

Management Insights

Competing on Time: An Integrated Framework to Optimize Dynamic Time-to-Market and Production Decisions

Özalp Özer, Onur Uncu

The timing of a new product introduction is a critical decision for firms competing in today's fast paced markets. The timing decision depends on whether firms invest more time in product and process design and improvement or push the product to market before competitors. The decision involves several key tradeoffs such as improved manufacturing yields versus higher market share. Market-timing decisions are even more challenging when product life cycles are shortened and firms are pressured to release new products more frequently. What has been the optimal timing for a new product may not be the best timing for the next new product. In addition, uncertainties in competitor market entry timing; sales volume projections and outcome of customer qualification tests further complicate the time-to-market decisions. Hence, firms face complex time-to-market and post introduction production decisions. Özalp Özer and Onur Uncu provide a comprehensive framework - a decision support tool - that considers key factors in time-to-market and production ramp-up decisions. They also provide an optimal time-to-market and production strategy that allows for a dynamic, real-time response to the changes in operational and market conditions. They discuss how such a decision support tool can help firms establish structured, data-driven decisions in a complex, dynamic, multi-faceted environment.

The Promise of Strategic Customer Behavior: On the Value of Click Tracking

Tingliang Huang, Jan A. Van Mieghem

Click tracking is gaining in popularity and the practice of web analytics is growing fast. How can operations managers benefit from click tracking? To answer this question, we need to understand whether strategic customers are willing to visit a website when they know their clicks may be tracked. This strategic customer behavior raises an important and complex problem involving various factors. Tingliang Huang and Jan A. Van Mieghem examine it by focusing on

the *operational* factor: by clicking, customers convey advance demand information that allows the firm to improve product availability which makes it in every customer's best interest to click. The authors also find that these customer incentives to click are robust to noise. When pricing is "click dependent", however, these incentives may be weakened, whereby the authors propose price commitment and product personalization to induce them to click. Notably, click tracking is typically advantageous to both the firm and its customers, compared with other traditional strategies such as advance selling, quantity commitment, availability guarantees, and quick response that have been extensively studied. Hence, the authors demonstrate the promise of strategic customer behavior, and suggest that newsvendor firms could proactively reveal their practice of click tracking to customers.

Finding and Implementing Energy Efficiency Projects in Industrial Facilities

Sam Aflaki, Paul R. Kleindorfer, Victor Sáenz de Miera Polvorinos

Energy efficiency (EE) projects reduce organizations' energy/carbon footprint for a given level of output. There are many profitable EE projects in nearly every industrial enterprise that are not implemented either because awareness is low or because there is no defined managerial framework for finding and executing these projects while linking them to the organization's overall sustainability strategy. Aflaki, Kleindorfer, and Sáenz de Miera Polvorinos refer to the literature on sustainable operations and industry best practices in developing such a framework. This framework is based on the continuous improvement principles of Kaizen, and it incorporates the main value/cost drivers of EE projects as identified in previous studies: direct energy savings, strategic importance of the firm's "green" image, and technical complexity of the EE project portfolio. The authors discuss how these dimensions are intertwined for various project types and indicate that reliable measurement, incentive systems, tested technologies, and financial and technical expertise within and outside the organization are critical success factors for industrial EE projects. A case study of an EE project and

portfolio management at Pfizer in Freiburg, Germany sheds further light on the details of implementation success.

Script usage in standardized and customized service encounters: Implications for perceived service quality

Liana Victorino, Rohit Verma, Don G. Wardell

The encounter between employees and customers plays a critical role in a customer's evaluation of service. To aid encounter design and management, service firms often use scripts to specify the employee's role. These scripts may define for employees the words and phrases to use when interacting with customers and range from stricter approaches where employees have limited discretion for improvisation to more flexible forms. Victorino, Verma, and Wardell examine different verbal scripting levels to test their impact on customer perceptions of quality. Video scenarios within a hospitality setting were developed that varied the script level used for standardized (hotel check-in) and customized (concierge service) encounters. They found that changes in the degree of script level had no effect on perceived quality for standardized encounters but for customized encounters the predominantly scripted approach was perceived as having significantly lower quality compared to the moderate and relaxed scripting scenarios. These results suggest that prior to making scripting decisions, a service should carefully assess the type of interactions customers have with their employees. Services may be able to reap the operational benefits of scripting without sacrificing perceived quality in standardized situations but the same result can't always be assumed for customized encounters.

Robust Structural Equations for Designing and Monitoring Strategic International Facility Networks

Panos Kouvelis, Charles L. Munson, and Shilei Yang

Mathematical models incorporating the many complexities of the global facility location-allocation decision can be used as powerful decision-making tools; however, they may be difficult to quickly populate and solve, and they may require a high level of mathematical programming expertise. Panos Kouvelis, Charles Munson, and Shilei Yang demonstrate how to transform a complex model into a set of representative equations that managers could populate and solve relatively quickly. The equations abstract from the details of a large-scale model in order to capture essential design tradeoffs of global manufacturing and distribution networks. Via the calculation of just

a few key independent variables representing economies of scale, complexity costs, transportation costs, and tariffs, the equations provide an indication of where the firm's network structure should fall along the dimensions of market focus, plant focus, and network dispersion. The authors provide equation sets for eight clusters. Many different product types could be classified into one of these clusters, which would allow managers to use the equations directly without needing to run the large-scale model to generate their own equations. Over time, as costs change, the equations can be used as a tracking device to detect potential need for adjustment of the current network.

Increasing the Revenue of Self Storage Warehouses by Facility Design

Yeming (Yale) Gong, René B. M. de Koster, J. B. G. (Hans) Frenk, Adriana F. Gabor

Self storage is a booming industry. Both private customers and companies can rent temporary space from such facilities. Such warehouses have spaces available of different sizes and with corresponding renting fees. The prime objective for the managers of such facilities is to maximize the revenue, for example by upscaling customers to larger sizes if small size space is sold out, but also by modifying the space division of the warehouse. Due to the modular design it is quite easily possible to do this. Warehouses that upscale customers either can reserve space for such customers, or not. Gong, de Koster, Frenk, and Gabor develop optimal layout design strategies for such warehouses with different customer policies. The resulting layouts are compared with various real public storage cases and tested for robustness against varying demand. Also the different upscaling policies are compared for total revenue. The results show that the existing self storage warehouses can be redesigned to generate larger revenues for all cases investigated. Although the upscaling policy without reservation generally slightly outperforms the upscaling policy with reservation, the difference in revenue decreases as the load increases. Hence, the choice for the a priori reservation policy may be justified by its simplicity and near-optimal revenue.

Advance Selling in the Presence of Speculators and Forward-Looking Consumers

Wei Shi Lim and Christopher S. Tang

Speculative purchase behavior has been increasingly observed in a wide range of markets. They include electronic gadgets (iPhone, iPad, Wii3), event tickets as well as real estate. Clearly, the rise of the Internet has fueled speculative behavior by providing a cheap and easily accessible platform for reselling. We exam-

ine the pricing strategy of a monopolist seller in the midst of speculators as well as both myopic and forward-looking consumers. We find that forward looking consumers adopt the same purchase decision as the speculators. Thus, prior to any resale by the speculators, the seller is not able to differentiate between these buyers and thus rein in speculative behavior. Further, the optimal pricing strategy depends on the market trend. In an upward market, the seller prices into the future while in a downward market, the seller may price lower to engage the assistance of speculators in product diffusion to increase the demand going forward. Finally, we show that an entry cost is ineffective as an entry barrier but an exit cost can rein in speculative purchase if executed as part of a multi-prong approach.

Delayed Differentiation for Multiple Lifecycle Products

James D. Abbey, V. Daniel R. Guide Jr., Gilvan C. Souza

Original equipment manufacturers that design their products for multiple lifecycles via a common platform with a modular design face the problem of product proliferation, but only after several generations of a product co-exist with customers. As the multiple variants of products are returned from the field, the returns are disassembled, remanufactured, and reassembled into one of many potential configurations to meet customer demand. Disassembling the return to the part level allows for the greatest flexibility but consumes the most capacity and cost in both the disassembly and reassembly stages. Additionally, this product proliferation inevitably leads to congestion at the plant level, higher inventory levels, and longer lead times. Abbey, Guide, and Souza propose a delayed differentiation model in a multiple lifecycle environment using an optimal push-pull boundary, which balances the trade-offs between disassembly and reassembly costs. The returned product is disassembled to a semi-complete product (the push process), and then the final configuration is determined by customer demand (the pull process). The push-pull boundary evolves over time as product proliferation increases.

Multiproduct Quality Competition: Impact of Resource Constraints

H. Müge Yayla-Küllü, Ali K. Parlaktürk, Jayashankar M. Swaminathan

There is considerable debate on the firm's product line strategy in a quality differentiated market: which products to choose and offer where each product has a different cost and quality level, and how to price

them are important decisions. The point that is ignored in this debate is the impact of capacity availability on this strategic decision. A firm often faces capacity constraints in the form of time, labor, equipment, space, and inventory. Yayla-Kullu, Parlaktürk, and Swaminathan show that the decisions regarding the product line design are closely related to the capacity: for a given set of capacity and product attributes (quality levels, unit costs, and resource consumptions), there exists a unique optimal product line strategy for the firm. Ignoring the capacity may cause the firm to follow fundamentally wrong strategies. Moreover, the implications of market competition may also change depending on the available capacity. For medium capacity firms, optimal product line may be different for different intensity of competition in the market.

On the Unimodality of the Profit Function of the Pricing Newsvendor

Ye Lu, David Simchi-Levi

Ye Lu and David Simchi-Levi study the coordinated inventory and pricing decisions under demand uncertainty. It shows that under general conditions, the retailer's expected profit as a function of price can behave nicely such that the optimal pricing region is connected. The result also indicates the existence of a Nash equilibrium in the pricing game of multiple retailers. Finally, it provides interesting insights on how the optimal pricing decision is affected by demand uncertainty.

Pricing Policy in a Supply Chain: Negotiation or Posted Pricing

Chia-Wei Kuo, Hyun-Soo Ahn, Goker Aydin

Often, a retailer may be willing to negotiate the price of one product, while not budging from the sticker price on another. Chia-Wei Kuo, Hyun-Soo Ahn, Goker Aydin offer the manufacturer's influence on the retailer's pricing policy as one cause. Using game-theoretic models, they show that a lower wholesale price encourages the retailer to negotiate, because a lower wholesale price gives the retailer more wiggle room to adjust the retail price. They also show that when the supply chain capacity is sufficiently tight or when the retailer's negotiation costs are sufficiently high, the retailer prefers posted pricing over negotiation. In such cases, if the manufacturer wishes the retailer to choose negotiation instead, then the manufacturer would have to reduce its wholesale price so that the retailer finds negotiation more attractive. Consequently, the retailer's discretion over the pricing policy produces interesting observations. For example, a retailer with high negotiation costs could

make more profit than a low-cost retailer, because a high-cost retailer may obtain a more favorable wholesale price from the manufacturer. Likewise, in a supply chain with tight capacity, the manufacturer would have to offer a generous wholesale price if it wants the retailer to adopt negotiation.

Coordinated Contract Decisions in a Make-to-Order Manufacturing Supply Chain: A Stochastic Programming Approach

Yan Feng, Alain Martel, Sophie D'Amours, Robert Beaugard

Contracting is a common practice for many manufacturing companies to secure sales, stabilize production, assure raw material supply possibly at lower cost, and cope with uncertainties. Contract is typically negotiated and signed sequentially with one customer/supplier at a time, under incomplete information. How to make good contract decisions that optimize the capacity allocation, hedge against uncertainties, and maximize the company's financial performance? Yan Feng, Alain Martel, Sophie D'Amours, and Robert Beaugard propose a coordinated contract decision-making approach, at tactical level in a make-to-order manufacturing supply chain. Through a real case illustration, their research indicates that this approach takes into account their anticipated impacts on the supply chain performances and offers significant advantages over non-coordinated approach. The performance of contract decisions can vary substantially under different economic and market conditions, and therefore, more robust contract decisions are required. Using stochastic method, the contract decisions obtained can perform consistently and significantly superior to the deterministic method, particularly under higher economic risks.

Supply Chain Contracting under Competition: Bilateral Bargaining vs. Stackelberg

Qi Feng, Lauren Xiaoyuan Lu

Qi Feng and Lauren Xiaoyuan Lu investigate the contracting behaviors of manufacturers and retailers in a competitive supply chain setting. They contrast the contracting outcome of a Stackelberg game, in which the manufacturers offer take-it-or-leave-it contracts to the retailers, with that of a bargaining game, in which the firms bilaterally negotiate contract terms. The manufacturers in the Stackelberg game possess a Stackelberg-leader advantage in that the retailers are not entitled to make counteroffers. Their analysis suggests that whether this advantage would benefit the manufacturers depends on the contractual form. With simple contracts such as wholesale-price contracts, the Stackelberg game replicates the boundary case of

the bargaining game with the manufacturers possess all bargaining power. In contrast, with sophisticated contracts such as two-part tariffs, the two games lead to distinct outcomes. The game structure being Stackelberg or bargaining also critically affects firms' preferences over contract types and thus their equilibrium contract choices. These observations suggest that the Stackelberg game may not be a sufficient device to predict contracting behaviors in reality where bargaining is commonly observed.

On the Effects of Capacity Agent on Market Equilibrium

Li Jiang

A prevalent industry phenomenon is capacity imbalance, whereby some firms have idle capacities but others crave for capacities to fulfill their service and production requirements. The flexibility and versatility of modern capacities make it practical for the capacity at one firm, after minor retooling if necessary, to serve the needs from other firms, even if they come from different industries. The capacity agent, as an emerging third-party intermediary, provides an effective platform for the supply and demand of capacity to match. It partners with those firms that have capacities available to perform multiple functions and sustains a market to draw the demand for capacity from the external firms. Its relationships with the partners are governed by contracts. Li Jiang shows that, depending on the motives of its partners to deploy capacities through it and their relevant capacity management tactics, the capacity agent can design contract parameters to incentivize different number of firms to partner with it and sustain the market structure to extract most of the benefits from capacity balancing.

Robust Stochastic Lot-Sizing by Means of Histograms

Diego Klabjan, David Simchi-Levi, Miao Song

Classical stochastic lot-sizing models require complete knowledge of demand distribution to determine an optimal inventory policy. In most real-world situations, the distribution of customer demand is unknown; only historical data is available. Standard approaches first estimate the demand distribution and then optimizes the inventory control policy, which often leads to fragile solutions. Diego Klabjan, David Simchi-Levi, and Miao Song propose a robust model that integrates data fitting and inventory optimization for the stochastic lot-sizing problem. Unlike the standard assumption of a given distribution, it is assumed that histograms are part of the input, and the model allows correlations in the demand distribu-

tions of different periods. Surprisingly, the optimal inventory control policies of the robust model share the same structure as that of the traditional stochastic dynamic programming counterpart. If demand samples are obtained from a known distribution, the robust model converges to the stochastic model with the true distribution under quite general conditions. Numerical results show that this robust approach outperforms the stochastic model with a sequential data-fitting and inventory optimization process as well as a robust model based on the sample mean and variance.

The Effect of Single Rater Bias in Multi-Stakeholder Research: A Methodological Evaluation of Buyer-Supplier Relationships

Joseph A. Roh, Judith M. Whipple, Kenneth K. Boyer

As the global competitive landscape intensifies, the scope of supply chain related operations have increasingly cut across organizational boundaries. In order to understand and capture such cross-organizational activities, researchers have broadened the focus of their studies and included multiple stakeholders in their analysis (e.g., integration, sustainability, and buyer-supplier relationships). Several studies suggest that neglecting the multi-sided nature of certain constructs can affect the research validity and reliability, and may invalidate research inferences and results; although such concerns have not been empirically demonstrated. As such, researchers may question whether the extra effort involved in collecting multi-stakeholder data is worthwhile, given the lack of empirical proof supporting well-published validity concerns. Joseph Roh, Judith Whipple, and Kenneth Boyer perform a series of tests using matched dyadic data and demonstrate that research conclusions can change depending on whether single rater data or multi-rater data is used. Although, the results also suggest that when perceptual agreement exists, single rater data may be appropriate to use in multi-stakeholder research.

A Performance Metric and Goal Setting Procedure for Deadline-Oriented Processes

Kenneth Howard Doerr and Kevin R. Gue

In a supply chain, continuous processes like order fulfillment connect to intermittent batch processes like

trucking. Metrics used to track order fulfillment need to be designed with the customer in mind – for example, delivery response time may be determined entirely by the ability to meet a transportation deadline. Metrics used to assess performance in a process will also change performance in that process, especially when workers are given a target, or goal, against the metric. Doerr and Gue provide a metric for order fulfillment which takes transportation deadlines into account, and a goal-setting procedure which takes the behavioral response to the metric into account.

Non-dominated Time Window Policies in City Distribution

Derya Eren. Akyol, René B. M. De Koster

In many cities, local governments have introduced policy measures, in particular time-access restrictions to alleviate problems caused by urban freight transport. However, setting time windows is very challenging due to the conflicting interests and objectives of the stakeholders involved. Derya Eren Akyol and René de Koster examine whether it is possible to develop time window policies that enhance environmental sustainability and distribution efficiencies, while meeting the objectives of the municipalities. A framework is developed for balancing the objectives of the retailers (minimize costs), municipalities (maximize city-access satisfaction), and the environment (minimize emissions), using data envelopment analysis, under different urban time window policies. The approach is illustrated by a case study of three Dutch retail organizations, with a large number of stores affected by such time windows. Based on an evaluation of 99 different time window policies, the results show that harmonizing time windows between neighboring cities leads to the best overall performance. Although it may be hard for policy makers of different municipalities to collaborate, the findings of this study show that the currently used time window policy can be improved in all dimensions. The method provided here might help to convince provincial and city authorities to align measures with neighboring cities.