Chapter 15

Collaboration of Single-Manufacturer Multi-Buyer Inventory Status With Credit Option Under Fuzzy Demand

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ABSTRACT

In this paper, a coordinated single-manufacturer and multiple heterogeneous buyers inventory model under fuzzy demand is developed. Here two cases are considered: (i) ex-site delivery case considers manufacturer dominance where manufacturer produce items and delivers to the group of heterogeneous buyers at common replenishment time through common shipment, (ii) ex-factory delivery case considers buyer’s dominance. Fuzzy set theory is used to handle the uncertainty in the demand variable. The model is analyzed using triangular membership function. Both models are illustrated with suitable numerical example.

INTRODUCTION AND RELATED LITERATURE

Achieving effective coordination among members of the supply chain has become a pertinent research issue in the supply chain management. This is because coordination has the advantage of reducing total cost and of improving system performance.

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The Supply chain Management (SCM) is the term used to describe the management of materials and information across the entire supply chain, from suppliers to component producers, to final assemblers, to distribution (warehouse and retailers), and ultimately to the consumer.

A single manufacturer supplying a product too many different buyers are studied by authors such as Kim and Hwang (1988); Weng and Wong (1993) and recently by Siajidi et al. (2006) and Chan and Kingsman (2007). Zahir and Sarkar (1991) have considered a price-dependent demand function for multiple regional wholesalers who are served by a single manufacturer. Woo et al. (2001) have studied an integrated inventory system where a single manufacturer purchases and processes raw materials in order to deliver it to multiple retailers. With the assumption that the manufacturer follows a lot-for-lot policy, Viswanathan and Piplani (2001) have shown that a manufacturer could implement the common replenishment period mechanism by offering price discounts to a set of heterogeneous buyers in a single manufacturer, multi-buyer supply chain.


Now, if all members of the supply chain unite under the coordination of the coordinated system, they can maximize both their profits and social benefits. However, it is difficult to put this ideal action into practice in the decentralized supply chain, since it involves the existence of several decision makers pursuing different objectives, possibly conflicting among each other.

Some coordination strategies, such as the quantity discount, credit option and payback/return policy, are often used to regulate the relationship among members involved in the supply chain.

Many authors have used Credit option policy (or delay in payment) as a coordination mechanism in their models. The basic inventory model is based on the implicit assumption that the retailer must pay for the items as soon as he receives them from a supplier. However, in practice, the supplier will allow a certain fixed period (credit period) for settling the amount that the supplier owns to retailer for the items supplied. Trade credit can be defined as the purchase of goods or services that involves delivery of goods or services at a certain date with payment at a later date (Issakson, 2002).

Goyal (1985) suggested a mathematical model for obtaining the economic order quantity for an item for which the supplier permits a fixed delay in settling the account. Kingsman (1983) and Chapman et al. (1985) also have used delay in payment option in the development of their mathematical models. Kim et al. (1995) have determined the optimum length of credit period for the product that the supplier sells to retailers in order to maximize his profit. Chung (1997) presented a procedure to determine the optimal time interval of permissible delay in payment model by minimizing the total annual variable cost function. Chu et al. (1998); Chu and Chung (1998) and Jamal et al. (2000) determined the optimal payment time if delay beyond a fixed credit period is permitted. Liao et al. (2000) developed an EOQ model for stock-dependent demand rate when a delay in payment is permissible.

Abad and Jaggi (2003) considered a seller-buyer problem in which the end demand is price sensitive and the seller may offer trade credit, characterized by delay in payment, to the buyer. Luo (2007) studied and analyzed coordinated strategy between manufacturer and buyer through the use of credit period. Sarmah et al. (2007) developed a manufacturer and a buyer coordination mechanism through credit option where both parties have a certain amount of target profit from the business. Sarmah et al. (2007) also developed a coordination model with credit option in a single-manufacturer and multiple heterogeneous buyers’ situation to determine the optimum production.
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