

# **Cross-Border Order Fulfillment and Inventory Planning Framework for a Distribution Network**

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## **Abstract**

We study the cross-border order fulfillment and inventory planning problem of a company which produces themed gift items in Turkey and ships these products to exhibition distribution points across Europe via its main warehouse in Europe. Currently, the company plans shipment frequencies, stock levels, and production quantities largely based on managers' experience. This structure can lead to excess stock at the main warehouse, stock shortages at sales points, and increased total logistics costs, especially during periods of uncertain demand and variable shipping times. Our primary goal is to design a data-driven planning framework that integrates production, inventory management in the main warehouse, and shipment decisions to sales points across Europe under a single umbrella. We develop an integrated mathematical model that aims to keep total costs at minimum while maintaining an acceptable level of service. Our model addresses a multi-product, multi-sales point, and multi-period structure; to decide production quantities in Turkey, quantities sent to the warehouse, stock levels at the warehouse, quantities shipped from the warehouse to each sales point, and the amount of backorder that may arise when necessary. The company's real-life constraints are directly considered in the model. For instance, elements such as shipments being made according to Euro pallet standards, product-based box capacities, warehouse capacity, and production and transportation capacity constraints are included in the constraint set of the model. Several scenarios are designed and their results indicate that the integrated model can be used as a decision support framework in the company.

## **Keywords**

Supply chain, Inventory panning, Mixed-integer linear programming, Optimization, Scenario analysis

## **Biographies**

**Demet Özgür-Ünlüakın** is an Assistant Professor in the Department of Industrial Engineering at Işık University, Istanbul, Turkey. She received her B.S., M.S. and Ph.D. degree in Industrial Engineering from Boğaziçi University, Istanbul, Turkey in 1995, 1997 and 2008 respectively. Her research interests include maintenance optimization, probabilistic graphical models and operations research applications.

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