An Optimal Reallocation Policy Model for Perishable Consumer Goods on a Finite Planning Horizon Considering Product Desirability

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Abstract

An application of returns management to the traditional supply chain activities would enable a firm to efficiently handle reverse product flows and would help identify opportunities to reduce the backward flow of goods. One way of implementing returns management is through proactive inventory monitoring of perishable consumer goods, alongside optimizing facility assignment, such that the occurrence of outdates are reduced. The study aimed to incorporate the concept of returns management and perishable inventory management in optimizing a system which allows for product reallocation at the same time considering the best possible assignment of facilities. The study deals with a three-level network consisting of retailers, warehouses, and final disposal facilities for a single product considering both forward and reverse logistics activities. A mathematical model was formulated to minimize the overall total system cost. A deterministic model was first constructed and translated to the General Algebraic Modeling Systems (GAMS) language after which Risk Optimizer was used to validate the model's behavior if demand were taken to follow a certain distribution. From the comparison, it was seen that the behavior of the model given either a deterministic or stochastic demand remains the same. Design of Experiments (DOE) was used to determine which factors significantly affect the system response. Using Response Surface Methodology (RSM), the relationships among all significant factors were analyzed and observed. Through RSM and GAMS, the desirability of product reallocation was evaluated. The model was compared to a traditional one wherein no reallocations were allowed. From the results of the comparison, it could be said that reallocation would indeed allow for minimization of cost and occurrence of outdates.