

Research and Management Insights

Clinic Capacity Management: Planning Treatment Programs that Incorporate Adherence

Jessica H. McCoy, M. Eric Johnson

Adherence plays an important role in treatment effectiveness and epidemic growth, particularly for chronic infectious diseases. Clinics can use patient characteristics such as how far patients live from the clinic to estimate patient adherence. The combination of declining adherence and increasing treatment enrollment for diseases such as HIV in resource-limited regions emphasizes the need for planners to consider adherence when allocating treatment funds. Jessica McCoy and Eric Johnson incorporate adherence to estimate the impact of a clinic's treatment decisions on disease incidence in a population. They find that clinics should allocate their budgets over time to achieve the lowest cost per infection averted. For example, clinics should enroll only patients with adherence above a threshold (reserving some funds for later) to minimize disease incidence over time. Further, clinics that ignore or overestimate the adherence of their patients will overestimate treatment program effectiveness. This work supports planners in choosing the best size for disease treatment programs, in much the same way that hospitals choose the number of beds to staff. Clinics can use the results here to gain a better understanding of the tradeoffs between epidemic growth and patient adherence and to help determine when to increase their service radius to target additional patients.

Vertical Integration under Competition: Forward, Backward, or No Integration?

Yen-Ting Lin, Ali K. Parlaktürk, Jayashankar M. Swaminathan

Vertical integration is a popular strategy for gaining competitive edge. Nevertheless, the direction of vertical integration is often diverse: some manufacturers choose to forward integrate retail operations, while others opt to backward integrate supply functions. Forward integration provides a manufacturer direct access to end customers, allowing it to better respond to changes in demand. On the other hand, backward integration strengthens the control on the quality of raw material. Which integration strategy should a manufacturer choose? How does competition

between supply chains affect a manufacturer's vertical integration decision? Yen-Ting Lin, Ali Parlaktürk and Jayashankar Swaminathan find that the degree of product perishability, cost of quality, and how much consumers value quality are critical determinants for a manufacturer's chosen direction of integration. Earlier research indicates that competing manufacturers may choose not to vertically integrate if forward integration is the only integration option. In contrast, the authors find that manufacturers always choose to vertically integrate when backward integration also becomes an option. In addition, competition increases the attractiveness of backward integration relative to forward integration.

Strategic motive of introducing Internet channels in a supply chain

Lu Hsiao and Ying-Ju Chen

In the Internet era, there are still a significant portion of retailers that focus exclusively on the physical channels, and a number of leading manufacturers insist to sell through the direct channels. Given the consistent profitability and large organizations, these channel management decisions seem to be strategic rather than operational. Lu Hsiao and Ying-Ju Chen provide an economic rationale for this seemingly puzzling phenomenon. They build a game-theoretic model to investigate the interaction between the capabilities of introducing the Internet channels, the pricing strategies, and the channel structure. Assuming that all channel parties are capable of operating the Internet channels, the authors uncover the salient drivers for the market equilibrium, and subsequently provide the practitioners new design principles for their channel management strategies.

Competitive Quality Choice and Remanufacturing

Adem Orsdemir, Eda Kemahlioglu-Ziya, Ali K. Parlakturk

Remanufacturing can be done either by third party independent remanufacturers (IR) or original equipment manufacturers (OEM). When it is done by the IRs, there is competition between the IRs and the OEMs. This type of competition has unique aspects because remanufactured products' quality, quantity and cost depend on that of the new products. This

dependency allows the OEM to use different strategic levers to compete with the IR. Adem Orsdemir, Eda Kemahlioglu-Ziya, Ali Parlakturk show that the OEM relies more on product quality as a strategic lever when it has a stronger competitive position (determined by the relative cost and value of new and remanufactured products), and in contrast it relies more heavily on limiting quantity of cores when it has a weaker competitive position. In addition, the results suggest that this type of competition may reduce consumer and social welfare. Furthermore, the authors show that intense competition (when the IR has competitive power similar to the OEM) may increase the environmental impact whereas mild competition (either the IR or the OEM has a higher competitive power) may reduce the environmental impact. The authors also demonstrate that making remanufacturing more attractive is more like to improve the environmental impact when remanufacturer is done by the OEM rather than the IR.

Dynamic Pricing and Inventory Management with Regular and Expedited Supplies

Sean X. Zhou and Xiuli Chao

Supply diversification and dynamic pricing are strategic tools nowadays companies often adopt to stay competitive. A resulting important operational issue is how to jointly determine optimal inventory replenishment and pricing policies. In this article, Sean Zhou and Xiuli Chao develop a joint inventory-pricing model with two supply sources differing in cost and lead time and characterize the optimal policy for the firm, and they show that supply diversification increases the firm's profit, reduces the optimal safety-stock level, and lowers the optimal selling price. Therefore, supply diversification benefits the firm as well as its customers. Moreover, supply diversification and dynamic pricing strategies are "substitute" to each other in improving the profitability of the firm.

An Auction Mechanism for Pricing and Capacity Allocation with Multiple Products

Selçuk Karabatı, Zehra Bilgintürk Yalçın

In a typical short term capacity planning and pricing problem, a centralized approach takes into consideration each customer's individual preferences and response to prices. In a setting where customers do have privately held information, centralized decision making is not possible, and decentralized mechanisms are required to solve the problem. Karabatı and Yalçın design and employ an iterative auction mechanism to address the integrated capacity planning and pricing problem. Their study provides a comprehen-

sive evaluation of efficiency of alternative pricing schemes that can be employed by the manufacturer. Most of the studied pricing schemes are found to be able to achieve system's maximum profit and transfer it almost completely to the manufacturer when all information is public. When buyers keep their information private, manufacturer is forced to solve the problem with market-based mechanisms, resulting in transfer of considerable amount of the system's maximum profit to the buyers. The designed auction mechanism also captures the dynamics of capacity scarcity as it allocates a higher portion of the system's profit to the manufacturer when the demand to capacity ratio is higher.

Lead-time Management through Expediting in a Continuous Review Inventory System

Hamed Mamani, Kamran Moinzadeh

The rise of global transportation companies within the shipment service industry presents retailers with diverse freight alternatives. Furthermore, the advent of tracking technologies such as radio frequency identification (RFID) provides order progress information. Together, shipping alternatives and order tracking technologies constitute a viable option for managing lead times in the current supply chains. Hamed Mamani and Kamran Moinzadeh consider an inventory system where delivery lead times can be managed by expediting in-transit orders shipped from the supplier, and propose an ordering/expediting policy and derive expressions for evaluating the operating characteristics of such systems. The article indicates that: (1) a single expediting hub that is optimally located in a shipment network can capture the majority of cost savings achieved by a multi-hub system, especially when expediting cost is not too low or demand variability is not too high; (2) when expediting time is proportional to the time to destination, for small-enough or large-enough demand variations, a single expediting hub located in the middle of the shipment network can capture the majority of cost savings of an optimally-located hub; and (3) in general, hubs close to the retailer significantly drives down costs, whereas hubs close to the supplier may not offer much cost savings.

Coordinated Logistics: Joint Replenishment with Capacitated Transportation for a Supply Chain

N.C. Buyukkaramikli, U. Gurler, O. Alp

Inventory management and transportation operations are two major logistics operations of supply chains. Inventory managers seek optimal inventory replenishment decisions whereas transportation managers seek optimal fleet sizes and least costly dis-

patching protocols. Even though these two operations are closely related to each other, conventional practice suggests managing these two operations separately. In practice, inventory unit generally ignores the capacitated and limited nature of the transportation vessels whereas the transportation unit focuses solely on the total cost of their operations and ignore the impact of dispatching decisions on the inventory related costs. In order to overcome this discrepancy, Buyukkaramikli, Gurler, and Alp develop models that coordinate these two logistics activities in a supply chain where the warehouse operates with a limited size in-house fleet of vehicles to ship the orders of its retailers. Inventory replenishment decisions as well as the fleet size can be optimized by these models. The authors show that there is a substantial value of coordinating these two logistics activities. Similarly, ignoring the capacitated nature of transportation operations elevates operational costs. The authors also show that there are minimum and maximum fleet size thresholds where congestion levels are permissible and operations are economical, respectively.

Supply disruptions, heterogeneous beliefs, and production efficiencies

Ying-Ju Chen

Supply chain disruption is an increasingly important issue facing supply chain managers. Ying-Ju Chen investigates the optimal procurement design with supply disruptions and heterogeneous beliefs between the buyer and the supplier. The author examines the impact of information asymmetry on the supplier's belief, the control right of the backup production, and the verifiability of supply disruption. The belief heterogeneity creates speculative gains and losses because the buyer and the supplier hold different estimates of the disruption probability. The author demonstrates that the buyer's incentive to exploit this belief heterogeneity leads to real production inefficiencies, and the production efficiency is not necessarily improved with more transparent information. The author also identifies the supplier's disincentive to

improve the reliability, and a cost increase in expectation may result in an upward adjustment of production planning. These non-trivial implications provide new guidelines for practitioners to fight against supply disruptions.

Dedicated Transportation Subnetworks: Design, Analysis, and Insights

Tharanga Rajapakshe, Milind Dawande, Srinagesh Gavirneni, Chelliah Sriskandarajah, P. Rao Panchalavarapu

Over the years, the scope of third-party logistics service providers (3PLs) has evolved to offering lucrative non-asset-based services to their customers, resulting in a need to progressively increase the resources allocated to these non-traditional avenues. Consequently, 3PLs are in need of alternate ways to handle their traditional asset-based businesses that are primarily involved in satisfying the shipping requirements of their customers. Among the various options, the novel idea of subcontracting a dedicated transportation subnetwork (DSN) can result in significant cost savings for a 3PL. A DSN is a piece of the original shipping network that can be autonomously operated. Therefore, a subcontractor can exclusively assign its assets to operate a DSN, resulting in a win-win situation for both the subcontractor and the 3PL. The size and the profitability of subcontracting a DSN depend on (i) structural properties of the original network, such as its density, demand distribution on its lanes, and connectivity, and (ii) the subcontractor's efficiency in handling shipping volume and available capacity. Tharanga Rajapakshe, Milind Dawande, Srinagesh Gavirneni, Chelliah Sriskandarajah, and Rao Panchalavarapu provide a practical solution to the problem of identifying a "good" DSN that is suitable for outsourcing to one or more subcontractors, while incorporating several important real-world features and constraints such as the need for asset repositioning, availability of subcontractors' resources, and the impact of splitting the shipping volume on the lanes of the network.