

PRODUCTION AND OPERATIONS MANAGEMENT

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Mission Statements

Industry Studies & Public Policy

The department seeks papers that further our understanding of operations by explicitly accounting for industry-specific *contextual details* that motivate, describe, or improve a firm's, organization's, or industry's operational decisions or outcomes. Studies that focus on industry specific considerations with respect to competitiveness, disruptions, inventory and logistics, productivity evolution, project management, product and service development, occupational safety, supply chains, sustainability, talent management, or technological choices are particularly welcome. Studies are encouraged to dive deeply into a specific industry (e.g. the pharmaceuticals industry), and their findings need not generalize to other settings (e.g. the automotive sector). However, the exposition must offer rich operational detail and explain how findings hinge upon details that may be unique to the industry context. We also encourage within-industry or cross-industry studies that examine *publicpolicy options* for improving entrepreneurship, financing, information systems, innovation, sourcing, and trade practices in emergent industry sectors such as alternative energy, bio-tech manufacturing and digital services.

Papers must be well written with a clear statement of their contribution to both theory and practice. We encourage a broad range of methodologies including analytical models, case work, econometric analysis, laboratory or field experiments and system dynamics. The chosen methodology should be well motivated and executed with the highest rigor.

POM-Accounting Interface

The department seeks papers that improve our understanding of how operations management impacts and is impacted by accounting institutions and practices. Topics of interest include but are not limited to financial reporting, incentive design, information sharing, internal controls, inventory management, organizational structure, outsourcing, performance

measurement, supply chain contracting, taxation, transfer pricing, etc. The department is interdisciplinary, broadbased, and open to submissions utilizing a variety of methodologies (e.g., analytical, experimental, empirical, survey). Contributors from any field (e.g., accounting, economics, marketing, psychology, operations) are encouraged to submit papers that can foster conversations between researchers and practitioners in accounting and operations.

POM-Marketing Interface

The department seeks to publish manuscripts that address the synergy between operations and marketing. Papers that fit four broad themes: shaping demand for operations and vice versa, trading off market opportunities with operations complexity, operations response to disruptions, and managing relationships are of particular interest. This would include (but not limited to) topics such as building capabilities, flexibility, emerging markets OM, life-cycles, preference mapping and variety, design and development, pricing and procurement, disruptions and inventory, JIT and just-in-case, due dates, capacity trading, customer service and fulfillment, demand decoupling and postponement, and customer/supplier relationships.

Manuscripts should address important research problems and help stimulate future research. They should also be well executed, and be technically flawless. The articles may draw upon quantitative/qualitative modeling, data analysis, simulation, and applications. Irrespective of the research methodology, manuscripts must display rigor and managerial relevance. Content must be original with significant contributions to OM and marketing. Theoretical manuscripts should establish why certain decisions are optimal. Domain specific empirical manuscripts need to provide generalization of methods and results. Methodological manuscripts should clearly establish superiority of new methods over existing ones.

Management Insights

Operational Slack and Venture Survival

Arash Azadegan, Pankaj C. Patel, Vinit Parida

Operational slack, in the form of excess capacity, labor or physical excesses in the production process can act as an added expense that increase the chance of venture failure. However, operational slack may also act as a buffer to protect the venture from external events. Arash Azadegan, Pankaj Patel, and Vinit Parida investigate whether operational slack acts to help or hinder the survival of young ventures. They find that as a venture's environment becomes more dynamic, more complicated, or more harsh (i.e. resource constrained), operational slack helps to augment chances of survival. These results suggest that operational slack should not be simply regarded as systemic waste for ventures. Nor should ventures be focused on eliminating all of their excess capacity, labor or physical assets. Second, the findings question whether entrepreneurs should tolerate inadequacy of resources and enduring short-term sacrifices in the hopes of future prosperity. These preconceptions can sway the venture away from carrying adequate resources to effectively and reliably manage its operations, particularly in tough environmental settings.

Increasing Revenue by Decreasing Information in Procurement Auctions

Ernan Haruvy, Elena Katok

The main managerial implication of this work is that purchasing managers facing the choice between open-bid and sealed-bid auctions should prefer sealed-bid auctions as these tend to generate higher levels of buyer surplus in our experiments, due to overly-aggressive bidding. This result nicely complements earlier findings in the literature that suggest that sealed-bid auctions are better for the buyer-supplier relationship and suppliers prefer them as well (Jap 2003, 2007). Consequently, it seems that sealed-bid auctions offer a superior format for both sides of the market. When open bidding is required (perhaps due to the dynamic nature of pricing or to government regulations), our laboratory findings indicate that it is best to leave bidder qualities unknown or ambiguous. That is, buyers should avoid revealing the identities of the bidders to the extent possible and

avoid posting differentiating features of the various bidders on the auction site or set individual reservation prices for different suppliers.

Remanufacturing and the Component Commonality Decision

Ravi Subramanian, Mark E. Ferguson, L. Beril Toktay

Component commonality across products is a way to reduce inventories and manufacturing costs through risk pooling and economies of scale. OEMs often compare these benefits against the potential costs of redesigning components and from diminished perceived differences between the products. Additional important trade-offs exist if remanufactured versions of products compete with the new versions for customer demand. For example, implementing component commonality may also make it less costly for a third-party firm to remanufacture the OEM's products. Certain product types are more prone to significant profit impacts of not considering third-party remanufacturing in determining whether to implement component commonality or not. A decision to implement commonality that is based only on manufacturing (ignoring remanufacturing) is important to review for products that promise larger savings from commonality to the third-party remanufacturer or whose production cost savings to the OEM from commonality are low. In such a situation, the OEM has much to lose from handing a cost advantage to the third party. Conversely, the decision to not implement commonality is important to review if the OEM's low-end product's cost does not increase significantly with commonality but its perceived quality and, therefore, competitiveness vis-à-vis the remanufactured product does.

An Advanced Heuristic for Multiple-Option Spare Parts Procurement after End-of-Production

Karl Inderfurth, Rainer Kleber

Inventory management of spare parts plays a key role in providing adequate after-sales service. From an OEM's perspective, managing a spare parts supply chain is particularly challenging for two main reasons. Firstly, even on the OEM's aggregate level demands for spare parts are characterized by both

time-dependencies and considerable uncertainty. Secondly, decreasing product life cycles along with long service periods steadily increase the number of products which are no longer produced, but for which spare parts must be provided. For this case, Karl Inderfurth and Rainer Kleber present a model to coordinate three main procurement options for spare part acquisition, namely a final order placed at the end of regular production of the parent product, extra production, and remanufacturing. The modeling assumptions cover the problem background found in the automotive industry. Since coordinating all three options yields a complicated stochastic dynamic decision problem, the authors develop an advanced heuristic based upon a quite simple but effective order-up-to decision rule that can easily be applied to practical problems. A comparison with simple decision rules adapted from practice provides evidence that the heuristic helps to exploit major potentials for cost improvement.

An Enhanced Concave Program Relaxation for Choice Network Revenue Management

Joern Meissner, Arne Strauss, Kalyan Talluri

The network choice revenue management problem models customers as choosing from an offer set, and the firm decides the best subset to offer at any given moment to maximize expected revenue. The resulting dynamic program for the firm is intractable and approximated by a deterministic linear program which has an exponential number of columns and is NP-hard to solve. Joern Meissner, Arne Strauss, and Kalyan Talluri give a procedure that first relaxes this linear program and then tightens it with simple cuts and give extensive computational results to show that the resulting formulation gives a value very close to the value of the linear program. Moreover this procedure applies to any choice model and makes the solution of this approximation practically possible.

A Nonatomic-Game Approach to Dynamic Pricing under Competition

Jian Yang, Yusen Xia

In today's marketplace, companies are often obliged to take the competition element into their dynamic pricing considerations. The proliferation of Internet access among virtually all homes and businesses brings price competition to an even more intense, global level. However, the modeling and solving of competitive dynamic pricing situations are notoriously difficult. Jian Yang and Yusen Xia use an indirect approach to tackle the infinite-firm limit, the so-called nonatomic game in which a continuum of infinitesimal firms is engaged in price competition. For such a

game, equilibrium can be reached, so that firms can agree on the price to charge at each time and inventory level, to the effect that everyone's action is the best response to the overall market condition which is itself a product of all firms taking the prescribed action plan. So far, computational studies have confirmed the effectiveness of such ideal games in approximating real finite-firm competitive situations. Convergence in theory still awaits further research.

On the Advantage of Quantity Leadership When Outsourcing Production to a Competitive Contract Manufacturer

Yulan Wang, Baozhuang Niu, Pengfei Guo

The authors study the quantity leadership problem on the consumer market between an original equipment manufacturer (OEM) and its contract manufacturer (CM). The CM not only participates in the OEM's contract manufacturing business but also produces and sells its self-branded products which substitute those of the OEM. They show that their endogenous preference over quantity leadership is affected by multiple factors such as the size of the consumer market, the substitution rates between their products, the wholesale price, the proportion of production outsourced from the OEM to this competitive CM, and their relative bargaining power. Interestingly, the authors find that the competitive CM has an incentive to set the wholesale price low enough to allow both parties to coexist in the consumer market whereas the OEM tends to outsource entirely from this competitive CM as long as the competitive CM offers a wholesale price lower than its other options.

Does Quality Still Pay? A Reexamination of the Relationship between Effective Quality Management and Firm Performance

Guoqiang Peter Zhang, Yusen Xia

Because the changing competitive environment forces firms to focus on other more challenging issues, quality may have lost some of its luster and emphasis in business. In this study, Zhang and Xia address an important question: Does quality still pay in the new competitive environment? Based on data from more than 500 firms that have won quality awards in the 1990s and early 2000s, they find that over a 10-year period, award-winning firms perform significantly better than several benchmark groups in various operating performance measures such as operating income, sales, and return on assets. Not only do award-winning firms have better results after receiving awards, they also have superior performance records before the award. The study shows that

effective TQM program continues to pay off despite changes in the business environment.

Managing Risk of Supply Disruptions: Incentives for Capacity Restoration

Xinxin Hu, Haresh Gurnani, Ling Wang

A supplier facing the prospect of disruption has to decide whether or not to invest in restoration capability. With restoration capability, if disruption occurs, additional costly effort can be exerted to rebuild capacity, although its outcome is uncertain. Xinxin Hu, Haresh Gurnani, and Ling Wang study how a firm (buyer) can use incentive mechanisms to motivate a supplier's investment in capacity restoration, and compare this approach with the traditional approach of diversifying part of the order to an expensive but reliable supplier. They find that both the buyer and the supplier at least weakly benefit if the buyer commits to offer incentives prior to disruption instead of after disruption. Furthermore, the buyer prefers to offer the incentives when the unreliable supplier's restoration outcome is more predictable or when a high restoration outcome is more likely. However, the buyer's preference for supplier diversification increases for high market demand.

Distributing a Product Line in a Decentralized Supply Chain

Jing Shao, Harish Krishnan, S. Thomas McCormick

Incentive distortions in supply chains can create problems in the distribution of products. Appropriately designed contracts can correct these distortions. The literature has extensively analyzed this topic but has focused on the case where a manufacturer is distributing a single product. In practice, most manufacturers distribute a line of vertically or horizontally differentiated products, with each product variant offering different features or quality levels. Customers facing a stock-out may choose a different product variant available at the store, or may go to a different store in search of the same product variant. Due to the possibility of substitution between different product variants, as well as between different retailers, the incentive distortions associated with distributing a product line can be more complex than that of distributing a single product. Optimal contracts need to be tailored to each product variant. Jing Shao, Harish Krishnan, and Thomas McCormick characterize retailers' incentive distortions under a residual-claimancy contract (wholesale prices equal to the production cost), and construct contracts that achieve channel coordination. They show that retail price floors or inventory buybacks, appropriately tailored to each product variant, are among the contracts that

can achieve coordination. Using numerical simulations, the authors demonstrate how the optimal contract terms (such as wholesale prices and buyback prices) for each variant are influenced by the parameters of an underlying consumer choice model.

Offshore Outsourcing, Yield Uncertainty, and Contingency Responses

Panos Kouvelis, Jian Li

Outsourcing finished products or components from overseas is a common practice in both manufacturing and retailing industries as part of their efforts to reduce procurement costs. While buyers enjoy the low procurement costs from offshore outsourcing, the risk in the yield uncertainties due to product quality, safety and other concerns cautions management to undertake appropriate contingent actions to mitigate their effects, if other preventive actions do not exist or fail. As reported in Wall Street Journal, emergency sourcing was used as contingent action in response to realized supply yield information. In a stylized periodic review inventory system with random demand and uncertain yield, Panos Kouvelis and Jian Li propose two variations of emergency sourcing that mitigate the yield risk of cycle orders, examine their effectiveness in cost reduction as well as the impact of other factors, such as demand and yield uncertainties, the cost and shipping lead-time of the emergency sourcing and the time to access the yield information, on the effectiveness. They also study the structure of the optimal ordering policies as well as the impact of other factors on the policy control-parameters.

Analysis of the Market-Based Adjustable Outsourcing Contract under Uncertainties

Baichun Feng, Tao Yao, Bin Jiang

The uncertainty of raw materials' costs have inevitably influenced global outsourcing practices, making the effort to predict operating costs much more difficult than ever. As a result, the market-based adjustable contract has emerged. Under such a contract, the vendor and its client negotiate a risk share ratio and a target outsourcing price. After a certain time, when the vendor delivers the product to the client, this contract helps the vendor and the client share the unpredictable difference between the negotiated target price and the market price. No matter what vendor and client's negotiation powers are, both parties have to agree on the unique optimal share ratio, while their bargaining powers only affect the target price. A market-based adjustable contract not only remedies the inflexibility of fixed pricing but also avoids the difficulty to monitor vendor's dynamic operating costs, because the market price is publicly available.

The Retail Space-Exchange Problem with Pricing and Space Allocation Decisions

Mingming Leng, Mahmut Parlar, Dengfeng Zhang

The practice of Waitrose (a British supermarket chain of food products) and Boots (a British retailer of healthcare products), Tim Hortons (a favorite doughnut store in Canada), and Cold Stone Creamery (an U.S.-based chain stores of ice cream) has indicated that retailers selling different products could exchange shelf space to improve their operating performance. Mingming Leng, Mahmut Parlar, and Dengfeng Zhang investigate the pricing and space allocation decisions of two retailers who implement such a space-exchange strategy. They show that the two retailers will decide to implement the space-exchange strategy if and only if the total space in each retailer's store is large enough to serve more than a half of a retailer's consumers. Moreover, each retailer's prices in two stores may or may not be identical but they are both higher than that retailer's price before the space exchange, and both retailers' profits are higher than those before they implement the space-exchange strategy.

Design of Stockless Production Systems

Antonio Arreola-Risa, Matthew F. Keblis

In stockless operations, items are produced only after demand is observed. Arreola-Risa and Keblis consider the design of multi-item production systems with demand and production uncertainty so that a stockless operation would be optimal. The relevant costs are inventory holding and demand back ordering per unit per period. Using a model developed for a real-world project, the authors derive stockless operation optimality conditions for two design variables: average unit production time (AUPT) and unit production time variability (UPTV). Their findings

offer several managerial insights. First, the optimality conditions can be evaluated numerically, but interpreting them defies intuition, attesting to the challenge of designing stockless production systems. Second, when unit product times follow a probability distribution widely observed in practice, the optimality conditions indicate that low AUPT and low UPTV favor a stockless operation. Third, when the multiple items share the same demand, production, and economic characteristics, the optimality conditions predict that demand pooling may work against a stockless operation. Fourth, when the system produces a single item, the optimality conditions can easily be interpreted. In addition, they still include AUPT but not UPTV; that is, surprisingly UPTV no longer matters.

A Markov Chain Model for an EMS System with Repositioning

Ramon Alanis, Armann Ingolfsson, Bora Kolfal

More and more emergency medical services (EMS) systems employ system status management strategies to make more effective use of their limited resources. One of these strategies is the repositioning of available ambulances in order to improve coverage when the system is congested. EMS dispatchers typically reposition ambulances using one or more *compliance tables* but analytical tools to evaluate and compare compliance tables have been lacking. Ramon Alanis, Armann Ingolfsson, and Bora Kolfal have developed a fast method to predict the response time performance of a compliance table. This method can be used to compare a set of compliance tables and to select the one that minimizes response times. The choice of compliance table can have a huge impact on performance, as the authors demonstrate using a simulation model that is calibrated with data from Edmonton, Alberta.

David Simchi-Levi

David Simchi-Levi grew up in a suburb of Tel-Aviv, Israel. He earned a Bachelor's degree in Aeronautical Engineering from the Technion, Israel Institute of Technology, and while serving as an officer in the Israeli Air-Force was introduced to the field of Operations Research. During this time he developed and analyzed models for weapon selection and pilot training and scheduling. It is then that he first observed the tremendous impact that effective Operations Research models and careful analysis can have in practice. That experience motivated David to pursue a PhD in Operations Research at Tel-Aviv University in Israel, shaped his academic work emphasizing both the theoretical and practical aspects of Operations Research techniques, and led to his interest in the impact that these methods have on business. In 1986, David joined the Industrial Engineering and Operations Research department at Columbia University, initially as a lecturer, and subsequently as an Assistant Professor, in what he intended to be a one-year visit to the USA, which has yet to end. He focused on the design of robust algorithms for location, vehicle routing and inventory routing problems, by exploiting the structure of optimal and asymptotically optimal solutions. One opportunity he faced early in his academic career there was to develop a system for School Bus Routing in NYC by applying the routing algorithms he designed in his research. The ensuing work eventually led David, along with his wife and life-long collaborator, Edith, to the founding in 1995 of LogicTools, now part of IBM, which provides software solutions and professional services for supply chain planning. LogicTools technology is now "used by over 50% of the world's largest supply chains and over 50% of AMR's top 50 global supply chains," according to IBM.

David's interest in supply chain management grew during his tenure at the Department of Industrial Engineering and Management Sciences at Northwestern University (1993-2000). At that time, he reached out to industry as the field was just forming, led executive programs and developed the Supply Chain Initiative, an industry/academic collaboration dedicated to advancing and disseminating the best supply chain management concepts, practices and strategies. Based on the research and business experiences gained, he wrote two books: *The Logic of Logistics*, published by

Springer in 1997 (with J. Bramel; 2nd Edition with X. Chen appeared in October 2004) which is appealing to a technical readership; and the award-winning *Designing and Managing the Supply Chain* published by McGraw-Hill in 1999 (with P. Kaminsky and E. Simchi-Levi; 2nd Edition appeared in October 2002 and 3rd Edition in July 2007), which has been widely adopted in MBA classrooms worldwide. Also noteworthy during this period are David's seminal work on quantifying the bullwhip effect (with F. Chen, Z. Drezner, and J. Ryan) with close to 500 citations, a computerized version of the beer game, a decision support system for production scheduling (with P. Kaminsky) and his role as editor-in-chief of *Naval Research Logistics* (2003 – 2005).

In 2000, David took his current position of professor of Engineering Systems at Massachusetts Institute of Technology. There he co-directed and oversaw significant growth of both the System Design and Management and the Leaders for Global Operations programs. His efforts on developing and implementing robust and efficient techniques for manufacturing and supply chains continued, and expanded to include revenue management aspects, production flexibility, healthcare applications and interplanetary operations. David's contribution to these new areas has been recognized through the 2009 INFORMS Revenue Management and Pricing Section Prize, the Pierskalla Best Paper Award, 2006, for research excellence in the field of health care management science, and an honorable mention (2nd prize) for the 2007 Logistics Spectrum Paper Award. He has published widely in professional journals on both practical and theoretical aspects of supply chain management. David became Editor-in-Chief of *Operations Research*, the flagship journal of INFORMS in 2006. During his tenure through 2011, the journal experienced broader coverage, higher impact factors, increased submissions, and reduced review times.

With five books and over 110 papers in refereed journals that have collected well over 2000 citations, 30 PhD students working on prominent academic and industrial positions, a widely used supply chain planning software, and remarkable consulting influence, David has played and continues to play a prominent role in shaping the field of Production and Operations Management.

