

NYU Stern School of Business
Department of Information, Operations & Management Sciences
OPERATIONS MANAGEMENT RESEARCH SEMINAR

TOPIC: Mitigating Spillover and Whiplash in Online Retailing via Replenishment

SPEAKER: Stephen Graves (MIT)

DATE: Wednesday, May 7, 2014

TIME: 11:00 AM-12:00PM

PLACE: KMC 3-60

ABSTRACT

This paper proposes and tests an inventory allocation heuristic for online retailing. Key characteristics that distinguish online retailing from brick-and-mortar retailing are: joint inventory replenishment to multiple fulfillment centers (warehouses); the flexibility to choose which fulfillment centers serve a particular customer order; and significant outbound shipping costs which must be considered in addition to holding and stockout costs.

In this paper, we describe the unique characteristics of an online retailing inventory system. Assuming that system-wide inventory levels and stocking locations have been decided a priori, we examine different ways to allocate this inventory among the selected fulfillment centers under a periodic review replenishment policy. By examining small examples and analyzing data from a large American online retailer, we show how traditional decentralized allocation policies may perform suboptimally and induce costly dynamics, especially when inventory imbalance and local stockouts are common. We then describe why local stockouts and inventory imbalance are especially common in online retailing, due to shared safety stocks and everyday operational realities. We provide evidence for the latter based on our acquired dataset. Finally, we propose a new replenishment policy that is based on an implementable linear programming-based heuristic and that allocates inventory accounting for possible spillover during the lead time. We test the heuristic by a simulation that accounts for disruptions due to operational realities. Our heuristic dampens the costly dynamics, and leads to savings in outbound shipping costs over the status quo policy of between 0.5% and 1%, depending on the magnitude of the disruptions.

Jason Acimovic and Stephen C. Graves

BIO

Stephen C. Graves is the Abraham J. Siegel Professor of Management Science at MIT. Steve received his A.B. and M.B.A. from Dartmouth College and completed his Ph.D. in operations research from the University of Rochester. Since 1977 he has been a faculty member at the MIT Sloan School of Management. He has served as a deputy dean at the MIT Sloan School (1990 –

1993) and the co-director of the MIT Leaders for Manufacturing (LFM) Program (1989- 1990 and 1994 – 2001) and the System Design and Management (SDM) Program (1999 – 2001). He served a two-year term as the Chair of the MIT Faculty (2001 – 2003). He has joint faculty appointments with both the Mechanical Engineering Department and the Engineering Systems Division at MIT. Steve is interested in the development and application of operations research models and methods to solve problems in manufacturing systems, supply chains and service operations. Current projects include supply chain optimization; strategic inventory positioning in a supply chain; tactical issues in e-retailing; and production planning and scheduling for various contexts. Steve has conducted practice-based research with many companies and served in various editorial capacities on several journals.