

# How Are Supply Chain Optimal Decisions Influenced by Product Characteristics?

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## Abstract

This study explores how supply chain strategies should be aligned with demand/product characteristics and market requirements. A review of the product-driven supply chain literature suggests that there is a lack of analytically proven guidelines to help strategy makers confidently design their supply chains. In this paper, we provide a mathematical validation for Fisher's (1997) framework which is extensively cited in the literature and matches supply chain strategies (i.e., efficient or responsive) with product type (i.e., functional or innovative). Specifically, we analyze the impact of demand variability, product life-cycle, and contribution margin on the supply chain capabilities, i.e., efficiency and responsiveness. Our analysis starts with an initial discussion on the two inventory models, newsvendor and continuous review, and then develops the continuous review model into a multi-echelon supply chain structure where optimality is mathematically explored to demonstrate how it would change when product/demand characteristics change. The results confirm that optimal lead-time decreases in demand variability and contribution margin, but increases in product lifecycle. Moreover, optimal order size increases in demand variability and contribution margin (and so does in average stock-out cost), but decreases in product lifecycle.

## Keywords

Supply chain strategy; optimal inventory decisions; product characteristics.

## Biography

**Mojtaba Mahdavi** is a PhD Student in Operations and Supply Chain Management in the Department of Information Systems and Operations Management at the University of Auckland Business School. He has received both his Bachelor and Master Degrees in Industrial Engineering in Iran, where he was working in automotive and lighting industries for five years after his graduation. Production Planning, Quality Management, and Maintenance Planning are the areas of his working experience. His PhD is in designing product-driven supply chain strategy, and he has presented his research outputs in some International Conferences, e.g., POMS 2015; Washington DC, MSOM 2016; Auckland, and INFORMS 2016; Nashville. He is currently lecturing on Business Logistics for undergraduate students at the University of Auckland Business School, and assisting the New Zealand Research Center for Supply Chain Management.

**Tava Lennon Olsen** holds the Ports of Auckland chair in Logistics and Supply Chain Management at the University of Auckland Business School and is the Director of the University's Centre for Supply Chain Management. Prior to joining Auckland, she was Professor of Operations and Manufacturing Management in the Olin Business School at Washington University in St. Louis, which she joined after serving as an Assistant Professor in the Department of Industrial and Operations Engineering at the University of Michigan, Ann Arbor. Professor Olsen received her B.Sc. (honours) in Mathematics from the University of Auckland and her Ph.D. in Operations Research in 1994 from Stanford University. Her research interests include supply-chain management, pricing and inventory control, and stochastic modeling of manufacturing, service, and healthcare systems. Professor Olsen is currently an Associate Editor for *Management Science*, *M&SOM*, and *Operations Research*, is a senior editor of *Production and Operations Management*, and is the Topical Editor for Supply-Chain Management for the *Wiley Encyclopedia of Operations Research and Management Science*. She is a past president of the Manufacturing and Service Operations (MSOM) society and has been awarded the Auckland Business School's sustained research excellence award.