

Omni-Channel Lot-Sizing with Split Fulfillment and Returns: A Mixed-Integer Linear Programming Model

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Abstract

We develop a multi-period, multi-product Mixed Integer Linear Programming (MILP) model for omni-channel retailer that operates distribution centers (DCs) and stores and serves both walk-in and online demand. In each period, the firm decides how much to order into DCs, how much to replenish to stores, and how to fulfill online orders—shipping from DCs, shipping from stores, or BOPIS (buy-online-pick-up-in-store). The objective is to minimize total cost, including fixed ordering, unit purchasing, inventory holding, DC-to-store transport, online order delivery or BOPIS handling, and reverse-logistics costs from product returns. The model unifies lot-sizing, split fulfillment (means an online demand is served by more than one location, for example, some units ship from a DC, some ship from store, or BOPIS), and returns, informing tactical planning and policy evaluation for omni-channel retailing practice. A test dataset validates the formulation: it lowers total cost, balances store workload, and recovers inventory versus a DC-only benchmark.

Keywords

Omni-channel retail; Lot-sizing; Split fulfillment; Reverse logistics; Mixed-Integer Linear Programming (MILP).

Biography

Nusrat T. Chowdhury is an Associate Professor, in the School of Technology, Art and Design at the Bemidji State University Minnesota, USA. She earned her Bachelors and Masters in Industrial and Production Engineering from Bangladesh University of Engineering and Technology, Bangladesh, and PhD in Industrial and Manufacturing System Engineering from University of Windsor, Ontario, Canada. Her research interest is in the areas of Supply Chain and Inventory Management, Computer Aided Process Planning (CAPP), Operations Research, and Computational Complexity.