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Research and Management Insights

The Influence of ISO 9000 Certification on Process Compliance
John V. Gray, Gopesh Anand, Aleda V. Roth

Worldwide, registrars have issued over a million ISO 9000 management standard certifications. In spite of this, John Gray, Gopesh Anand, and Aleda Roth answer some fundamental questions that remained open concerning the effectiveness of certification in realizing its primary intended outcome, process compliance. They show that operational process compliance of a certified plant is not necessarily superior to that of a non-certified plant. Early adopters have superior process compliance performance in the years immediately following certification relative to similar non-certified plants, but we do not find this to be the case for late adopters. Notably, they also find that operational process compliance tends to decay significantly over time after certification, especially for early adopters. Because of these effects, over time, the average levels of compliance for both early and late adopting plants approximately converge to the same level, which is similar to that of non-certified plants. Their results, based on the examination of thirteen years of the Food and Drug Administration's expert inspections of plant-level process compliance in the medical device industry, offer insights for managers. Sourcing managers may find that ISO 9000 is not a reliable indicator of high levels of process compliance, under many conditions, and thus may need to add external monitoring in their contracts. Once ISO 9000 is adopted, manufacturing managers must exert continual efforts and interventions to maintain any gains in process compliance improvements.

Signaling to Partially Informed Investors in the Newsvendor Model
William Schmidt, Vishal Gaur, Richard Lai, Ananth Raman

Why do managers make capacity decisions that purposefully do not maximize the expected profits of their firms? William Schmidt, Vishal Gaur, Richard Lai, and Ananth Raman examine this question under a relatively common scenario in which the investors in the firm do not know as much as managers about the quality of demand for the firm's product, and the managers care about the share price assigned by the investor to the firm. The authors show the conditions under which managers will find it attractive to either underinvest or overinvest in capacity. Of particular interest are situations in which managers of firms with low quality demand and managers of firms with high quality demand make similar capacity decisions so as to provide identical signals to investors. The authors show that such actions reduce the cost of signaling which can be prohibitive. Thus, such actions can yield better payoffs for both sets of managers compared to capacity investments that perfectly reveal the firm's demand to investors.

Lower Cost Arrivals for Airlines: Optimal Policies for Managing Runway Operations under Optimized Profile Descent
Heng Chen and Senay Solak

Optimized profile descent (OPD) is an operating procedure being used by airlines to improve fuel and environmental efficiency during arrival operations at airports. Heng Chen and Senay Solak consider the management of sequencing and separation of flights during OPD operations at airports. Through a stochastic dynamic programming framework, they find that basic analytical solutions can be used as optimal decision rules during OPD implementations. This can be done either through simple spreadsheet based tools that air traffic controllers can use, or as part of advanced and automated systems such as the Traffic Management Advisor tool developed for the U.S. Next Generation Air Transportation System. Chen and Solak conclude that the expected annual savings for airlines due to such policies can be around $29 million if implemented by major airports in the U.S. This implies a total savings of around $27 per flight, which can be estimated on average as being about 2% of the net profit obtained per flight. The authors highlight that most of these savings will be due to the optimal spacing of OPD flights, as opposed to the optimal sequencing policies.

The Impact of Costliness, Competitive Importance, and Modularity of Investments on Outsourcing
Jovan Grahovac, Geoffrey Parker, Ekundayo Shittu

Conventional wisdom suggests that no firm should want one supplier to gain a monopoly position in the market for critical components. This wisdom can break down when firms find themselves having to expend critical development resources on expensive modules. Two or more firms might find themselves in an investment race that consumes substantial resources but confers no market advantage. Grahovac, Parker, and Shittu add new insight to this problem by analyzing the relative importance of particular modules to overall products. They make predictions about which outcomes are likely to emerge in markets characterized by high development costs and the opportunity for supplier power. When components are modular, firms will prefer to outsource moderately costly subsystems, even to suppliers that extract monopoly profits. The more complex situation arises when modularity is lower and development costs are higher. In such cases, outsourcing solutions appear to require multiple periods before reaching stability, but remain vulnerable to change in market or technological conditions.

A Maximum Entropy Joint Demand Estimation and Capacity Control Policy
Costis Maglaras, Serkan Eren

When the demand for a product is less than the available capacity, the manager observes the true demand realization. When the demand exceeds the available capacity, the manager observes sales that are equal to the available capacity. This observation is censored by the available capacity. Often times, the demand observations are combined into a forecast that is then used to decide how much capacity to make available in future sales seasons. Demand censoring can lead to forecasts that indicate that the demand is smaller than actual, which, when used, could reduce the firm's inventory or capacity control decision. Coupled in the iterative interaction between forecasting and managerial control decisions, this can give rise to undesirable behavior, where the firm never learns the true demand distribution and continues to use suboptimal controls. Costis Maglaras and Serkan Eren suggest a simple and intuitive procedure that managers can use to correct for demand censoring and ultimately correctly learn the underlying demand and appropriately optimize inventory decisions.

Strategic Design Responsiveness: An Empirical Analysis of U.S. Retail Store Networks
Jeff Shockley, Lawrence A. Plummer, Aleda V. Roth, Lawrence D. Fredendall

Jeff Shockley, Lawrence Plummer, Aleda Roth, and Lawrence Fredendall explore how retailers maintain a robust service offering by effectively coordinating strategic design choices—e.g., human and structural resource capital - with the complexity and profitability of their primary product line offerings over time. The coordination of complementary assets over time, or "strategic design responsiveness", is not well understood in retailing, and there are many examples of once powerful U.S. chain store retailers that have failed to synchronize store network designs with merchandising or product lifecycle management strategies consistently; and over time, have suffered dire performance consequences. Building from extant service operations management theory, the authors introduce and empirically test a model showing the effects of strategic design responsiveness on both long-term and short-term retail operating performance. The authors find that retailers that fail to keep pace with investments in both structural and human capital over time may exhibit short-term financial benefits, but have worse ongoing operational performance. These findings corroborate the importance of maintaining the complementarity of design-related choices for improving and sustaining the long-term financial performance and viability of retail firms.

A Dynamic Disaggregation Approach to Approximate Linear Programs for Network Revenue Management
Thomas W.M. Vossen, Dan Zhang

The linear programming approach to approximate dynamic programming has received considerable attention in the recent network revenue management literature. A major challenge of the approach lies in solving the resulting approximate linear programs (ALPs), which often have a huge number of constraints and/or variables. Starting from a recently developed compact affine ALP for network revenue management, Thomas Vossen and Dan Zhang develop a novel algorithm to tackle the problem. The new algorithm, which is called dynamic disaggregation algorithm, combines column and constraint generation and exploits the structure of the underlying problem. The authors also show that the ALP formulations can be further tightened by considering structural properties satisfied by an optimal solution. It is proven that the sum of dynamic bid-prices across resources is concave over time, even though individual resources are not concave in general. Extensive numerical experiments demonstrate that dynamic disaggregation is often orders of magnitude faster than existing algorithms in the literature for problem instances with and without choice. In addition, enforcing concavity constraints can further speed up the algorithm, often by an order of magnitude, for problem instances with choice.

Remanufactured Products in Closed-Loop Supply Chains for Consumer Goods
James D. Abbey, Margaret G. Meloy, V. Daniel R. Guide, Jr., Selin Atalay

In this experimental work, James Abbey, Margaret Meloy, Daniel Guide, and Selin Atalay test many managerial beliefs regarding the market for remanufactured consumer products. For instance, managers at HP have stated that over-discounting remanufactured products leads to cannibalization of new product sales. However, the studies provide evidence that consumers do not view remanufactured products as equal in appeal to new products and over-discounting may exacerbate negative perceptions of remanufactured products. Specifically, the studies reveal that many consumers hold pre-existing negative perceptions of remanufactured products stemming from the product's prior ownership. This makes the products permanently dirty and disgusting. Another commonly held managerial belief is that consumers perceive remanufactured products as environmentally friendly. The results only weakly support the belief that green consumers find remanufactured products appealing. Though these results may appear disheartening at first, there are opportunities for firms to increase the attractiveness of remanufactured products. The studies revealed that firms should stress the environmentally friendly nature of materials reuse and provide assurances to consumers that the products are appropriately sterile. Educating consumers about the like-new quality of remanufactured products may also show promise. That said, negative perceptions remained significant even after education and could continue to pose a major challenge. As such, managers for products that elicit strong negative perceptions may find that materials reclamation/recycling, as opposed to remanufacturing, provides a more viable choice for returned products in their consumer market closed-loop supply chain processes.

Optimal Software Free Trial Strategy: Limited Version, Time-locked, or Hybrid?
Hsing Kenneth Cheng, Shengli Li, Yipeng Liu

Hsing Kenneth Cheng, Shengli Li, and Yipeng Liu develop a unifying analytical model to examine three prevalent software free trial strategies employed in the software industry – limited version free trial where some key features of the software are disable, time-locked free trial where a fully functional version is offered with a limited trial time, and hybrid free trial that is a combination of the limited and time-locked free trials. They find that the intensity of the network effects is a key factor in determining which software free trial strategy is most effective. In general, the time-locked free trial is preferable when the intensity of network effects is weak, while the limited version free trial is optimal in the presence of strong network effects. The hybrid free trial strategy is most suitable in the mid-range of network effects. For the hybrid strategy to be effective, both the trial time and the functionalities to be disabled variables must be optimally set simultaneously in order to outperform the limited version and time-locked strategies. Furthermore, the authors show that simply implementing a common industry practice of offering a hybrid free trial with a 30-day trial time, after which 10% of the functionalities are disabled can result in a substantially worse profit than would result from using either the limited version or time-locked strategy.