

## Research and Management Insights

### Industrialization, Productivity and the Shift to Services and Information

Uday S. Karmarkar, Kihoon Kim, Hosun Rhim

All major world economies are moving towards services and information in terms of GNP as well as employment. The traditional explanation for the shift to services was the steady growth of manufacturing productivity. But this does not explain the initial growth in manufacturing, or that of information intensive services relative to physical services. The authors adduce a second factor that explains both trends: the relative maturity of a market. Increasing productivity in a mature sector with limited potential growth in demand, causes the decline of that sector. However, if the sector is relatively young, with the possibility of rapid demand growth, then the sector grows.

In the growth scenario, income inequality generally increases, while it decreases in the decline scenario. In the growth case, labor in the increasing productivity sector does better, but may not in the decline case. Paradoxically, labor in sectors with low productivity increases, always benefits from productivity increases in other sectors. For managers, it is important to recognize the double-edged consequences of industrialization and productivity gains, which increase competitive intensity in mature markets, leading to sector decline, consolidation, and labor cuts even while it is difficult to find skilled employees.

### Economic Manufacturing Quantity and Its Integrating Implications

Jaya P. Moily

Several contradictions exist among the Economic Order Quantity (EOQ), Just-In-Time (JIT), and Optimized Production Technology (OPT) approaches and the economic framework for profit maximization. Jaya Moily developed and examined a fundamental model referred to as the Economic Manufacturing Quantity (EMO) to reconcile and integrate the three approaches. An implication for the classic EOQ approach is that the balance between setup and inventory carrying costs is valid when a production

facility is operating at or below a certain critical level but not when operating above that level. An implication for the JIT approach is that one must reduce setup cost at non-bottlenecks and setup time at bottlenecks to reduce inventory. An implication for the OPT approach is that trade-offs between setup and inventory carrying costs may indeed be ignored while determining process batch sizes, provided each facility in a production system is operating at or above its critical level.

Economic theoretic analysis of the EMO model provides a basis for unification of JIT which advocates stability in operating level as a key to improved productivity and quality, and OPT that advocates maximizing operating level with resultant emphasis on bottlenecks as a key to increased profits. This unifying basis states that a profit-maximizing production system will operate at the full and stable level as long as market demand remains relatively sensitive to price and operating at the full (maximum) level provides positive unit contribution.

### Strategic Management of Operations in the Emergency Department

Arvind Venkat, Sunder Kekre, Gajanan G. Hegde, Jennifer Shang, Thomas P. Campbell

The emergency department is the gateway to the health care system. Regardless of whether a patient has a medical, surgical, obstetric or psychiatric condition, the one location where that individual can receive acute care is the emergency department. This role is more critical given that it is the only location where care is available 24 hours per day, 7 days per week. With the revolutionary changes expected under the Affordable Care Act, a financial analysis of how patients, payers, hospitals/physician staffing companies and physicians view the professional services provided by emergency physicians in the emergency department seems extremely timely. Given the price and reimbursement opacity in the health care industry, a clearer understanding of how revenue for physician services and compensation of physicians can be structured may aid in preserving the necessary infrastructure of emergency department services nationwide.

The field study conducted by Venkat, Kekre, Hegde, Shang, and Campbell examines the challenges in managing today's emergency department (ED) from the perspective of value creation to the major stakeholders and discusses the implications to improve the financial health of EDs. Understanding the impacts of changes in volume, mix and complexity of patients is critical for aligning the incentives of physicians and staff to improve the performance of these universal care facilities. The authors analyze the ED value chain, comprised of payers/insurers, physicians, patients and hospital/physician employer groups, from a value drivers' perspective. The value focus on the major stakeholders allows joint consideration of both revenues as well as costs and to identify strategic operations changes in the ED from a capacity portfolio perspective so as to achieve the multiple objectives of controlling costs, improving outcomes and raising patient satisfaction.

#### **Mechanisms to Induce Buyer Forecasting: Do Suppliers Always Benefit from Better Forecasting?**

Thunyarat (Bam) Amornpetchkul, Izak Duenyas, Özge Şahin

While it is intuitive to believe that more accurate demand information should always benefit both the supplier and the buyer in a supply chain, the existing supply chain contracting literature has shown that with static contracts, the supplier's and the buyer's profits may be hurt by the buyer's improved demand information. To investigate whether this insight carries over to more sophisticated contracts, Thunyarat Amornpetchkul, Izak Duenyas, and Özge Şahin consider contracts with contingent clauses, which allow the buyer to place orders in multiple periods (terms of the orders placed in later periods are contingent on the terms of the initial order), in addition to the conventional types of contracts where the buyer has only a single ordering opportunity in a procurement season. Such contingent contracts are shown to always deliver additional benefits to the supplier as long as the buyer's demand forecasts become more accurate over time. This finding helps explain why contingent contracts have recently been observed in practice. Even in the situation where the supplier is uncertain whether the buyer has the capability to obtain improved forecasts over time, the authors show that there exists sophisticated screening contracts (which screen both the buyer's forecasting capability and demand type) that the supplier can utilize to always benefit from more accurate demand information whenever available. These results suggest that contract structures (contingent

vs static) can significantly influence how the profits of the supply chain parties are affected by the quality of demand forecasts.

#### **Unsold versus Unbought Commitment: Minimum Total Commitment Contracts with Nonzero Setup Costs**

Quan Yuan, Geoffrey A. Chua, Xing Liu, Youhua (Frank) Chen

Supply contracts with minimum total commitment (MTC) involve an inventory problem with a fixed number of periods and a requirement to purchase a minimum total quantity over all the periods. In this paper, Quan Yuan, Geoffrey A. Chua, Xing Liu and Youhua (Frank) Chen establish that by tracking remaining unsold commitment instead of unbought commitment, the optimal ordering policy becomes an easy-to-implement (s,S) policy. While the supplier prefers minimum order quantity (MOQ) in each period over MTC and the buyer prefers the reverse, the authors find that neither MOQ nor MTC is always better in terms of total supply chain performance. The preferred contract depends on factors such as commitment level, the supplier's unit production cost and order variability penalty. In general, MTC is better for achieving stability of total orders while MOQ is better for production smoothing. Another useful idea is to use multiple two-period contracts as a compromise between the extremes of MTC and MOQ where both parties sacrifice the least.

#### **Online Manufacturer Referral to Heterogeneous Retailers**

Hao Wu, Gangshu (George) Cai, Jian Chen, Chwen Sheu

Hao Wu, Gangshu (George) Cai, Jian Chen, and Chwen Sheu investigate manufacturer referral where the manufacturer refers its visiting consumers to certain retailer(s). As e-tailing grows more competitive, manufacturer referral prevails in the current e-commerce environment as a tool for the manufacturer to avoid overly intensive channel conflict with retailers. The authors suggest that if exclusive referral is adopted, the manufacturer may want to refer consumers to the more cost-efficient retailer if the retailers are of the same size, or the smaller retailer if the retailers are equally cost efficient. However, the equilibrium choice of exclusive referral to the bigger retailer can lead to supply chain inefficiency. The nonexclusive referral emerges as the equilibrium choice for all firms as long as the manufacturer referral market size is sufficiently large. The incentives to

implement manufacturer referral reduce as the impact of local consumers and infomediary referral grows.

### **How to Compete Against a Behavioral Newsvendor**

Anton Ovchinnikov, Brent Moritz,  
Bernardo F. Quiroga

At many firms procurement decisions for seasonal/fashion items are made not by the automated systems, but rather by people, who are often irrational but predictable: their decisions systematically deviate from those generated by normative models. Current studies that rely on such models therefore may miss the opportunity to strategically take advantage of the predictable irrationality of human competitors. Ovchinnikov, Moritz and Quiroga study precisely that: how should a science-driven firm compete against a behaviorally-biased competitor. They document behavioral ordering regularities of human decision-makers in competitive inventory ordering environments, and present an analytical model extending the standard theory of inventory competition by including a best response policy for competing with a behaviorally-biased agent. Their key insight is that in a high-margin context, the science-driven firm should order a larger quantity than the standard models suggest. Yet in determining such quantity it should not be particularly concerned about the subsequent reaction of the behavioral competitor – experiments show that the observed behavioral response is insignificant when there is an even slight variability in the orders of the science-driven competitor. The authors test the effectiveness of this policy using an out-of-sample experiment and find that it results in improved market share, service level and profitability.

### **Impact of Customer Traffic and Service Process Outsourcing Levels on e-Retailer Operational Performance**

Olga Perdikaki, David Xiaosong Peng,  
Gregory R. Heim

E-retailers outsource a variety of service processes ranging from front-end customer facing processes to back-end order fulfillment and content management processes. Using a panel dataset of top North American e-retailers, Olga Perdikaki, David Xiaosong Peng, and Greg Heim study the drivers and operational impacts of e-retailer outsourcing with a focus on customer traffic to the e-retailer website. The empirical evidence suggests that customer

traffic and website features drive e-retailers to outsource both front-end and back-end service processes, and e-retailers emphasize certain differences between front-end and back-end processes when considering which service processes to outsource. Front-end and back-end service process outsourcing also exhibits different operational performance impacts. While front-end outsourcing is associated with increased customer satisfaction and faster website response time, back-end outsourcing is associated with higher operational workload as captured by the number of orders. More interestingly, the authors find that front-end outsourcing and customer traffic are jointly associated with longer website response time and lower customer satisfaction, whereas back-end outsourcing and customer traffic jointly have no effect on operational outcomes. This finding is consistent with fundamental service operations principles suggesting services with intensive customer touchpoints (e.g., front-end service processes) may not be prime candidates for outsourcing.

### **Competition and The Operational Performance of Hospitals: The Role of Hospital Objectives**

Dimitrios A. Andritsos, Sam Aflaki

Dimitrios Andritsos and Sam Aflaki examine the effect of a hospital's objective (i.e., non-profit vs. for-profit) on the operational characteristics of hospital markets for elective care and provides some guidance on the design of such markets. First, market heterogeneity and intensity of competition are both important for the operational effect of introducing patient choice. In a sufficiently competitive hospital market, the presence of a for-profit sector can be beneficial. A homogeneous market consisting only of a non-profit sector, especially when "money follows the patient", may suffer from reduced economies of scale. Second, the choice between homogeneous and heterogeneous hospital markets depends on the severity of the patient condition. For less severe conditions, for which patients may be willing to wait longer before receiving care, a homogeneous market may be preferable. For-profit hospitals will have more difficulty competing in markets for elective care, when patients are sufficiently tolerant to waiting. Finally, indirect support of the for-profit hospital sector (e.g., via subsidies) should be provided cautiously. It may result in increased waiting and monetary costs for patients. In the long run, it may be preferable for the public funder to direct financial resources towards an increased reimbursement of the non-profit sector.

**Note on “The Backroom Effect in Retail Operations”**

Zümbül Atan, Nesim Erkip

Most retailers use backrooms as extra storage space. Backrooms are necessary when inventories do not fit to the available shelf space. Excess inventories are

placed to the backrooms and used to satisfy customer orders when shelf inventory is depleted. We show the value of using the exact models instead of the approximate ones in quantifying the benefits of considering the existence of backrooms when making replenishment decisions.