International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)
doi : https://doi.org/10.32628/IJSRST

Fuzzy Inventory Models - Literature Review

Priya Advani
Assistant Professor (Mathematics), Govt. Women Engineering College, Ajmer, India

Article Info
Volume 8, Issue 2
Page Number : 718-721
Publication Issue
March-April-2021

Article History
Accepted : 05 April 2021
Published : 20 April 2021

ABSTRACT
The present paper focuses on the review of existing literature in the field of Inventory Management in fuzzy environment which helps in learning both conceptual and research based studies. A Number of studies have been conducted incorporating the concept of fuzzy on various inventory models and the process is still going on. The present study is the summary of critical points of the particular topic consisting of essential findings as well as theoretical and methodological contributions.

Keywords : *Inventory Model*, Trapezoidal Fuzzy Numbers, Fuzzy Demand

I. INTRODUCTION

Inventories are an important asset to all business organizations. The proper management of their levels usually brings significant savings in costs. The development of inventory theory has evolved through several stages since its beginning in the 1900. F. Harris (1915) developed first inventory model. . At first, it had very simple models that used only a few parameters to describe the nature of deterministic demands Whitin, T. M. (1957). Later, these models were embellished to include more details, and probabilistic models were developed in the 1950s to capture the effects of stochastic demands Arrow, K.J. (1958). Lotfi A. Zadeh (1965) introduced the concept of fuzzy set theory in inventory modelling. L. A. Zadeh and R. E. Bellman (1970) considered an inventory model on decision making in fuzzy environment. H. J. Zimmerman (1983) tried to use fuzzy sets in operational research. K. S.Park (1987) define the fuzzy set theoretical interpretation of an EOQ problem.

Shan-Huo Chen, Chien-Chung Wang, Arthur Ramer (1996)

In this paper, the *fuzzy inventory model* is analyzed, especially in the case of permitting *backorder* under the fuzzy environment of fuzzy demand, fuzzy order cost, fuzzy inventory cost, and fuzzy backorder cost. *function principle* is used instead of the *extension principle*, to calculate the total fuzzy inventory cost. also the *median rule* is applied to find the optimal *economic order quantity* (EOQ) and shortage quantity.

Mirko Vujošević , Dobrila Petrović , Radivoj Petrović (1996)

This paper investigates the modification of EOQ formula in the presence of imprecisely estimated parameters. Holding and ordering costs are often not precisely known and are usually expressed by

linguistic terms such as: "Holding cost has approximately value c_h", or: "Ordering cost is about value c_o or more". These imprecise parameters are presented by fuzzy numbers, defined on a bounded interval on the axis of real numbers. Also, Alternative approaches are developed to determine the optimal order quantity in a fuzzy environment .

Chiang Kao, Wen-Kai Hsu (2002)

This paper considers the lot size-reorder point inventory problem with fuzzy demands, the shortages are backordered with shortage cost incurred. The α cut of the fuzzy demand is used to construct the fuzzy total inventory cost for each inventory policy (Q, r), where Q is the quantity to be ordered and r is the reorder point. Yager's ranking method for fuzzy numbers is utilized to find the best inventory policy in terms of the fuzzy total cost.

Liang-Ho Chen , Liang-Yuh Ouyang (2006)

This paper is an extension of Jamal et al. model by fuzzifying the carrying cost rate, interest paid rate and interest earned rate simultaneously, based on the interval-valued fuzzy numbers and triangular fuzzy number to fit the real world. Also it is proved that the estimate of total variable cost per unit time in the fuzzy sense is a strictly pseudo-convex function.

G. C. Mahata and A. Goswami (2009)

It is the most comprehensive study on infinite time horizon fuzzy Economic Order Quantity (EOQ) models for deteriorating items with stock dependent demand rate and nonlinear holding costs by taking deterioration rate as a triangular fuzzy number

The traditional parameters such as unit cost and ordering cost have been kept constant but holding cost is considered to be, a non-linear function of the length of time for which the item is held in stock and a non-linear function of the amount of on-hand inventory. The effect of non-linearity in holding costs on approximate optimal solution for the fuzzy cost functions is studied in both the cases.

S.R. Singh, Neeraj Kumar and Rachna Kumari (2011)

They have developed, a two-warehouse inventory model under the conditions of permissible delay in payments in fuzzy environment. A rented warehouse is used when the ordering quantity exceeds the limited capacity of the owned warehouse. During the permissible delay period, no interest is charged by the supplier, but beyond this period interest is charged under the terms and conditions agreed upon and also interest can be earned on the revenue received during the credit period. They have discussed four different cases to represent realistic situations of market: (1) when the inventory system has both the warehouse facilities, (2) when the owned warehouse has large capacity to store the inventory, (3) when simple EOQ model of single storage system and (4) when one does not wish to take RW services and OW has unlimited capacity.

N. Mahapatra, U. Bera and M. Maiti (2012)

In this paper a production inventory model has been formulated for a single item. The demand varies with the on-hand inventory level and production price. Shortages are allowed and fully backlogged. The time gap between the decision and actual commencement of production is termed as "preparation time" and is assumed to be crisp/imprecise in nature. The set-up cost depends on preparation time. The fuzzy preparation time is reduced to a crisp interval preparation time using nearest interval approximation and following the interval arithmetic. The reduced problem thus obtained is converted to a multi-objective optimization problem.

Dutta, Pavan Kumar (2013)

This paper deals with the formulation of a fuzzy inventory model for deteriorating items with shortages under fully backlogged condition. Deterioration rate and demand are assumed to be constant. Shortages are fully backlogged. Fuzziness is

introduced by allowing the cost components (holding cost, shortage cost, etc.), demand rate and the deterioration. In fuzzy environment all the related inventory parameters are assumed to be trapezoidal fuzzy numbers. The total cost function is minimized in fuzzy environment.

Ritha, W. and Rexlin Jeyakumari, S. (2013)

In this paper, a fuzzy based inventory model for imperfect quality items with shortages has been formulated. The fixed cost; holding cost and shortage cost are taken as fuzzy numbers. the triangular fuzzy number are considered to represents fuzzy parameters. The optimum order quantity is obtained in fuzzy sense with the help of signed distance method.

Kumar, S. and Rajput, U. (2015)

In this paper a fuzzy inventory model for deteriorating items with time dependent demand rate is developed. Shortages are allowed and completely backlogged. The backlogging rate of unsatisfied demand is considered to be a decreasing exponential function of waiting time. The demand rate, deterioration rate and backlogging rate are assumed as a triangular fuzzy numbers. The purpose of the paper is to defuzzify the total profit function by signed distance method and centroid method.

Sharmila Vijai Stanly and R Uthayakumar (2015)

This paper discusses the fuzzy inventory model for deteriorating items for power demand under fully backlogged conditions. Various factors which are affecting the inventory cost by using the shortage costs are determined. This paper studies the inventory modelling through fuzzy environment. Inventory parameters, such as holding cost, shortage cost, purchasing cost and deterioration cost are assumed to be the trapezoidal fuzzy numbers.

R. Uthayakumar1 and S.K.Karuppasamy (2016)

The classical Harris - Wilson inventory model considered that all the cost associated with the model to be constant and does not depended on any quantity ordered. In this paper Ordering cost, holding cost and order quantity all are taken to be triangular fuzzy numbers. Graded mean integration representation method is used for defuzzification. The ordering cost depends on the size of the lot and increases in steps as the lot size increases in the inventory model developed. The main purpose of this paper is to reduce the healthcare cost and without sacrificing customer service.

S.K. Indrajitsingha , P.N. Samanta and U.K. Misra (2018)

This paper proposes a fuzzy economic order quantity (EOQ) model for deteriorating items with stock dependent demand rate without shortages . The cycle time is divided into two parts. In the first interval stock dependent demand is considered and the second part demand is assumed to be constant. A crisp model is developed. The demand, holding cost, deterioration cost and deterioration rate are assumed to be as triangular fuzzy numbers. Graded mean representation, signed distance method and centroid method are used to defuzzify the total cost function.

REFERENCES

[1]. Harris, F., (1915). Operations and Cost. (Factory Management Series), Chicago: A. W. Shaw Co., 48-52.

[2]. Whitin, T. M. (1957). “Theory of Inventory Management”, Princeton University Press, Princeton, NJ, 62-72.

[3]. Arrow, K.J., Karlin, S. and Scarf, H.E. (Eds.), (1958). “Studies in Applied Probability and Management Science”, Stanford University Press, Stanford, CA.

[4]. Lotfi A. Zadeh, “Fuzzy sets,” Information and Control, vol. 8, no. 3, pp. 338–353, 1965.

[5]. R. E. Bellman und L. A. Zudeh Decision-Making in a Fuzzy Environment National Aeronautics

and Space Administration Washington, D. C. MAY 1970.

[6]. Zimmerman, H. J., "Using fuzzy sets in operational research", European Journal of Operational Research, vol. 13, pp.201-206, 1983,

[7]. Park, K. S., "Fuzzy set theoretical interpretation of economic order quantity", IEEE Trans. Systems Man. Cybernet SMC, vol. 17, pp.1082-1084, 1987.

[8]. Shan-Huo Chen, Chien-Chung Wang, Arthur Ramer "Backorder fuzzy inventory model under function principle" Information Sciences Volume 95, Issues 1–2, Pages 71-79 (1996).

[9]. Mirko Vujošević , Dobrila Petrović , Radivoj Petrović "EOQ formula when inventory cost is fuzzy" International Journal of Production Economics Volume 45, Issues 1–3,Pages 499-504, (1996).

[10]. Chiang Kao, Wen-Kai Hsu "Lot size-reorder point inventory model with fuzzy demands"Computers & Mathematics with Applications Volume 43, Issues 10–11, Pages 1291-1302 (2002)

[11]. Liang-Ho Chen , Liang-Yuh Ouyang "Fuzzy inventory model for deteriorating items with permissible delay in payment" Applied Mathematics and Computation Volume 182, Issue 1, Pages 711-726, (2006).

[12]. A.M.M. Jamal, B.R. Sarker, S. Wang, An ordering policy for deteriorating items with allowable shortage and permissible delay in payment, Journal of Operations Research Society 48 ,826–833 (1997).

[13]. G. C. Mahata and A. Goswami "Fuzzy EOQ Models for Deteriorating Items with Stock Dependent Demand & Non-Linear Holding Costs" International Journal of Applied Mathematics and Computer Sciences 5;2 (2009)

[14]. S.R. Singh, Neeraj Kumar and Rachna Kumari "Two-warehouse fuzzy inventory model under the conditions of permissible delay in payments" International Journal of Operational Research Vol. 11, No. 1 , pp 78-99 ,(2011).

[15]. N. Mahapatra, U. Bera and M. Maiti, "A Production Inventory Model with Shortages, Fuzzy Preparation Time and Variable Production and Demand," American Journal of Operations Research, Vol. 2 No. 2, pp. 183-192, (2012).

[16]. D. Dutta, Pavan Kumar "Fuzzy Inventory Model for Deteriorating Items with Shortages under Fully Backlogged Condition" International Journal of Soft Computing and Engineering (IJSCE) Volume-3, Issue-2,(2013).

[17]. Ritha, W. and Rexlin Jeyakumari, S.. "Fuzzy Inventory model for Imperfect quality items with shortages", Annals of pure and applied Mathematics, Vol. 4, pp. 127-137, (2013).

[18]. Kumar, S. and Rajput, U. Fuzzy Inventory Model for Deteriorating Items with Time Dependent Demand and Partial Backlogging. Applied Mathematics, 6, 496-509 (2015).

[19]. Sharmila Vijai Stanly R Uthayakumar "Inventory Model for Deteriorating Items Involving Fuzzy with Shortages and Exponential Demand" International Journal of Supply and Operations Management Volume 2, Issue 3 - Serial Number 3 November Pages 888-904 (2015).

[20]. R. Uthayakumar and S.K.Karuppasamy "A FUZZY INVENTORY MODEL WITH LOT SIZE DEPENDENT ORDERING COST IN HEALTHCARE INDUSTRIES" Operations Research and Applications : An International Journal (ORAJ), Vol.3, No.1, (2016)

[21]. S.K. Indrajitsingha , P.N. Samanta and U.K. Misra "A fuzzy inventory model for deteriorating items with stock dependent demand rate" International Journal of Logistics Systems and Management ,Vol. 30, No. 4 pp 538-555 (2018)