Chapter 11
Inventory Control Policies for Deteriorating Item With Preservation Technology, Quadratic Demand, and Trade Credit for a Single Supplier–Two Retailers Supply Chain: A Centralization vs. Decentralization Approach

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ABSTRACT
Nowadays in use of, the offer of delay payment from supplier is very remarkable implement to boost the market demand by attracting more retailers. Furthermore, offer of delay payment is advantageous for retailers as they do not have to pay the supplier immediately at the time of procurement. In this chapter, we study inventory policies with trade credit from a single supplier to two retailers. We consider the item with deterioration as loss of utility is the real situation of items like fruits, vegetables, juices, ice-creams, etc. To reduce deterioration of the item, vendor spends capital on preservation technology to preserve the item. Here, time dependent quadratic demand is discussed which is suitable for the items whose demand increases primarily and afterward it starts to decrease. Formerly, we present the centralized inventory system in which supplier and retailers willingly take joint decision. Succeeding, we address the decentralized inventory system in which a supplier and both retailers take individual decisions.

INTRODUCTION

Nowadays, by keenly dealing expenditure terms and working capital desires, managers can encourage economic performance and achieve significant cost savings. Credit limit permits a retailer to accumulate income and earn interest throughout the credit period. On the other hand, after the accomplishment of the credit period the supplier charges the retailer interest on the unpaid amount. Therefore, from the retailer’s point of view, a credit limit decreases its holding cost, and hence is a dominant advertising tool to attract new customers. In contrast, from the supplier’s perspective, although credit limit increases its opportunity cost because of interest loss in the course of the credit period, it decreases its retailer’s holding cost, attracts new customers, and in turn increases its income.

The economic order quantity (EOQ) was first planned by Harris (1913). Since then creative extensions of his EOQ model have been renowned by researchers. Grubbstrom (1980) invented an inventory policy with two level trade credit with no optimization. Goyal (1985) recognised the retailer’s EOQ model when the supplier scheduled credit limit. Aggarwal and Jaggi (1995) overextended the EOQ model under the effect of credit limit financing from non-deteriorating items to deteriorating items. Jamal et al. (1997) allowed shortages in EOQ model. Chang et al. (2003) accepted an EOQ model of deteriorating items with supplier credits linked to ordering quantity. Huang (2003) offered an inventory model by assuming that the supplier offers the retailer a credit limit and the retailer also supplies its consumers another credit limit to encourage demand. Chen et al. (2014) considered EPQ models for deteriorating items with up-stream full credit limit and down-stream partial trade credit. Recently, Shah and Jani (2016a) studied optimal ordering policy for deteriorating items of fixed-life time with quadratic demand and two-level trade credits. Several interesting articles are by Ouyang and Chang (2013), Chung and Cárdenas-Barrón (2013), Ouyang et al. (2013), Sarkar et al. (2015), Shah and Cárdenas-Barrón (2015), Shah and Jani (2016b), Tiwari et al. (2016), Wu et al. (2016) and their cited references.

Due to the effect of important environmental changeability, most of the goods loses its utility over time is said to be deterioration. Ghare and Schrader (1963) deliberated the inventory model with deterioration. The research papers by Raafat (1991), Shah and Shah (2000), Goyal and Giri (2001), Bakker et al. (2012), for inventory system under the influence of deterioration, emphasising the role of deterioration. The citations in the review articles enclose constant deterioration rate, weibull distributed deterioration etc. Shah et al. (2015a) reflected optimal down – stream credit period and cycle time with deterioration rate in a supply chain. Sett et al. (2012) established flexible deterioration rate. Shah and Chaudhari (2015) considered optimal policies for three players with fixed life-time and two-level trade credits with time and credit dependent demand. Recently, Teng et al. (2016) calculated inventory model of lot-size policies for deteriorating items with expiration dates and advance payments. Some interesting articles are by Chung et al. (2014), Wu et al. (2014) and their cited references.

In contrast, to reduce deterioration, use of preservation technology which means item preservation, wrapping and storage focuses on the ways in which items can be treated during and after their development in order to preserve their integrity over time by obstructing internal dreadful conditions and/or protecting them from external damage. Hsu et al. (2010) studied an inventory model with preservation technology investment to optimise the deterioration rate of an item with constant demand. Dye and Hsieh (2012) projected an optimal replenishment policy with preservation technology investment for deteriorating items. Hseih and Dye (2013) offered an EPQ model under the effect of preservation technology investment with time dependent demand. In recent times, Shah and Shah (2014) expressed an inventory model for optimal replenishment time and preservation technology investment with price-sensitive