

---

**Research Paper****Inventory Model For Power Price Demand****R. H. Waliv**

Faculty of Statistics, Kisan Veer Mahavidyalay, Wai.

**1. Abstract:**

In this paper an inventory model is developed in crisp environment. This model is nonmanufacturing inventory model. Demand is taken as price dependent. Deterioration rate is considered to be constant. Model is developed for without shortage case. Profit and optimum order quantity is obtained for deterministic inventory parameters. Model is illustrated with numerical values of parameters and sensitivity analysis is provided.

**2. Keywords:**

Inventory model; Price dependent demand; Deterioration

**3. INTRODUCTION:**

In Inventory Control System, demand and Deterioration plays important role. Most of the classical inventory models assumed the utility of the inventory remains constant during their storage period. But in a real life, deterioration does occur in storage. The problem of deteriorating inventory has received considerable attention in recent years. Deterioration is defined as change, damage, decay, spoilage, evaporation, obsolescence pilferage, and loss of utility or loss of marginal value of a commodity that results in decreasing usefulness from the original one. Most product such as medicine, blood, fish alcohol, gasoline, vegetables and radioactive chemicals have finite shelf life and start to deteriorate once they are replenished. So An important problem confronting a supply manager in any modern organization is the control and maintenance of inventories of deteriorating items Ongoing deterioration inventory has been studies by several authors in recent decades. price is most important factor in variation of demand. Begum et. al [5] developed an instantaneous replenishment policy for deteriorating items with price-dependent demand. Bhunia et. al [3] developed an inventory model for decaying items by using selling price along with frequency of advertisement and linearly time dependent demand with shortages. In this paper profit maximization EOQ model is developed in crisp environment in which selling price is of item is fixed and known. Deterioration rate is constant. In this paper optimal value of quantity of item to be ordered is determined along with time point when inventory is to be replenished.

**4. ASSUMPTIONS :**

- The scheduling period is constant
- No lead-time.
- Replenishment rate is infinite.
- Demand rate is price dependent.

➤ Shortages are not allowed

### 5. NOTATIONS:

- $Q(t)$  : Inventory level at time  $t$
- $T$  : Time period of cycle
- $Ch$  : holding cost per unit
- $Cd$  : Deterioration cost per unit
- $P$  : Selling Price of item
- $C$  : purchasing cost per item.
- $R$  : Demand rate per item;  $R = (ap^\beta)$
- $PF$  : Net Profit
- $\theta$ : Deterioration rate

### 6. MATHEMATICAL ANALYSIS :

$Q(t)$  is the inventory level at time  $t$  of the item, then the differential equation describing the state of inventory is given by

$$\begin{aligned}\frac{dQ(t)}{dt} + \theta * Q(t) &= -(ap^\beta), 0 \leq t \leq T \\ \frac{d}{dt} e^{-\theta t} * Q(t) &= -(ap^\beta)e^{-\theta t}, 0 \leq t \leq T \\ Q(t) &= -\frac{(ap^\beta)}{\theta} + ce^{-\theta t}, 0 \leq t \leq T\end{aligned}$$

solving the above differential equation using boundary condition  $Q(t)=Q$  at  $t=0$ , we get ,

$$\begin{aligned}c &= \frac{(ap^\beta)}{\theta} + Q \\ Q(t) &= -\frac{(ap^\beta)}{\theta} + \left(\frac{(ap^\beta)}{\theta} + Q\right) e^{-\theta t}, 0 \leq t \leq T\end{aligned}$$

and using boundary condition  $Q(t)=0$  at  $t=T$  in above equation we get

$$\begin{aligned}T &= \frac{\log\left[1 + \frac{Q\theta}{(ap^\beta)}\right]}{\theta} \\ \int_0^T Q(t) &= -\frac{T * (ap^\beta)}{\theta} + \frac{\left(\frac{(ap^\beta)}{\theta} + Q\right)(1 - e^{-\theta T})}{\theta} \\ PF &= (c - p) * Q - (Ch + \theta * Cd) * \int_0^T Q(t)\end{aligned}$$

$$PF = (c - p) * Q - (Ch + \theta * Cd) * \left( -\frac{T * (ap^\beta)}{\theta} + \frac{\left(\frac{(ap^\beta)}{\theta} + Q\right)(1 - e^{-\theta T})}{\theta} \right)$$

Hence the problem is

$$\text{Max } PF = (c - p) * Q - (Ch + \theta * Cd) * \left( -\frac{T * (ap^\beta)}{\theta} + \frac{\left(\frac{(ap^\beta)}{\theta} + Q\right)(1 - e^{-\theta T})}{\theta} \right)$$

Subject to

$$T = \frac{\log_{10} \left[ 1 + \frac{Q\theta}{(ap^\beta)} \right]}{\theta}$$

## 7. NUMERICAL EXAMPLE :

Input : P=10, C=6, a=100,  $\beta=0.5$ ,  $\theta = 0.05$

Output: PF=904.85, T=1.81, Q=466.56

## 8. REFERENCES :

- [1] ArindamRoy ,SamarjitKar, ManoranjanMaiti(2008) “A deteriorating multi-item inventory model with fuzzy costs and resources based on two different defuzzification techniques” Applied Mathematical Modelling, Vol. 32, Issue 2, 208–223
- [2] Bellman R. E., and Zadeh, L. A., (1970), “Decision-making in a fuzzy environment”, Management science, Vol. 17, 141 - 164
- [3] Bhunia A.K. and Maiti M.,(1997), “An inventory model for decaying items with selling price, frequency of advertisement and linearly time dependent demand with shortages”, IAPQR Transactions, Vol. 22, 11 - 49
- [4] Klir, G.J. and Bo Yuan, Fuzzy sets and fuzzy logic, Theory and applications.
- [5] R. Begum, R. R. Sahoo, S. K. Sahu, and M. Mishra(2010), “An EOQ Model for Varying Items with Weibull Distribution Deterioration and Price-dependent Demand” Journal of Scientific Research Vol. 2, Issue 1, 24-36
- [6] Umap. H. P., V. H. Bajaj (2007),” Multi-item fuzzy EOQ model for deteriorating item”, International Journal of Agricultural & Statistics Sciences, Vol. 3, Issue 2, 597-608
- [7] Zimmermann, H.J., (1991), Fuzzy set theory and its applications, second Ed., Kluwer, Academic publisher, Dordrecht.