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Methodologies and Applications

Editors

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Chapter 13

An Inventory Model for Substitutable Deteriorating Products under Fuzzy and Cloud Fuzzy Demand Rate

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1. Introduction

Management of inventory has been a subject of interest for many researchers and decision makers since long as it directly affects the profit of an organisation. Many super markets and big retail stores face the situation of stock-out of some most consumed items specially on holidays due to a heavy rush of customers. It is commonly seen that in today's fast and busy life many customers choose the substitute product in place of the original one and avoid going to other stores. The study carried out by Anupindi et al. (1998) reveals that 82.88% of customers would switch over to buy the substitute product if the original product they wish to buy is not available instead of visiting different stores. This study is an attempt to model this phenomenon and offers a joint ordering inventory policy for deteriorating substitute products under crisp, fuzzy and cloud fuzzy environment.

Since Harris (1913) developed the first economic order quantity (EOQ) model, many researchers developed mathematical models by considering various parameters with different cases. Whitin (1957) developed the first inventory model which includes the effect of deterioration. A brief review on perishable inventory having stochastic and deterministic demand has been done by Nahmias (1982). A comprehensive survey on continuously deteriorating inventory has been done by Raafat (1991), Shah and Shah (2000) and, Goyal and Giri (2001). Shah (2006) has formulated an inventory model for deteriorating items for a finite time horizon with the condition of permissible delay in payments. Min et al. (2010) developed a lot-sizing model for deteriorating items when demand is dependent on current stock. Tayal et al. (2015) derived an inventory model for seasonal products having Weibull rate of deterioration. Jaggi et al. (2017) worked on an inventory model for deteriorating items by allowing imperfect quality items and one level of trade credit. Khanna et al. (2020) studied the effect of preservation technology in controlling the life span of deteriorating items having time-varying holding cost and stock dependent demand.

In general practices, there are very few cases when the demand remains constant with time. In most of the cases, it depends on many parameters. The stock of inventory displayed in large quantity has a significant effect on the demand and sale of the product. Balakrishnan et al. (2004) developed an optimal policy by considering the cases when inventories stimulate demand. Levin et al. (1972) suggested that inventory displayed in large piles will tempt the customer to buy the product. Mandal and Maiti (1999) developed a deterministic inventory model having stock-dependent demand. An inventory model with stock and time varying demand has been presented by Prasad and Mukherjee (2016). Mishra et al. (2017) investigated the inventory problem by considering price and stock dependent demand for a controllable deterioration rate. Bardhan et al. (2019) derived an optimal replenishment policy for the items with non-instantaneous deterioration rate with stock dependent demand.

McGillivray and Silver (1978) made the first attempt to formulate an inventory model for substitutable products by assuming that they all have the same unit variable cost.

An EOQ model was presented by Drenzner et al. (1995) by comparing substitutable and non-substitutable products. Maity and Maiti (2009) investigated inventory policies for deteriorating complementary and substitute items with stock-dependent demand. Salameh et al. (2014) developed an inventory model for two substitutable items with deterministic demand rate. Krommyda et al. (2015) worked out an inventory control problem to find the optimal order quantity of substitute products having stock dependent demand.

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