

## Analysis of Two-Echelon Supply Chain with Perishable Items under Stochastic Demand

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**Abstract :** Perishability and developing an intelligent control policy for perishable items are the major concerns of marketing managers in a supply chain. In this study, we address a two-echelon supply chain problem for perishable items with a single vendor and a single buyer. The buyer adopts an aged-based continuous review policy which works by taking both the stock level and the aging process of items into account. The vendor works under the warehouse framework, where its lot size is determined with respect to the batch size of the buyer. The model holds for a positive and fixed lead time for the buyer, and zero lead time for the vendor. The demand follows a Poisson process and any unmet demand is lost. We provide exact analytic expressions for the operational characteristics of the system by using the renewal reward theorem. Items have a fixed lifetime after which they become unusable and are disposed of from the buyer's system. The age of items starts when they are unpacked and ready for the consumption at the buyer. When items are held by the vendor, there is no aging process which results in no perishing at the vendor's site. The model is developed under the centralized framework, which takes the expected profit of both vendor and buyer into consideration. The goal is to determine the optimal policy parameters under the service level constraint at the retailer's site. A sensitivity analysis is performed to investigate the effect of the key input parameters on the expected profit and order quantity in the supply chain. The efficiency of the proposed age-based policy is also evaluated through a numerical study. Our results show that when the unit perishing cost is negligible, a significant cost saving is achieved.

**Keywords :** two-echelon supply chain, perishable items, age-based policy, renewal reward theorem

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