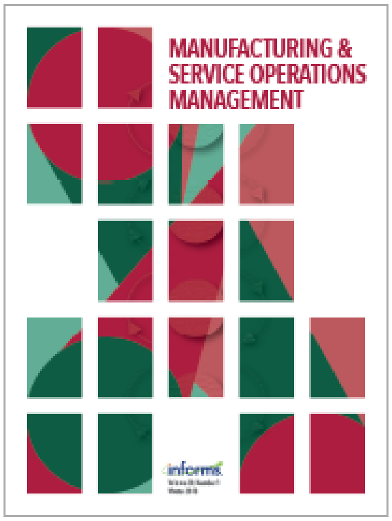

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In This Issue

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In This Issue

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A regular feature of *Manufacturing & Service Operations Management*, "In This Issue" briefly describes each issue's articles and highlights their contributions.

Key words: editor's comments; issue overview; summaries

"A Staffing Algorithm for Call Centers with Skill-Based Routing," by Rodney B. Wallace and Ward Whitt
Call centers have become a dominant channel of delivery for modern service providers. A key strategic concern in call center operations is how best to balance economies of scale and economies of specialization in staffing. Namely, while having cross-trained workers able to handle all call types provides pooling economies, it increases training costs and risks spreading agent time and attention over a large variety of call types, decreasing their efficiency. Conversely, having agents specialize in a particular call type increases their efficiency in handling calls, but fragments the staff into disjoint agent pools that cannot effectively share workload imbalances. Assessing this trade-off, moreover, hinges on how calls are routed and agents are managed on a tactical level, which inextricably links the strategic and tactical decisions.

To address this connection, the authors develop an algorithm for both routing and staffing in call centers, which—though fundamentally tactical in focus—provides a means to analyze the important strategic issue of determining the "optimal" degree of specialization. Their model shows that a modest amount of staff flexibility goes a long way and parallels similar results in the flexible manufacturing literature. They apply this limited flexibility principle to develop an algorithm for both routing and staffing decisions and show it is nearly optimal in a range of simulation test. Because the model assumptions are realistic, the proposed methods can be applied in practice with only minor modifications.

"Safety Stock Positioning in Supply Chains with Stochastic Lead Times," by David Simchi-Levi and Yao Zhao
A common planning problem in supply chain management is determining the location and magnitude of safety stocks in a multistage production and distribution system. In this paper, the authors extend the theory of the exogenous, sequential supply systems to include multistage assembly systems, and they provide a uniform treatment of various supply chain topologies such as serial, assembly, and distribution systems. They derive exact recursive equations for the backorder delays at each stage in the supply chain, which allows them to characterize the dependency among the backorder delays at different stages, including complex correlations in multistage assembly systems.

The approach provides both transient and steady-state analysis. By considering what happens at the arrival of an external demand, the authors are able to characterize the time at which the corresponding order is placed at each stage in the supply chain. Thus, the recursive equations hold for supply chains both in steady states and in transient states with either time-varying or temporally correlated demand. The analysis provides new insights into system properties and safety stock allocation decisions. The authors also develop numerically efficient approximations and provide conditions under which the approximations work well. Using the expected backorder delays as the decision variables, they also show how to modify Graves and Williams's algorithm to optimize the safety stock allocation in single-product, *a*-cyclic supply chains with stochastic sequential lead times.

"Improved Base-Stock Approximations for Independent Stochastic Lead Times with Order Crossover," by James R. Bradley and Lawrence W. Robinson

An analytical difficulty in inventory theory is the possibility of order crossing. Specifically, when replenishment orders cross—that is, arrive in a different sequence than that in which they were placed—the optimal base-stock level should be set as a fractile of the inventory shortfall distribution rather than a fractile of the lead-time demand distribution. (The inventory shortfall is the quantity of goods that has been ordered and that has not yet been received.) Approximate base-stock policies based on the shortfall distribution, however, are difficult to compute compared with those based on the lead-time demand distribution, because the former requires calculating the variance of the number of orders outstanding. This is cumbersome and requires more information than is likely to be known in practice.

The main contribution of this paper is to develop tractable bounds on that variance. The bounds allow the authors to closely approximate the variance of the inventory shortfall and to easily calculate heuristic base-stock levels. These simple and accurate bounds obviate the need to compute the precise variances when setting heuristic base-stock levels. On a theoretical level, the authors' bounds show that the variance of the number of orders outstanding is bounded above by the standard deviation of lead time divided by $\sqrt{3}$. Hence, the shortfall can be significantly less than that of the lead-time demand. This implies that the common approach of setting the base-stock level using the lead-time demand distribution can significantly overstate how much safety stock is required. On a practical level, the authors' upper bound makes the normal approximation of the shortfall distribution just as easy to use as the common normal approximation of the lead-time distribution: It requires no more information or computational effort.

"Retail Assortment Planning in the Presence of Consumer Search," by Gérard P. Cachon, Christian Terwiesch, and Yi Xu

Customers often decide which product variants they want while shopping rather than knowing their preferred variant ex ante. In such cases, a retailer's assortment decision can significantly influence a customer's assessment of the range of market alternatives and hence their decision to buy now or continue searching; higher levels of variety in an assortment may dissuade customers from searching elsewhere, while low levels of variety may encourage them to search further. In this paper, the authors formulate several models of assortment planning that explicitly consider the effects of assortment variety on customer search decisions. They show that it may be optimal for a retailer to carry product variants that are not profitable simply to discourage customers from searching; that is, the increased likelihood of purchasing generated by having a large assortment can more than compensate for the losses incurred by carrying low-volume product variants. They further show that if retailers ignore the effect of variety on search behavior, they may severely underestimate the value of increased product variety, leading to significant losses in total category profits.

"Biform Analysis of Inventory Competition," by Harborne W. Stuart Jr.

Strategic inventory (newsvendor) competition is a topic of growing interest in operations management. An essential feature of this literature is the assumption that firms use fixed prices and incur overage and underage costs when there are supply-demand imbalances. Using a biform game formalism, the author examines this assumption and compares it to the case where ex post price competition is used to match supply and demand. The biform analysis allows this second-stage price competition to be modeled quite generally without a priori assumptions about who has price-setting power or what pricing mechanisms are used to clear the market. With no demand uncertainty, he shows the inventory decision is equivalent to the capacity decision in Cournet competition. The analysis shows that the fixed price assumption is, in many ways, the defining characteristic of inventory competition models. It also demonstrates that unrestricted ex post pricing competition may not lead to market clearing prices, and hence additional assumptions about the pricing procedure may be necessary to obtain sharp predictions. Overall, the analysis highlights the important role that pricing assumptions play in the theory of inventory competition.

"A Supply Chain Model with Reverse Information Exchange," by Apurva Jain and Kamran Moinzadeh This paper models a new and growing business practice in which manufacturers share their supply status information directly with retailers. But what are the implications of this practice for supply chains? The authors' model of this situation is rooted in an existing stream of research on inventory models with supply information, but their model simplifies and extends the existing theory in a novel way. Specifically, the authors propose a new approach to solve the underlying Markov chain and prove its validity. Their exact analysis is used as the basis for an algorithm to find the optimal parameters for the retailer's policy and to determine the effect of the retailer's decisions on the manufacturer's operating performance and profits.

The authors' analysis provides several important insights for managers of such systems. For one, they show that because a retailer's behavior influences the supply system, retailers may not benefit by having the supply information under a range of parameter values. Specifically, sharing such information with a retailer may actually increase variability in the retailer's orders and may thus lead to worse operating performance. The authors also show computationally that even if the manufacturer knows the retailer's inventory position, it may still suffer from the increased variability of orders. Finally, they develop examples to illustrate how the manufacturer can also benefit from such information sharing. The paper provides guidelines for when manufacturers should and should not share supply information with retailers.