Vol.05 Issue-11, (November 2017) ISSN: 2321-1784
International Journal in Management and Social Science (Impact Factor- 6.178)

SAFE TRANSPORTATION OF INVENTORIES IN FUZZY ENVIRONMENT

Dr. S.Maheswari, Principal,

Gonzaga college of Arts and Science for Women,

Kathanpallam, Elathagiri – 635108, Krishnagiri (District)

Ms. S. Theresaselas, Assistant Professor,

Department of Mathematics, Gonzaga college of Arts and Science for Women,

Kathanpallam, Elathagiri – 635108 Krishnagiri (District)

Abstract

Today, the world is under the big risk of environmental pollution. In this critical situation, we need to preserve our products without any damage which requires packaging. The classical EOQ models have been derived without considering the packaging charge. But it is very essential to pack the products produced with the proper materials safely which justifies the inclusion of packaging charge. As some of the parameters vary and change, the fuzzy mathematical model has been developed. Graded Mean Integration Representation Method has been used to defuzzify the total charge and to find the optimal order quantity. The sensitivity analysis has been performed to study the effects of changes of various charges in the total charge.

Keywords

Inventory, Packaging, Social Charge, Triangular Fuzzy Numbers, Defuzzification Technique.

Introduction

The economic Order quantity (EOQ) model of (Harris, 1913) is the foundation of modern-day inventory models, Many researchers, have contributed a great deal to the development of EOQ model, researchers have modified the classical EOQ models by introducing new charges like inspection charge, transportation charge, advertisement charge in addition to the purchasing charge, setup charge, holding charges which are the components of the classical EOQ model. Dubois, D and Prade, H., in the year 1978 introduced the operations on fuzzy numbers. . Langley (1980) discussed the need for the inclusion of transportation charge to the inventory model, Chen S.H. in 1985 explained Operations on fuzzy numbers with function principle. In 1991 Kaufmann.A, Gupta. MM had written a book on Introduction to Fuzzy Arithmetic Theory and Applications, New York. Carthy S.P gave the information about the Bio degradable polymers for packaging. Lockamy.A (1995)[7]discussed the Conceptual Framework For Assessing Strategic Packaging Decisions. Carter, J.R., Ferrin B.G., 1996 explain the effect of transportation charge in production inventory models.

In 1996 Richter, K gave the EOQ repair and waste disposal model with variable step-up numbers. In 1996 Zimmermann. H.J explained Fuzzy Set Theory and Its Applications Aggarwal, K.K., Aggarwal, S.P. and Jaggi, C.K. explained the impact of Inflation and Credit Policies on Economic Ordering. Buckley, J.J., illuminated the possibilities linear programming with triangular fuzzy numbers in the year 1998.In 1999 Chen S.H and Hsieh C.H [4] introduced Graded Mean Integration Representation of generalized fuzzy number. In the year 2000, Goyal, S.K., presented the integrated production inventory model with a generalized policy. In 2000, Li, L., Lai, K.K., gave a fuzzy approach to the multi-objective transportation problem.

Chang, H.J Hung, C.H. and Dye, C.Y., presented an inventory model for deteriorating items with linear trend demand under the condition of permissible delay in payments. Hsu, H.M., Wang, W.P., illuminated the possibilistic programming in production planning of assemble-to-order environments in 2001.. Teunter, R.H., Vlachos, D., in 2002, proposed the necessity of a disposal option for returned products that can be remanufactured .In 2003 Fung, R.Y.K., Tang, J., Wang, D., explained the multiproduct aggregate production planning with fuzzy demands and fuzzy capacities. In 2005 Huang, B.C., Chew, E.P., Goh, H.K. [5], used transportation capacity constraint in an echelon inventory system.

In general, the need for transportation begins, when the retailers and the buyers are far apart from each other. Nagoorgani, A., and Maheswari S., [8] explained vendor-buyer fuzzy inventory system with transportation charge. k. Jaber (2011) explicated the requirement of transportation along with the social charge that results from the emission of pollutants. He has added the notation of transportation charge to the classical EOQ model. The charge of transportation is expressed as Ct(Q)+Ce(Q)+Cw(Q),where Ct(Q) is the Transportation charge per cycle (delivery and collection of returned items), Ce(Q) is the Emission charge from transportation, Cw(Q) is the charge of Disposal of waste produced by the inventory system per cycle. The items that are transported, must reach the buyers in good condition, for which packaging is essential. The charge of packaging is included along with the Enviroimental.EOQ model (Jaber,2011).This paper is based on the concept of packaging charge introduced by Ritha et al [10] and our aim is to study in Fuzzy environment.

Fuzzy set theory provides a major paradigm in modeling and reasoning with uncertainty. In constructing a model, we always attempt to maximize its usefulness. This aim is closely constructed with relationship among these key characteristics of every model complexity credibility and uncertainty. Here uncertainty plays an important role which tends to reduce the complexity and increase credibility of the resulting model. In 1965 the fuzzy set theory was first subjected to technical scrutiny by Lotfi. A. Zadeh, in his seminar work “Fuzzy sets”. It is an extension of crisp sets, by enlarging the triple value set of ‘Grade membership’ from the two value set {0,1} to the unit interval [0,1] of real numbers. Fuzzy set theory is a tool that gives reasonable analysis of complex, systems without making the process of analysis too complex. Also there might be situations in which a decision maker needs to consider multiple criteria in arriving at the overall best decision. Hence Fuzzy set theory solves all the inventory models in an uncertain environment. Fuzzy mathematical model is also developed in which setup charges, holding charges of vendor and buyers and inspection charge of the vendor are taken as triangular fuzzy numbers. Modified integration representation method is used for defuzzifying the total charge.

This paper treats as the various charges considered, which is vary from time to time. Also in this paper the order charge, holding charge, demand rate and unit purchasing charge are considered as the triangular fuzzy numbers, and given some ideas to reducing the social charge from packaging, presents a numerical examples, concluded the proposed work.

Packaging Packaging is recognized as having a significant impact on the efficiency of logistical systems (Twede, 1992; Ebeling, 1990; Lockamy, 1995[7]) and activities such as manufacturing, distribution, storage and handling throughout the supply chain, many packaging dependent charges in the logistical system are frequently overlooked by packaging designers(Twede, 1992). Packaging specifications directly influence the time required for completing packaging operations which ultimately affects product lead time and due date performance (delivery) to the customer (Lockamy, 1995).

Kotler [6] defines packaging as "all the activities of designing and producing the container for a product." Packaging can be defined as the wrapping material around a consumer item that serves to contain, identify, describe, protect, display, promote, and otherwise make the product marketable and keep it clean. Packaging is the outer wrapping of a product. It is the intended purpose of the packaging to make a product readily sellable as well as to protect it against damage and prevent it

from deterioration while storing. Furthermore the packaging is often the most relevant element of a trademark and conduces to advertising or communication.

- Primary packaging: Primary packaging material is for holding the product, keeping the contents clean, fresh, sterile and safe.

Eg: gas cylinders, wrapped chocolates (butter papers)

- Secondary packaging: Secondary packaging material is used to covers the larger cases or boxes that are used to group quantities of primary packaged goods for distribution and display.

Eg: sugar, fertilizers, cements

-Transport packaging: The product entering in to the trade need to be packed well enough to protect against loss damage during handling, transport and storage.

Eg: fiberboard, woodener etc.

-Consumer Packaging: This packaging holds the required volume of the product for ultimate consumption and is more relevant in marketing.

Eg: beverages, tobacco etc.

As technology develops, the packaging industry also makes use of modern techniques. To make packaging easier and to make the material used for packaging reliable, different tools are used which resulted in the production of non- bio

degradable materials. One such example is plastic. Plastic materials for packaging have seen a dramatic increase in the last two decades and over the past 50 years synthetic polymers have been replacing more traditional materials such as paper, glass and metals in many packaging applications. This is because of their low charge, low density, resistance to corrosion, desirable physical (e.g. barrier and optical) and mechanical properties and ease of processing. Most plastics are made almost entirely from chemicals derived from crude oil (Carthy, 1993) [3]. A large variety of plastics are available from different grades of thermoplastics and thermosetting polymers. These non-biodegradable materials when exposed to the environment emit toxic pollutants. Plastics, are petroleum-based, contain toxins that can leach into water supplies and pollutes the environment. The production of plastic requires large amount of chemicals, the constant exposure to heat melts plastic, emits gases into the atmosphere by the process of out gassing. Once the goods are delivered, the materials used for packaging are expelled to the environment as waste. This waste accounts for the proportion of waste produced per lot Q as in the case of Jaber (2011).

Fuzzy Set

If X is a collection of objects denoted generically by x, then a fuzzy set A in X is defined as a set of ordered pairs $A = \{(x, \mu_A(x)) \mid x \in X\}$, where, $\mu_A(x)$ is called the **membership function** (or MF for short) for the fuzzy set A. The MF maps each element of X to a membership grade (or membership value) between 0 and 1 (included).

Let X = {0, 1, 2, 3, 4, 5, 6} be the set of numbers of children a family may choose to have. Then the fuzzy set B = "desirable number of children in a family" may be described as follows: B = {(0, 0.1), (1, 0.3), (2, 0.7), (3, 1), (4, 0.7), (5, 0.3), (6, 0.1)}. Here we have a discrete ordered universe X. Again, the membership grades of this fuzzy set are obviously subjective.

Fuzzy Numbers

The notion of fuzzy numbers was introduced by Dubois .D and Prade. H .

A fuzzy subset of the real line R with membership function Ã: R [0,1] is called a fuzzy number if

i. Ã is normal,(i.e) there exists an element X_0 such that $(x_0) = 1$

ii. Ã is fuzzy convex,

(i.e) $\mu_{\tilde{A}}$ $[\lambda x_1+(1-)\lambda x_2] \geq \mu\tilde{A}(x_1) \wedge \mu\tilde{A}(x_2)$, x_1, x_2 R,$\forall$ $\lambda \in [0, 1]$

iii. $\mu_{\tilde{A}}$, is upper continuous , and

iv. supp $\tilde{A}$ is bounded , where supp $\tilde{A} = \{x \in R: \mu_{\tilde{A}}(x) > 0\}$

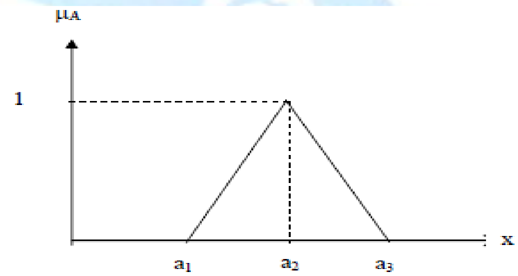
Generalized Fuzzy Number

Any fuzzy subset of the real line R, whose membership function μ_A satisfied the following conditions is a generalized fuzzy number $\tilde{A}$.

(i) $\mu_{\tilde{A}}$ is a continuous mapping from R to the closed interval [0, 1],
(ii) $\mu_{\tilde{A}} = 0, -\infty < x \leq a_1$,
(iii) $\mu_{\tilde{A}} = L(x)$ is strictly increasing on $[a_1,a_2]$
(iv) $\mu_{\tilde{A}} = 1, a_2 \leq x \leq a_3$
(v) $\mu_A = R(x)$ is strictly decreasing on $[a_3, a_4]$
(vi) $\mu_A = 0, a_4 \leq x < \infty$

Where a_1, a_2, a_3 and a_4 are real numbers. Also this type of generalized fuzzy number be denoted as $\tilde{A} = (a_1, a_2, a_3, a_{4;}w_A)_{LR}$; When w_A=1, it can be simplified as $\tilde{A} = (a_1, a_2, a_3, a_4)_{LR}$.

There are different fuzzy numbers. In the present research, the researcher has confined to triangular fuzzy number.



Triangular Fuzzy Number

The fuzzy set $\tilde{A} = (a_1, a_2, a_3)$ where $a_1 \leq a_2 \leq a_3$ and defined on R, is called the triangular fuzzy number, if the membership function of μ_A is given by

$$\mu_A = \begin{cases} \frac{X-a_1}{a_2-a_1}, & a_1 \leq X \leq a_2 \\ \frac{a_3-X}{a_3-a_2}, & a_2 \leq X \leq a_3 \\ 0 & ,\text{other wise} \end{cases}$$

Defuzzification

Defuzzification is a process of transforming fuzzy values to crisp values. Defuzzification Methods have been widely studied for some years and were applied to fuzzy systems. The major idea behind these methods was to obtain a typical value from a given set according to some specified characters. Defuzzification method provides a correspondence from the set of all fuzzy sets into the set of all real numbers.

Median Rule

One way of transforming a fuzzy set into a real number is characterized by choosing median that divides the area under the membership function into two equal parts. If $\tilde{A} = (a_1, a_2, a_3\}$ is a triangular fuzzy number, then by median rule the defuzzified value of $\tilde{A}$ is given by $p(\tilde{A}) = (a_1 + 2a_2 + a_3)/4$.

Graded Mean Integration Representation Method

Chen and Hsieh introduced Graded Mean Integration Representation Method based on the integral value of graded mean h-level of generalized fuzzy number for defuzzifying generalized fuzzy number

If $\tilde{A} = (a_1, a_2, a_3, a_4, w_A)_{LR}$ is a generalized fuzzy number then the defuzzified value $p(\tilde{A})$ by graded mean integration representation method is given by $p(\tilde{A}) = \int_0^{w_a} h\left[\frac{L^{-1}(h)+R^{-1}(h)}{2}\right]dh \; / \; \int_0^{w_{A1}} h dh$, with $0 < h \le w_A$ and $0 < w_A \le 1$.

If $\tilde{A} = (a_1, a_2, a_3)$ is a triangular number then the graded mean integration representation of $\tilde{A}$ by above formula is $= \frac{a_1 + 4a_2 + a_3}{6}$

Notations and Assumptions

The following notations and assumptions are used throughout to develop the EOQ model using fuzzy environment.

Notations

Monetary units (mu) (e.g.£,€,$)

$\tilde{O}$ fuzzy order charge (mu)

$\tilde{c}$ unit purchase charge (mu / unit)

$\tilde{b}$ fuzzy holding charge (mu / unit/ year)

p labour charge for packing per parcel (mu)

l the charge of material used for packing per parcel (mu)

f fixed charge per trip (mu)

g variable charge per unit transported per distance travelled (mu / Unit/km)

r distance travelled (from supplier to buyer, km)

μ proportion of demand returned (o < μ < 1)

$\tilde{R}$ fuzzy demand rate (units/year)

ĕ social charge from vehicle emission (mu/h)

v average velocity (km/h)

ɳ charge to dispose waste to the environment (mu/unit)

n Number of parcels.

$P(\tilde{T}_c)$ Defuzzification of the total charge

Assumptions

The assumptions of this model are that,

(1) The units that are transported are finally packed in parcels.

(2) The packaging charge is incurred for each parcel.

(3) The packaging charge per parcel includes the labour charge and the material charge used for packaging in fuzzy triangular numbers

(4) The demand rate, ordering charge, holding charge, unit purchase charge are taken as a triangular fuzzy numbers.

(5) The proportion of waste produced per lot Q incorporates the waste produced due to the disposal of the materials used for Packaging.

Model Development

In classical EOQ inventory model, the charge per cycle is the sum of the Ordering charge, purchasing charge and holding charge and Transportation charge. The items that is required by the buyer are transported to their consign via vehicles. The Items may be perishable, deteriorating, or non perishable. To Preserve the items and its quality When transported, packaging is essentially employed. The Materials used for packaging varies according to the nature of the item to be packed. The labour charge for packing also differs as per the techniques used in packaging. The units that are transported to the buyer are packed in parcels.

EOQ charge per cycle using fuzzy triangular numbers, $\tilde{R}=(R_1, R_2 R_3)$, $\tilde{O}=(O_1, O_2, 0_3)$, $\tilde{b}=(b_1, b_2, b_3)$

$$C(Q) = \tilde{O} + cQ + \frac{\tilde{b}Q^2}{2\tilde{D}}$$

Transportation charge per cycle (delivery and collection of returned items)

$$C_t(Q) = 2f + grQ + gr\,\mu Q.$$

Emission charge from transportation and package per cycle.

$$C_e(Q) = 2\,\breve{e}\,\frac{d}{v}$$

Waste produced by the inventory system per cycle.

$$C_w(Q) = \eta_0 + \eta\, Q\,(\theta + \mu)$$

Packaging charge per parcel includes both the labour charges and the material charges.
Packaging charge per parcel = p+l

The total charge of packaging per cycle

$$C_p(Q) = (p+l)\, m$$

Total charge per unit of time

$$T_C(Q) = \frac{C(Q) + Ct(Q) + C_e(Q) + C_w(Q) + C_p(Q)}{T} \text{ where } T = \frac{Q}{\tilde{R}}$$

$\tilde{R}=(R_1,R_2,R_3)$, $\tilde{O}=(O_1,O_2,O_3)$, $\tilde{b}=(b_1,b_2,b_3)$, $\tilde{c}=(c_1,c_2,c_3)$

$$T_C(Q) = \frac{\tilde{O}\otimes\tilde{R}}{Q} + \tilde{c}\otimes\tilde{R} + \frac{\tilde{b}\otimes Q}{2} + \frac{2f\tilde{R}}{Q} + gd\otimes\tilde{R} * (1+\alpha) + \frac{2\breve{e}r\otimes\tilde{R}}{vQ} + \frac{\tilde{R}\otimes\eta_0}{Q} + \eta\tilde{R}\,(\theta+\mu) + (p+l)n\otimes\frac{\tilde{R}}{Q}$$

$$= \Big[\frac{(O_1,O_2,0_3))\otimes(R_1,R_2 R_3)}{Q} + (c_1,c_2,c_3)\otimes(R_1, R_2 R_3) + \frac{(b_1,b_2,b_3)\otimes Q}{2} + \frac{2f\otimes(R_1,R_2,R_3)}{Q} + gd(D_1,D_2,D_3)*(1+\mu) + \frac{2\breve{e}r\otimes(R_1,R_2 R_3)}{vQ} + \frac{(R_1,R_2 R_3)\otimes\eta_0}{Q} + \gamma(R_1, R_2, R_3)*(\theta+\mu) + (p+l)\,n\otimes\frac{(R_1,R_2 R_3)}{Q}$$

$$\frac{\partial Tc(Q)}{\partial Q} = \frac{\partial}{\partial Q}\Big[\frac{O_1,O_2,0_3)\otimes(R_1,R_2,R_3)}{Q} + (c_1,c_2,c_3)\otimes(R_1, R_2 R_3)) + \frac{(b_1,b_2,b_3)\otimes Q}{2} + \frac{2f\otimes(R_1,R_2,R_3)}{Q} + gd\otimes(R_1, R_2, R_3)(1+\mu) + \frac{2\breve{e}r\otimes(R_1,R_2 R_3))}{vQ} + \frac{R_1,R_2 R_3)\otimes\eta_0}{Q} + \gamma D(\theta+\mu) + (p+l)n\otimes\frac{(R_1,R_2,R_3)}{Q}\Big]$$

Defuzzified total charge is defined as,

$$P(T_C(Q)) = \frac{1}{6}\Big[\Big[\frac{(O_1R_1)}{Q} + (c_1R_1) + \frac{O_1Q}{2} + \frac{2fR_1}{Q} + (1+\alpha) + \frac{2\breve{e}rR_1}{vQ} + \frac{R_1\gamma_0}{Q} + \gamma R_1(\theta+\mu)+(p+l)n\frac{R_1}{Q}\Big]+4\Big[\frac{(O_2R_2)}{Q} + (c_2R_2) + \frac{O_2Q}{2} + \frac{2fR_2}{Q} + (1+\mu) + \frac{2\breve{e}rR_2}{vQ} + \frac{R_2\gamma_0}{Q} + \gamma R_2(\theta+\mu)+(p+l)n\frac{R_2}{Q}\Big]+\Big[\frac{(O_3R_3)}{Q} + (c_3R_3) + + \frac{2fR_3}{Q} + (1+\mu) + \frac{2\breve{e}rR_3}{vQ} + \frac{R_3\gamma_0}{Q} + \gamma R_3(\theta+\mu)+(p+l)n\frac{R_3}{Q}\Big]\Big]$$

The objective is to determine the optimal order quantity, the necessary condition is,

$$\frac{\partial P\big(\mathrm{Tc}(Q)\big)}{\partial Q} = 0$$

The optimal solution Q is,

$$\sqrt{\frac{2\{(R_1)\big(O_1+\frac{2\breve{e}r}{v}+\gamma_0+(p+l)n+2f\big)+4(R_2)\big(O_2+\frac{2\breve{e}r}{v}+\gamma_0+(p+l)n+2f\big)+(R_3)\big(O_3+\frac{2\breve{e}r}{v}+\gamma 0+(p+l)n+2f\big)\}}{(b_1+4b_2+b_3)}}$$

Steps to reduce the social charge

In spite of advantages of packaging it may also gives some profit. (Eg) If you consider the lipstick charge of product is much lower than the charge of packaging. But the packaging waste forms a municipal waste and this waste gives the environmental pollution. If we through this packaging waste to the environment as such has caused increasing some concerns. A question that arises in our mind is how to reduce this pollution, the answer for this is proper planning with correct style of execution.

Here we are considering more solutions to reduce the social charge.

Wood

The packaging used for wood is the cheapest and commonly available material. It is Eco-friendly and easy to dispose packaging material must be using in wood. You cannot give tax to nature, you have conserve energy.

Green packaging

Green packaging is one of the components of the total life cycle. It is only the environmental friendly material, therefore the charge is very less.

1. Germany is very strict they will not accept any material if it is not environmental friendly.

Paper

The packaging used by paper is one of the degradable particle, also corrugated boxes are permitted for the packaging is good for ours, use the paper instead of using the thermocole, cell tape. The paper bags are useful for packaging. Instead of all this the self realization is most important for each and everyone to reduce the pollution. We use the recycling material for the packaging is most important.

"If I say don't use polythene use only paper tape means nobody will look at me. That is our national problem and corporate problem, but when it is forced on ours we will use it"

Numerical Example

To find the result obtained in this paper, a numerical example is derived. Consider the inventory system with the following characteristics.

$(R_1, R_2 R_3)=(9,10,11),(A_1,A_2,A_3)=(4,5,6),(c_1, c_2, c_3)=(2,3,4),(h_1, h_2, h_3)=(0.5,1,1.5)$, n=1,p =3, l=2,f=5,g=0.5,r=250, ĕ =0.5,v=180,γ_0=1

The optimal solution Q is,

$$\sqrt{\frac{2\{(R_1)\left(O_1+\frac{2\breve{e}r}{v}+\gamma_0+(p+l)n+2f\right)+4(R_2)\left(O_2+\frac{2\breve{e}r}{v}+\gamma_0+(p+l)n+2f\right)+(R_3)\left(O_3+\frac{2\breve{e}r}{v}+\gamma_0+(p+l)n+2f\right)\}}{(h_1+4h_2+h_3)}}$$

= 21.18

Sensitivity Analysis

Keeping the following values constants

$(c_1,c_2,c_3)=(2,3,4)$,f=5,n=1,P=3,l=2,f=5,g=0.5,r=250, ĕ =0.5,v=180,γ_0=1, θ=0.001 μ=0.005, γ=0.002 and changing the following values of

$\tilde{R}=(R_1,R_2,R_3)$, $\tilde{O}=O_1, O_2, O_3)$, $\tilde{h}=(h_1,h_2,h_3)$,P, L, ĕ

(R_1,R_2,R_3)	(O_1, O_2, O_3)	(h_1,h_2,h_3)	p	l	ĕ	Q
(10,11,12)	(8,9,10)	(0.5,1,1.5)	3	2	0.5	22.21
(8,9,10)	(8,9,10)	(0.5,1,1.5)	3	2	0.5	20.09
(9,10,11)	(5,6,7)	(0.5,1,1.5)	3	2	0.5	21.64
(9,10,11)	(3,4,5)	(0.5,1,1.5)	3	2	0.5	20.70
(9,10,11)	(8,9,10)	(1.5,2,2.5)	3	2	0.5	14.97
(9,10,11)	(8,9,10)	(0,0.5,1)	3	2	0.5	29.95
(9,10,11)	(8,9,10)	(0.5,1,1.5)	4	2	0.5	21.64
(9,10,11)	(8,9,10)	(0.5,1,1.5)	2	2	0.5	19.88
(9,10,11)	(8,9,10)	(0.5,1,1.5)	3	2.5	0.5	21.41
(9,10,11)	(8,9,10)	(0.5,1,1.5)	3	1.5	0.5	20.94
(9,10,11)	(8,9,10)	(0.5,1,1.5)	3	2	1	21.82
(9,10,11)	(8,9,10)	(1.5,2,2.5)	3	2	0.3	20.91

The following inferences are made from the Sensitivity analysis.

- If the demand rate ($\tilde{R}$) increases, the optimal order quantity also increases, if it decreases the Q also decreases.
- The order($\tilde{O}$) charge is increases the optimal order quantity also increases, if it decreases the Q also decreases
- The Holding charge ($\tilde{h}$) is increases the optimal order quantity is decreased, if it is decreases the Q is increases.
- The labour charge(p) and the charge of material used for packaging (l) increase the optimal order quantity also increase, if they decrease the Q also decrease.
- The social charge (ĕ) is increases the optimal order quantity also increases, if it decreases the Q also decreases.

Conclusion

This paper concludes that, the packaging pollutes the environment, it is uncontrollable. Most of the environmental problems come under the misuse of the waste packaging products. But the main reason of this problem is irresponsibility of each individual and hence the society at large. Natural disasters due to flood happen because of the improper disposal of the non degradable items like plastics which happened in latest flood in Mumbai. This paper gives information about an Economic Order Quantity which includes the charge of packaging in Fuzzy environment in which setup charges, holding charges of vendor and buyers and inspection charge of the vendor are taken as a triangular fuzzy numbers. Fuzzy mathematical model is also developed in modified integration representation method is used for defuzzifying the total charge. The Optimal ordering quantity depends upon the social charge. From the sensitivity analysis, we observe that If the demand rate (($\tilde{R}$) increases, the optimal order quantity also increases, if it decreases the Q also decreases. The order ($\tilde{O}$) charge is increases the optimal order quantity also increases, if it decreases the Q also decreases. The Holding charge ($\tilde{h}$) is increases the optimal order quantity is decreased, if it is decreases the Q is increases. The labour charge (p) and the charge of material used for packaging (l) increase the optimal order quantity also increase, if they decrease the Q also decrease. The social charge (ĕ) is increases the optimal order quantity also increases, if it decreases the Q also decreases.

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