

## **Decarbonizing Spare Parts Logistics: Inventory Optimization with Dual Sourcing**

Bram De Moor

*Eindhoven University of Technology*

Spare parts inventory management systems have traditionally focused on balancing cost efficiency with service performance. More recently, environmental considerations have gained attention, driven by ambitious emission-reduction targets. In this context, we study a spare parts inventory network that jointly optimizes costs and emissions associated with inventory holding and transportation, while satisfying service level agreements. To reduce emissions, we introduce the option of shipping from the central warehouse to local warehouses by boat---a slower but lower-emission mode compared to the currently used air transport. The network is managed using a dual base-stock policy. We develop a heuristic method to efficiently evaluate and optimize base-stock levels, enabling practical optimization in a large, real-world setting. A numerical experiment illustrates the effectiveness of our approximation method. We then apply our approach to a real-world case to assess how dual sourcing affects costs, emissions, and service levels. Our findings reveal that the benefits and feasibility of dual sourcing are highly context-dependent, varying with the characteristics of the operational environment.