INTERNATIONAL RESEARCH JOURNAL OF AGRICULTURAL ECONOMICS AND STATISTICS
Volume 2 Issue 2 (September, 2011) Page : 236-239

Received : May, 2011; ***Revised :*** July, 2011; ***Accepted :*** August, 2011

Research Paper

An inventory model for deteriorating items with price dependent demand and salvage value

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ABSTRACT

In this paper a deterministic inventory model has been developed for deteriorating items. It is assumed that the deterioration rate is time proportional. Instead of constant rate of demand, it is considered to be the function of selling price. A shortage is not permitted and some salvage value is assigned to deteriorated items whereas it is negligible or zero in general inventory models. The results have been then supported with numerical examples.

Kawale, Sunil V. (2011). An inventory model for deteriorating items with price dependent demand and salvage value, *Internat. Res. J. agric. Eco. & Stat.*, **2** (2) : 236-239.

Key words : EOQ model, Deterioration model, Price dependent demand, Salvage value

INTRODUCTION

Inventory modeling is one of the most developed fields of operations management. Deterioration is defined as decay, change or spoilage that prevents the item from being used for its original purpose. The items come under direct deterioration are fruits, vegetables and food items. The items like alcohol, gasoline, radioactive substance having no shelf-life come under the decaying products and the remaining items gradually deteriorate e.g. electronic goods, photographic films, grains etc.

Ghare and Schreder (1963) developed a simple economic order quantity model with constant rate of deterioration. Similar models were developed by Shah and Jaiswal (1977), Aggarwal (1978), Dave and Patel (1981). The time dependent rate of deterioration were discussed by Covert and Philip (1973) and Philip (1974).Chakraborty and Chaudhari (1997) extended Philips model under trended demand. The model under price dependent demand and price discount is developed by Burwell *et al.* (1997). For ameliorating items with price dependent demand rate is derived by Mondal *et al.* (2003). Time and price dependent demand inventory model is carried out by You (2005). The similar model with time varying holding cost was discussed by Roy (2008).

In all these inventory models, it is assumed that the salvage value is completely zero or negligible for the items which deteriorate. Therefore, it is not added in the inventory models discussed so far. Mishra and Shah (2008) has included the salvage value against deteriorating items during cycle time.

In present paper, the EOQ model is developed for deteriorating items with demand rate as a function of selling price. Deterioration rate is expressed as linearly increasing function of time and salvage value is associated with deteriorating items during cycle time with following assumptions:

Assumption and notation:

- The demand rate is function of selling price
- Shortages are not allowed
- The deterioration rate is time proportional
- C_1 is the holding cost per unit per time unit
- C_2 is the salvage value C_2?(0= C_2<1)
- Replenishment is instantaneous and lead time is zero
- T is the length of the cycle
- The order quantity in one cycle is q
- A is the cost of placing an order
- The selling price per unit time is p
- C is the unit cost of an item
- $\theta(t) = \theta t$ is the rate of deterioration $0< \theta < 1$
- selling price p follow an increasing trend and demand rate posses the negative derivative through out its domain, where demand rate is $f(p) = (a-p) > 0$