Development of an EOQ Model for Single Source to Multi Destination: Multi Deteriorating Products under Fuzzy Environment

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ABSTRACT

Industry environment has become competitive because of product’s short life cycle. Competition reaches to extreme, when products are deteriorating which further makes demand uncertain. Generally, in deriving the solution of economic order quantity (EOQ) inventory model, the authors consider the demand rate as constant quantity. But in real life, demand cannot be forecasted precisely which causes fuzziness in related constraints and cost functions. Managing inventory, procurement, and transportation of deteriorating natured products with fuzzy demand, and holding cost at source and destination becomes very crucial in supply chain management (SCM). The objective of the current research is to develop a fuzzy optimization model for minimizing cost of holding, procurement, and transportation of goods from single source point to multi demand points with discount policies at the time of ordering and transporting goods in bulk quantity. A real life case study is produced to validate the model.

Keywords: Deteriorating Products, Discount Models, Fuzzy Programming, Supply Chain Management, Transportation Models

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INTRODUCTION

Supply chain systems are currently entering the age of adaptive and intelligent supply chains, a new generation of networks that explains collaboration and visibility features across the different partners to deal with the system dynamics, such as supplier failures or demand uncertainty (Cachon & Netessine, 2004; Stadler, 2005). In today’s intense global competition, SCM is as a critical instrument for helping managers to improve productivity, profitability and the performance of their organizations. In doing so, SCM requires more accurate cost data regarding its activities and processes within and outside the organisations (Askarany, Yazdifar, & Askary, 2010).

In the current study a specific division of SCM is explained, where deteriorating natured multiple products are ordered to one supplier by multi buyers. The problem is faced by the supplier not being able to forecast demand because of the deteriorating nature of the products. In the process, buyer at demand point is playing a major role, which will provide a holistic approach by integrating all the holding, procurement, inspection and transportation activities such that holding cost, ordered quantity to supplier & its purchase cost, inspection cost on ordered quantity, transported weights and its freight cost. He would also take care of the holding cost at supplier, because supplier cannot keep goods in warehouse for long time, as capacity of warehouse is limited and it will incur more cost which may further affect the selling price. The paper presents a fuzzy optimization model, who integrates inventory, procurement and transportation mechanism to minimize all the costs discussed. The total cost of the model becomes fuzzy because of fuzzy holding cost and demand. The study includes the aspect of discounts also, which benefits to buyer to avail discounts on bulk purchased quantity and transported weights.

Following sections are arranged in the formats, Review of literature, Problem statement & assumptions, Proposed model formulation and equations’ analysis along with model’s sets, parameters, decision variables and price breaks, Fuzzy solution algorithm, A real life case of a “Retail Stores and Meat Co.” to testify and validate the procedure of the model and finally Conclusion of the research.

REVIEW OF LITERATURE

Transportation costs may be influenced by decisions regarding choice of model, size and type of shipments. In fact, transportation decisions may influence inventory decisions. Inventory management and transportation policy interact, particularly, “when alternatives exist for transporting replacement inventory from a vendor or a plant, and each alternative necessitates different parameters for the management of inventories” (Constable & Whybark, 1978). Russell and Krajewski (1991) presented a simple analytical approach for finding the order quantity that minimizes total purchase costs which reflects both transportation economies and quantity discounts. Chung and Tsai (2001) derive an inventory model for deteriorating items with the demand of linear trend and shortages during the finite planning horizon considering the time value of money. It is also seen that the demand of a consumer product usually varies with time and hence, the demand rate should be taken as time-dependent. Weiguo and Xue (2011) establishes inventory control model of deteriorating items based on time under the VMI mode, it introduced the fuzzy membership function of the decay rate based on the model in the past. Hou, Huang, and Lin (2011) presents an inventory model for deteriorating items with stock-dependent selling rate under inflation and time value of money over a finite planning horizon. In the model, shortages are allowed and the unsatisfied demand is partially backlogged at the exponential rate with respect to the waiting time. Tu, Lo, and Yang (2011) develops a two-echelon inventory model with mutual beneficial pricing strategy with considering fuzzy annual demand; single vendor and multiple buyers in this model. This pricing strategy can benefit the vendor more.
Unique Applications of Multi-Agent Models in Uncovering Language Learning Processes
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