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Survey of Partial Backlogging Inventory Models

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ABSTRACT *In the present model we present an up to date review of literature of backlogging inventory models. In this literature we analyzed all the aspects of backlogging case*

KEYWORDS :Inventory, Backlogging.

INTRODUCTION

This is a very important issue in the inventory theory related to how to deal with the unfulfilled demands which occur during shortages or stock outs. In most of the existing models researchers considered that the shortages are either completely backlogged or completely lost. The first case is known as backordered or backlogging case, represent a situation where the unfulfilled demand is completely back ordered. In the second case, also known as lost sale case, we assume that the unfulfilled demand is completely lost. Furthermore, when the shortages occur, some customers are willing to wait for backorder and others would turn to buy from other sellers. In many cases customers are conditioned to a shipping delay and may be willing to wait for a short time in order to get their first choice. For instance, for fashionable commodities and high-tech products with short product life cycle, the willingness of a customer to wait for backlogging is diminishing with the length of the waiting time. Thus, the length of the waiting time for the next replenishment would determine whether the backlogging would be accepted or not. In many real life situations, during a shortage period, the longer the waiting time is, the smaller is the backlogging rate would be. Thus, concept of partial backlogging should not be ignored in inventory models of shortage.

ANALYSIS:

Zangwill (1966) formulated a production multi-period production scheduling model with backlogging. Inventory models with a mixture of backorders and lost sales were formulated by **Montgomery et al. (1972)**.**Rosenberg (1979)** discussed the analysis of a lot-size model with partial backlogging. **Mak (1987)** find optimal production-inventory control policies for an inventory system. Shortages in inventory were allowed and partially backlogged.

Economic production lot size model for deteriorating items with partial backordering was suggested by **Wee (1993)**. **Abad (1996)** calculated a generalized model of dynamic pricing and lot-sizing for perishable items. Shortage was allowed and the demand was partially backlogged. The effects of lost sales on composite lot sizing were discussed by **Sharma** and **Sadiwala (1997)**.Deteriorating inventory model with quantity discount, pricing and partial backordering was developed by **Wee (1999)**. In this study, demand was assumed to decrease with the increment in price for the product. The numerical example was also given to illustrate the model. Optimal price and order size inventory policy for a reseller under partial backlogging was proposed by **Abad (2000-a)**. The problem of determining the lot size for a perishable good under finite production was formulated by **Abad (2000-b)**. Shortage in inventory was allowed with partial backordering and lost sale. Author has taken a problem of determining the production lot size of a perishable product that decays at an exponential rate. **Wu (2000)** developed inventory model for items with Weibull distribution deterioration rate, time dependent demand and partial backlogging.An EOQ inventory model for items with Weibull distribution deterioration rate and ramp type demand was formulated by **Wu (2001)**. Shortages in inventory were allowed and assumed to be partially backlogged. **Ouyang** and **Chang (2002)** presented stochastic continuous review inventory model with variable lead time and partial backorders to capture the reality of uncertain backorders. An EOQ model for deteriorating items with time-varying demand and partial backlogging was suggested by **Teng et al. (2003)**. **Papachristos** and **Skouri (2003)** considered a model where the demand rate was a convex decreasing function of the selling price and backlogging rate was a time dependent function. The time of deterioration of the item was distributed as two parameter Weibull distribution function of time. A general time-varying demand inventory lot-sizing model with waiting-time-dependent backlogging and a lot-size-dependent replenishment cost was developed by **Zhou et al. (2004)**.An EOQ model with time varying deterioration and linear time varying demand over finite time horizon was proposed by **Ghosh** and **Chaudhuri (2005)**. Shortages in inventory were allowed and partially backlogged with waiting time dependent backlogging rate. **Ouyang et al. (2005)** discussed an EOQ inventory mathematical model for deteriorating items with exponentially decreasing demand. The shortages were allowed and partially backordered. The backlogging rate was variable and dependent on the waiting time for the next replenishment. **Pal et al. (2006)** have developed an inventory model for single deteriorating item by considering the impact of marketing strategies such as pricing and advertising as well as the displayed stock level on the demand rate of the system. Shortages were allowed and the backlogging rate was dependent on the duration of waiting time up to the arrival of next lot. An economic production lot size model for deteriorating items with stock-dependent demand was produced by **Jolai et al. (2006)** under the effects of inflation. Shortages were allowed and partially backlogged. A deterministic inventory model for deteriorating items with price dependent demand was developed by **Dye et al. (2007-a)**. The demand and deterioration rates were continuous and differentiable function of price and time, respectively. Shortages for unsatisfied demand were allowed and backlogging rate was taken as negative exponential function of the waiting time. Numerical example was also used to study the problem numerically. **Dye et al. (2007-b)** presented a deterministic inventory model for deteriorating items with two warehouses. The deterioration rate in both the warehouses was taken as different. Shortages in OW were allowed and the backlogging demand rate was dependent on the duration of stockout. Authors have used numerical example to illustrate the model and conclude the paper with suggestions for possible future research.An inventory lot-size model for deteriorating items with partial backlogging was formulated by **Chern et al. (2008)**. Authors have taken time value of money in to consideration. The demand was assumed to fluctuating function of time and the backlogging rate of unsatisfied demand was a decreasing function of the waiting time. The effects of inflation and time value of money were also considered in the model. **Thangam** and **Uthayakumar (2008)** presented a two-level supply chain model with partial backordering and approximated Poisson demand. **Skouri et al. (2009)** developed an inventory model with general ramp type demand rate, time dependent (Weibull) deterioration rate and partial backlogging of unsatisfied demand.A perishable inventory model for decaying items with decay rate as two parameter Weibull distribution in which demand was taken as a function of time and shortages were allowed was formulated by **Agarwal and Singh (2013). Chang et al. (2010)** formulated an inventory model for non-instantaneous decaying items in which demand was taken as dependent on stock. **Shukla et al. (2013)** established an inventory model for decaying items .In this model demand was taken as exponential function and shortages were allowed. **Jaber et al. (2008)** discussed an production inventory model for non perfect quality items. **Singh et al. (2010)** stated a perishable inventory model or decaying items. In this model demand was taken as dependent on stock and shortages were

allowed with inflationary conditions. **Dye, (2013)** formulated a perishable inventory model for decaying items. In this model the effects of preservation technology were studied. **Singh & Sharma (2014)** examined the a perishable inventory model for non perfect production system. The demand in this model was taken as stock dependent. **Tayal et al. (2014)** discussed a decaying items model with seasonal products and an option of an alternative market. **Singhal & Singh (2015)** formulated an inventory model with multi- variate demand under volume flexibility and learning. Credit financing in policies of orders for non-instantaneous decaying items and the demand was taken as price dependent under the environment of permissible delay in payments was developed by **Jaggi et al. (2015).** Therefore, during the proposed study we discussed a model in which the demand is taken as dependent on stock with non-instantaneous decay. Shortages are allowed and partially backordered with a variable backlogging rate.

CONCLUSION:

In the present model we review up to date literature of backordering item inventory model. In the whole literature it is obvious that mostly we encountered with single item inventory model. A few models are there for multi item inventory model.

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