PP^E\right]$

Here the average total expense is given by,

$$T_6^c = \frac{1}{T}\left\{\begin{array}{l} s^u + \left(d^c\alpha e^{-\omega' p^t} + h^u + c^t e^{-a'G^t}\left(d_{ce}\alpha + h^u_{ce}\right)\right)\times \\ \left(\frac{e^{-\alpha(1-f(\alpha))T}-1}{-\alpha(1-f(\alpha))}\left(\begin{array}{l}\left(s_i - \frac{m^r\rho + s_i n^n}{\rho\alpha(1-f(\alpha)} + \frac{s_i\left(\rho d_i^p(t)+n^n\right)}{\rho\left(\rho+\alpha(1-f(\alpha)\right)}\right) + T\frac{m^r\rho + s_i n^n}{\rho\alpha(1-f(\alpha)} - \\ \frac{s_i\left(\rho d_i^p(t)+n^n\right)}{\rho\left(\rho+\alpha(1-f(\alpha)\right)}\frac{e^{\rho T}-1}{\rho}\end{array}\right)\right) + \\ f^p m^r T\left(1+c^t e^{-a'G^t}\right) + \left(\frac{m^c}{m^r}+t^c\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i\left(e^{\rho T}-1\right) + n^n\left(e^{\rho T}-\rho T-1\right)\right) + f^f + v^f + \\ n^f + e^c + f^a + v^a + n^a + o^a + t^d + f^t + v^t + p^t T \end{array}\right\}$$

Here m^r, T, G^t and p^t are decision variables and their values are obtained by finding the partial derivative of the total cost with respect to m^r, T, G^t and p^t.

6.2 FUZZY PARADIGM:

Prototype 1:

$$T_1^c = \frac{1}{T}\left\{\begin{array}{l} s^u + d^c\alpha\left(\frac{s_i d_i^p(t)}{\rho}\left(e^{-\rho T}-1\right) + \frac{m^r}{\rho^2}\left(1-T\rho-e^{-\rho T}\right) + s_i\left(\begin{array}{l}\frac{d_i^p(t)}{\alpha+\rho}\left(\frac{e^{\rho T}-1}{\rho}+\frac{e^{-\alpha T}-1}{\alpha}\right) + \\ \frac{n^n}{\rho}\left(\frac{e^{\rho T}-1}{(\alpha+\rho)\rho} - \frac{T}{\alpha} + \frac{\rho(1-e^{-\alpha T})}{(\alpha+\rho)\alpha^2}\right)\end{array}\right)\right) + \\ f^p m^r T + \left(\frac{m^c}{m^r}+t^c\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i\left(e^{\rho T}-1\right) + n^n\left(e^{\rho T}-\rho T-1\right)\right) + f^f + v^f + n^f + e^c \end{array}\right\}$$

Being that the number under consideration is a trapezoidal neutrosophic fuzzy number,

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$$T_1^c = \frac{1}{T}\left\{\begin{array}{l} s^{uN} + d^{cN}\alpha\left(\frac{s_i d_i^p(t)}{\rho}\left(e^{-\rho T}-1\right)+\frac{m^r}{\rho^2}\left(1-T\rho-e^{-\rho T}\right)+s_i\left(\begin{array}{l}\frac{d_i^p(t)}{\alpha+\rho}\left(\frac{e^{\rho T}-1}{\rho}+\frac{e^{-\alpha T}-1}{\alpha}\right)+\\ \frac{n^n}{\rho}\left(\frac{e^{\rho T}-1}{(\alpha+\rho)\rho}-\frac{T}{\alpha}+\frac{\rho(1-e^{-\alpha T})}{(\alpha+\rho)\alpha^2}\right)\end{array}\right)\right)+ \\ f^{pN}m^r T+\left(\frac{m^{cN}}{m^r}+t^{cN}\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i\left(e^{\rho T}-1\right)+n^n\left(e^{\rho T}-\rho T-1\right)\right)+f^f+v^{fN}+n^f+e^{cN}\end{array}\right\}$$

Through utilisation of the Duffin's and Peterson's theorem and the geometric programming technique with a degree of complexity of zero.

$$m^r = \left\{d^c\left(\frac{1}{\alpha}\left(1-T\rho-e^{-\rho T}\right)\right)+f^pT-\left(\frac{m^{cN}}{m^{r2}}\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i\left(e^{\rho T}-1\right)+n^n\left(e^{\rho T}-\rho T-1\right)\right)\right\}$$

$$T = \left\{\begin{array}{l} s^{u} + d^{c}\alpha\left(\frac{s_i d_i^p(t)}{\rho}\left(e^{-\rho T}-1\right)+\frac{m^r}{\rho^2}\left(1-T\rho-e^{-\rho T}\right)+s_i\left(\begin{array}{l}\frac{d_i^p(t)}{\alpha+\rho}\left(\frac{e^{\rho T}-1}{\rho}+\frac{e^{-\alpha T}-1}{\alpha}\right)+\\ \frac{n^n}{\rho}\left(\frac{e^{\rho T}-1}{(\alpha+\rho)\rho}-\frac{T}{\alpha}+\frac{\rho(1-e^{-\alpha T})}{(\alpha+\rho)\alpha^2}\right)\end{array}\right)\right)+ \\ f^{p}m^r T+\left(\frac{m^{c}}{m^r}+t^{c}\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i\left(e^{\rho T}-1\right)+n^n\left(e^{\rho T}-\rho T-1\right)\right)+f^f+v^{f}+n^f+e^{c}\end{array}\right\}+$$

$$\left\{d^c\alpha\left(\begin{array}{l} s_i d_i^p(t)e^{-\rho T}+\frac{m^r}{\rho^2}\left(1-T\rho-e^{-\rho T}\right)+\left(s_i\left(\begin{array}{l}\frac{d_i^p(t)}{\alpha+\rho}\left(\frac{e^{\rho T}-1}{\rho}+\frac{e^{-\alpha T}-1}{\alpha}\right)+\\ \frac{n^n}{\rho}\left(\frac{e^{\rho T}-1}{(\alpha+\rho)\rho}-\frac{T}{\alpha}+\frac{\rho(1-e^{-\alpha T})}{(\alpha+\rho)\alpha^2}\right)\end{array}\right)+f^pm^r+ \\ \left(\frac{m^c}{m^r}+t^c\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i e^{\rho T}+n^n\left(e^{\rho T}-\rho\right)\right)\end{array}\right)\right)\right\}$$

Prototype 2:

$$T_2^c = \frac{1}{T}\left\{\begin{array}{l} s^{u} + \left(d^{c}\alpha+h^u\right)\left(\frac{s_i d_i^p(t)}{\rho}\left(e^{-\rho T}-1\right)+\frac{m^r}{\rho^2}\left(1-T\rho-e^{-\rho T}\right)+s_i\left(\begin{array}{l}\frac{d_i^p(t)}{\alpha+\rho}\left(\frac{e^{\rho T}-1}{\rho}+\frac{e^{-\alpha T}-1}{\alpha}\right)+\\ \frac{n^n}{\rho}\left(\frac{e^{\rho T}-1}{(\alpha+\rho)\rho}-\frac{T}{\alpha}+\frac{\rho(1-e^{-\alpha T})}{(\alpha+\rho)\alpha^2}\right)\end{array}\right)\right)+ \\ f^{p}m^r T+\left(\frac{m^{c}}{m^r}+t^{c}\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i\left(e^{\rho T}-1\right)+n^n\left(e^{\rho T}-\rho T-1\right)\right)+f^f+v^{f}+n^f+e^{c}+f^a+v^a+n^a+o^a\end{array}\right\}$$

Being that the number under consideration is a trapezoidal neutrosophic fuzzy number,

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$$T_2^c = \frac{1}{T}\left\{ \begin{array}{l} s^{uN} + \left(d^{cN}\alpha^N + h^{uN}\right) \left(\frac{s_i d_i^p(t)}{\rho}\left(e^{-\rho T}-1\right) + \frac{m^r}{\rho^2}\left(1-T\rho - e^{-\rho T}\right) + s_i \left(\begin{array}{l} \frac{d_i^p(t)}{\alpha+\rho}\left(\frac{e^{\rho T}-1}{\rho}+\frac{e^{-\alpha T}-1}{\alpha}\right)+ \\ \frac{n^n}{\rho}\left(\frac{e^{\rho T}-1}{(\alpha+\rho)\rho} - \frac{T}{\alpha} + \frac{\rho(1-e^{-\alpha T})}{(\alpha+\rho)\alpha^2}\right)\end{array}\right)\right) + \\ f^{pN} m^r T + \left(\frac{m^{cN}}{m^r}+t^{cN}\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i\left(e^{\rho T}-1\right) + n^n\left(e^{\rho T}-\rho T - 1\right)\right) + f^f + v^{fN} + n^f + e^{cN} + f^a + v^{aN} + n^a + o^{aN}\end{array}\right\}$$

Through utilisation of the Duffin's and Peterson's theorem and the geometric programming technique with a degree of complexity of zero.

$$m^r = \left\{\left(d^c\alpha + h^u\right)\left(\frac{1}{\alpha}\left(1-T\rho-e^{-\rho T}\right)\right) + f^p T - \left(\frac{m^{cN}}{m^{r2}}\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i\left(e^{\rho T}-1\right)+n^n\left(e^{\rho T}-\rho T-1\right)\right)\right\}$$

$$T = \left\{ \begin{array}{l} s^{u} + \left(d^{c}\alpha + h^{u}\right) \left(\frac{s_i d_i^p(t)}{\rho}\left(e^{-\rho T}-1\right) + \frac{m^r}{\rho^2}\left(1-T\rho - e^{-\rho T}\right) + s_i \left(\begin{array}{l} \frac{d_i^p(t)}{\alpha+\rho}\left(\frac{e^{\rho T}-1}{\rho}+\frac{e^{-\alpha T}-1}{\alpha}\right)+ \\ \frac{n^n}{\rho}\left(\frac{e^{\rho T}-1}{(\alpha+\rho)\rho} - \frac{T}{\alpha} + \frac{\rho(1-e^{-\alpha T})}{(\alpha+\rho)\alpha^2}\right)\end{array}\right)\right) + \\ f^{p} m^r T + \left(\frac{m^{c}}{m^r}+t^{c}\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i\left(e^{\rho T}-1\right) + n^n\left(e^{\rho T}-\rho T - 1\right)\right) + f^f + v^{f} + n^f + e^{c}\end{array}\right\} +$$

$$\left\{\left(d^c\alpha+h^u\right)\left(\begin{array}{l} s_i d_i^p(t) e^{-\rho T} + \frac{m^r}{\rho^2}\left(1-T\rho-e^{-\rho T}\right) + \left(s_i \left(\begin{array}{l} \frac{d_i^p(t)}{\alpha+\rho}\left(\frac{e^{\rho T}-1}{\rho}+\frac{e^{-\alpha T}-1}{\alpha}\right)+ \\ \frac{n^n}{\rho}\left(\frac{e^{\rho T}-1}{(\alpha+\rho)\rho} - \frac{T}{\alpha} + \frac{\rho(1-e^{-\alpha T})}{(\alpha+\rho)\alpha^2}\right)\end{array}\right)\right) + f^p m^r + \\ \left(\frac{m^c}{m^r}+t^c\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i e^{\rho T} + n^n\left(e^{\rho T}-\rho\right)\right)\end{array}\right)\right\}$$

Prototype 3:

$$T_3^c = \frac{1}{T}\left\{ \begin{array}{l} s^u + \left(d^c\alpha + h^u + c^t\left(d_{ce}\alpha + h_{ce}^u\right)\right)\times \\ \left(\frac{s_i d_i^p(t)}{\rho}\left(e^{-\rho T}-1\right) + \frac{m^r}{\rho^2}\left(1-T\rho - e^{-\rho T}\right) + s_i \left(\begin{array}{l} \frac{d_i^p(t)}{\alpha+\rho}\left(\frac{e^{\rho T}-1}{\rho}+\frac{e^{-\alpha T}-1}{\alpha}\right)+ \\ \frac{n^n}{\rho}\left(\frac{e^{\rho T}-1}{(\alpha+\rho)\rho} - \frac{T}{\alpha} + \frac{\rho(1-e^{-\alpha T})}{(\alpha+\rho)\alpha^2}\right)\end{array}\right)\right) + \\ f^p m^r T\left(1+c^t\right) + \left(\frac{m^c}{m^r} + t^c + c^t\left(t_{ce} + \frac{m_{ce}^u}{m^r}\right)\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i\left(e^{\rho T}-1\right)+n^n\left(e^{\rho T}-\rho T-1\right)\right) + \\ f^f + v^f + n^f + e^c + f^a + v^a + n^a + o^a + t^d + f^t + v^t \end{array}\right\}$$

Being that the number under consideration is a trapezoidal neutrosophic fuzzy number,

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$$T_3^c = \frac{1}{T}\left\{\begin{array}{l} s^{uN} + \left(d^{cN}\alpha^N + h^{uN} + c^t\left(d_{ce}{}^N\alpha^N + h_{ce}^{u\,N}\right)\right)\times \\ \left(\frac{s_i d_i^p(t)}{\rho}\left(e^{-\rho T}-1\right) + \frac{m^r}{\rho^2}\left(1-T\rho-e^{-\rho T}\right) + s_i\left(\begin{array}{l}\frac{d_i^p(t)}{\alpha+\rho}\left(\frac{e^{\rho T}-1}{\rho}+\frac{e^{-\alpha T}-1}{\alpha}\right)+ \\ \frac{n^n}{\rho}\left(\frac{e^{\rho T}-1}{(\alpha+\rho)\rho}-\frac{T}{\alpha}+\frac{\rho(1-e^{-\alpha T})}{(\alpha+\rho)\alpha^2}\right)\end{array}\right)\right)+ \\ f^{pN}m^r T\left(1+c^t\right)+\left(\frac{m^{cN}}{m^r}+t^{cN}+c^t\left(t_{ce}{}^N+\frac{m_{ce}^{u\,N}}{m^r}\right)\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i\left(e^{\rho T}-1\right)+n^n\left(e^{\rho T}-\rho T-1\right)\right)+ \\ f^f + v^{fN} + n^f + e^{cN} + f^a + v^{aN} + n^a + o^{aN} + t^d + f^t + v^{tN} \end{array}\right\}$$

Through utilisation of the Duffin's and Peterson's theorem and the geometric programming technique with a degree of complexity of zero.

$$m^r = \left\{\frac{\left(d^c\alpha + h^u + c^t\left(d_{ce}\alpha + h_{ce}^u\right)\right)\left(\frac{1}{\alpha}\left(1-T\rho-e^{-\rho T}\right)\right) + f^p T\left(1+c^t\right) - \left(\frac{m^{cN}+c^t m_{ce}^c}{m^{r2}}\right)\left(\frac{s_i}{\rho^2}\right)}{\left(\rho s_i\left(e^{\rho T}-1\right)+n^n\left(e^{\rho T}-\rho T-1\right)\right)}\right\}$$

$$T = \left\{\frac{\begin{array}{l} s^u + \left(d^c\alpha + h^u + c^t\left(d_{ce}\alpha + h_{ce}^u\right)\right)\left(\frac{s_i d_i^p(t)}{\rho}\left(e^{-\rho T}-1\right)+\frac{m^r}{\rho^2}\left(1-T\rho-e^{-\rho T}\right)+s_i\left(\begin{array}{l}\frac{d_i^p(t)}{\alpha+\rho}\left(\frac{e^{\rho T}-1}{\rho}+\frac{e^{-\alpha T}-1}{\alpha}\right)+ \\ \frac{n^n}{\rho}\left(\frac{e^{\rho T}-1}{(\alpha+\rho)\rho}-\frac{T}{\alpha}+\frac{\rho(1-e^{-\alpha T})}{(\alpha+\rho)\alpha^2}\right)\end{array}\right)\right)+ \\ f^p m^r T\left(1+c^t\right)+\left(\frac{m^c}{m^r}+t^c+c^t\left(t_{ce}+\frac{m_{ce}^u}{m^r}\right)\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i\left(e^{\rho T}-1\right)+n^n\left(e^{\rho T}-\rho T-1\right)\right)+f^f+v^f+n^f+e^c \end{array}}{\left(d^c\alpha + h^u + c^t\left(d_{ce}\alpha + h_{ce}^u\right)\right)\left(\begin{array}{l} s_i d_i^p(t)e^{-\rho T}+\frac{m^r}{\rho^2}\left(1-T\rho-e^{-\rho T}\right)+\left(s_i\left(\begin{array}{l}\frac{d_i^p(t)}{\alpha+\rho}\left(\frac{e^{\rho T}-1}{\rho}+\frac{e^{-\alpha T}-1}{\alpha}\right)+ \\ \frac{n^n}{\rho}\left(\frac{e^{\rho T}-1}{(\alpha+\rho)\rho}-\frac{T}{\alpha}+\frac{\rho(1-e^{-\alpha T})}{(\alpha+\rho)\alpha^2}\right)\end{array}\right)\right)+ \\ f^p m^r T\left(1+c^t\right)+\left(\frac{m^c}{m^r}+t^c+c^t\left(t_{ce}+\frac{m_{ce}^u}{m^r}\right)\right)\left(\frac{s_i}{\rho^2}\right)\left(\rho s_i e^{\rho T}+n^n\left(e^{\rho T}-\rho\right)\right)\end{array}\right)}\right\}$$

In the similar manner, the remaining prototypes are modelled and solved to obtain the optimal solution.

7. Numerical Example:

7.1 Crisp Paradigm:

$\gamma' = 4; d_i^p(t) = 10000 / individual; \rho = 0.05\%; s_i = 0.05 / annum; \alpha = 0.05\%; n^n = 100\, individuals / annum;$
$s^u = \$100 / order; f^p = \$100 / order; m^c = \$15 / order; d^c = \$0.8 / order; t^c = \$10 / unit / annum; a' = 0.2;$
$h^u = \$0.1 / unit / annum; m_{ce}^c = \$1 / unit / annum; c^t = \$1 / unit / annum; d_{ce} = \$0.4 / unit / annum; \omega' = 0.1;$
$t_{ce}^c = \$0.5 / unit / annum; h_{ce}^c = \$0.05 / unit / annum$

7.2 FUZZY PARADIGM:

The fuzzy values and their corresponding fuzzy trapezoidal neutrosophic values of parameters are given by,

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$$\tilde{\alpha} = (0.02, 0.04, 0.06, 0.08); \alpha^{N} = \left((0.02, 0.04, 0.06, 0.08), (0.01, 0.04, 0.06, 0.09), (0.01, 0.03, 0.05, 0.09)\right);$$

$$\left[T_{\alpha}^{L}, T_{\alpha}^{U}\right] = [80,120]; \left[I_{\alpha}^{L}, I_{\alpha}^{U}\right] = [75,125]; \left[F_{\alpha}^{L}, F_{\alpha}^{U}\right] = [70,125]$$

$$\tilde{d}^{c} = (0.77, 0.79, 0.81, 0.83); d^{cN} = \left((0.77, 0.79, 0.81, 0.83), (0.76, 0.79, 0.81, 0.84), (0.75, 0.78, 0.82, 0.85)\right);$$

$$\left[T_{d^c}^{L}, T_{d^c}^{U}\right] = [0.78, 0.82]; \left[I_{d^c}^{L}, I_{d^c}^{U}\right] = [0.78, 0.83]; \left[F_{d^c}^{L}, F_{d^c}^{U}\right] = [0.77, 0.84]$$

$$\tilde{s}^{u} = (70, 90, 110, 130); s^{u^N} = \left((70, 90, 110, 130), (60, 90, 110, 140), (50, 90, 120, 130)\right);$$

$$\left[T_{s^u}^{L}, T_{s^u}^{U}\right] = [80,120]; \left[I_{s^u}^{L}, I_{s^u}^{U}\right] = [75,125]; \left[F_{s^u}^{L}, F_{s^u}^{U}\right] = [70,125]$$

$$\tilde{t}^{c} = (7, 9, 11, 13); t^{c^N} = \left((7, 9, 11, 13), (6, 9, 11, 14), (5, 9, 12, 13)\right);$$

$$\left[T_{t^c}^{L}, T_{t^c}^{U}\right] = [8,12]; \left[I_{t^c}^{L}, I_{t^c}^{U}\right] = [7.5,12.5]; \left[F_{t^c}^{L}, F_{t^c}^{U}\right] = [7,12.5]$$

$$\tilde{f}^{p} = (40, 80, 120, 160); f^{p^N} = \left((40, 80, 120, 160), (30, 80, 120, 170), (20, 80, 120, 180)\right);$$

$$\left[T_{f^p}^{L}, T_{f^p}^{U}\right] = [60,140]; \left[I_{f^p}^{L}, I_{f^p}^{U}\right] = [55,145]; \left[F_{f^p}^{L}, F_{f^p}^{U}\right] = [50,150]$$

$$\tilde{m}^{c} = (12, 14, 16, 18); m^{c^N} = \left((12, 14, 16, 18), (11, 14, 16, 19), (10, 12, 18, 20)\right);$$

$$\left[T_{m^c}^{L}, T_{m^c}^{U}\right] = [13,17]; \left[I_{m^c}^{L}, I_{m^c}^{U}\right] = [12.5,17.5]; \left[F_{m^c}^{L}, F_{m^c}^{U}\right] = [11,19]$$

$$\tilde{h}^{u} = (0.07, 0.09, 0.11, 0.13); h^{u^N} = \left((0.07, 0.09, 0.11, 0.13), (0.06, 0.09, 0.11, 0.14),\right)(0.05, 0.08, 0.12, 0.15);$$

$$\left[T_{h^u}^{L}, T_{h^u}^{U}\right] = [0.08, 0.12]; \left[I_{h^u}^{L}, I_{h^u}^{U}\right] = [0.075, 0.125]; \left[F_{h^u}^{L}, F_{h^u}^{U}\right] = [0.065, 0.135]$$

$$\tilde{d}_{ce} = (0.37, 0.39, 0.41, 0.43); d_{ce}^{N} = \left((0.37, 0.39, 0.41, 0.43), (0.36, 0.39, 0.41, 0.43), (0.37, 0.38, 0.42, 0.43)\right);$$

$$\left[T_{d_{ce}}^{L}, T_{d_{ce}}^{U}\right] = [0.38, 0.42]; \left[I_{d_{ce}}^{L}, I_{d_{ce}}^{U}\right] = [0.375, 0.425]; \left[F_{d_{ce}}^{L}, F_{d_{ce}}^{U}\right] = [0.375, 0.425]$$

$$\tilde{m}_{ce}^{c} = (0.97, 0.99, 1.01, 1.03); m_{ce}^{c^N} = \left((0.97, 0.99, 1.01, 1.03), (0.96, 0.99, 1.01, 1.04), (0.95, 0.98, 1.02, 1.05)\right);$$

$$\left[T_{m_{ce}^c}^{L}, T_{m_{ce}^c}^{U}\right] = [0.98, 1.02]; \left[I_{m_{ce}^c}^{L}, I_{m_{ce}^c}^{U}\right] = [0.975, 1.025]; \left[F_{m_{ce}^c}^{L}, F_{m_{ce}^c}^{U}\right] = [0.375, 0.425]$$

$$\tilde{h}_{ce}^{u} = (0.02, 0.04, 0.06, 0.08); h_{ce}^{u^N} = \left((0.02, 0.04, 0.06, 0.08), (0.01, 0.04, 0.06, 0.09), (0.01, 0.03, 0.05, 0.09)\right);$$

$$\left[T_{h_{ce}^u}^{L}, T_{h_{ce}^u}^{U}\right] = [0.03, 0.07]; \left[I_{h_{ce}^u}^{L}, I_{h_{ce}^u}^{U}\right] = [0.025, 0.075]; \left[F_{h_{ce}^u}^{L}, F_{h_{ce}^u}^{U}\right] = [0.02, 0.07]$$

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$\tilde{t}^c_{ce} = (0.47, 0.49, 0.51, 0.53); t^{c^N}_{ce} = \left((0.47, 0.49, 0.51, 0.53), (0.46, 0.49, 0.51, 0.54), (0.45, 0.48, 0.52, 0.55)\right);$

$\left[T^L_{t^c_{ce}}, T^U_{t^c_{ce}}\right] = [0.48, 0.52]; \left[I^L_{t^c_{ce}}, I^U_{t^c_{ce}}\right] = [0.475, 0.525]; \left[F^L_{t^c_{ce}}, F^U_{t^c_{ce}}\right] = [0.465, 0.535]$

$\tilde{v}^f = (77.5, 152.5, 227.5, 302.5); v^{f^N} = \begin{pmatrix} (77.5, 152.5, 227.5, 302.5), (76.5, 152.5, 227.5, 303.5), \\ (75.5, 152.5, 228.5, 302.5) \end{pmatrix};$

$\left[T^L_{t^f_v}, T^U_{t^f_v}\right] = [115, 265]; \left[I^L_{t^f_v}, I^U_{t^f_v}\right] = [114.5, 265.5]; \left[F^L_{t^f_v}, F^U_{t^f_v}\right] = [114, 265.5]$

$\tilde{e}^c = (125, 175, 225, 275); e^{c^N} = \left((125, 175, 225, 275), (115, 175, 225, 285), (105, 165, 235, 295)\right);$

$\left[T^L_{t^c_e}, T^U_{t^c_e}\right] = [150, 250]; \left[I^L_{t^c_e}, I^U_{t^c_e}\right] = [145, 255]; \left[F^L_{t^c_e}, F^U_{t^c_e}\right] = [135, 265]$

$\tilde{v}^t = (20, 40, 60, 80); v^{t^N} = \left((20, 40, 60, 80), (10, 40, 60, 90), (20, 30, 50, 120)\right);$

$\left[T^L_{t^t_v}, T^U_{t^t_v}\right] = [30, 70]; \left[I^L_{t^t_v}, I^U_{t^t_v}\right] = [25, 75]; \left[F^L_{t^t_v}, F^U_{t^t_v}\right] = [25, 85]$

$\tilde{v}^a = (75, 125, 175, 225); v^{a^N} = \left((75, 125, 175, 225), (65, 125, 175, 235), (55, 135, 165, 245)\right);$

$\left[T^L_{t^a_v}, T^U_{t^a_v}\right] = [100, 200]; \left[I^L_{t^a_v}, I^U_{t^a_v}\right] = [95, 205]; \left[F^L_{t^a_v}, F^U_{t^a_v}\right] = [95, 205]$

$\tilde{o}^a = (45, 95, 145, 195); o^{a^N} = \left((45, 95, 145, 195), (35, 95, 145, 205), (25, 105, 135, 215)\right);$

$\left[T^L_{t^a_o}, T^U_{t^a_o}\right] = [70, 170]; \left[I^L_{t^a_o}, I^U_{t^a_o}\right] = [65, 175]; \left[F^L_{t^a_o}, F^U_{t^a_o}\right] = [65, 175]$

The values of the score function for the above mentioned fuzzy parameters are,

$S\left(\alpha^N\right) = 1.045; S\left(d^{c^N}\right) = 1.8; S\left(s^{u^N}\right) = 98.5; S\left(t^{c^N}\right) = 10.75; S\left(f^{p^N}\right) = 101; S\left(m^{c^N}\right) = 16; S\left(h^{u^N}\right) = 1.1;$

$S\left(d_{ce}{}^N\right) = 1.4; S\left(m^{c\,N}_{ce}\right) = 2; S\left(h^{u\,N}_{ce}\right) = 1.045; S\left(t^{c\,N}_{ce}\right) = 1.5; S\left(v^{f^N}\right) = 190.75; S\left(e^{c^N}\right) = 201; S\left(v^{t^N}\right) = 56;$

$S\left(v^{a^N}\right) = 151; S\left(o^{a^N}\right) = 121$

Table 1: Optimum values of the total cost and the decision variables in crisp and fuzzy paradigm

Prototype	Crisp Paradigm					Fuzzy Paradigm				
	m^r	T	G^t	p^t	T^c	m^r	T	G^t	p^t	T^c
1	8.76	0.77	-	-	8711.1	7.03	0.56	-	-	8029.74
2	8.77	0.83	-	-	9108.44	7.15	0.63	-	-	8069.36
3	6.40	0.83	-	-	9655.29	5.23	0.63	-	-	9156.56
4	8.76	0.94	27.12	-	8976.43	7.30	0.87	25.03	-	8313.99
5	8.76	0.80	-	36.65	9738.15	7.30	0.71	-	33.01	9115.00
6	8.77	0.91	29.18	36.61	9865.84	7.69	0.82	27.63	32.87	9336.47

8. Conclusion:

A legitimate productive repertoire replica for sweet commodities for diabetic people is evolved in this contemplate. Also, it is scrutinized that the envirotech outlay minimizes greenhouse emissions and thereby the overall price remarkably. Furthermore, embalming outlay declines the cost of decay. Subsequently, raise in inceptive community and mean intake increases the rate of production and the overall price-envirotech and conservation technology outlay are required in accordance with government strategies, to safeguard the environment and prolong the life of inventory commodities is embellished under the aegis of trapezoidal neutrosophic fuzzy number.

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