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Management Insights

Product Reuse Economics in Closed-Loop Supply Chain Research
Atalay Atasu, V. Daniel R. Guide, Jr., Luk N. Van Wassenhove

Research in closed-loop supply chains (CLSCs) has grown rapidly over the last 10 years. The authors offer a critical review of influential CLSC research that takes a business economics perspective. Much of the research was inspired by practice-driven thought-pieces, and this helped to keep research focused on relevant issues. However, CLSC research has several assumptions, such as perfect substitution between new and remanufactured products that risk becoming institutionalized. There is a strong need to carefully examine current industrial practice so that research remains focused on relevant problems. Deeper understanding of consumer perceptions of remanufactured products, product diffusion, and valuation of returned products are needed for the field to continue to add insights into developing sustainable economies.

Design for Life-Cycle Mismatch
James R. Bradley, Héctor H. Guerrero

Electronic parts are sometimes available on the market for only two years, and redesigning a product that uses a part that becomes obsolete can be costly. Alternatively, designing a product that is less vulnerable to the obsolescence of its constituent parts will increase either the cost of designing the product or its cost of manufacture. These opposing forces present a tradeoff to managers who must entertain this question: "When is it economical to invest in a product design that will be less vulnerable to part obsolescence or, in a sense, be more *durable*?" Furthermore, when nondurable designs are used, are the costs of design or manufacture more important? The most striking feature of the answer to these questions is that the rate at which a product's sales volume grows significantly affects which design tack is most economical. For high-growth products, the constituent parts must be available until the time when sales peak. Furthermore, high-growth products with shorter lives must have designs that reduce manufacturing costs and, conversely, high-growth products with longer lives must be less costly to design. With low-growth products, there are no such easy rules of thumb—the economic trade-offs must be carefully considered on a case-by-case basis.

Managing Slow-Moving Perishables in the Grocery Industry
Michael Ketzenberg, Mark Ferguson

Managing the supply chain for a perishable product (such as fresh meat and produce) involves all of the challenges of managing for a nonperishable product along with the additional exposure of frequent product spoilage. The authors evaluate two common prescriptions to improve the management of perishable products: sharing information on demand or current inventory levels through investments in information technology, and coordinating replenishment activities between the supplier and the retailer. Although there is anecdotal evidence from practitioner activity that such initiatives have significant value, due to privacy and competitive issues, success stories are rarely communicated, and there has been no rigorous evaluation of the conditions where the value is greatest. Hence, there remains a lack of understanding among both academics and practitioners regarding the value of these initiatives. The authors establish the importance of information sharing and centralized control in the supply chain and identify conditions under which benefits are realized. The major benefit is driven by the supplier's ability to provide the retailer with fresher product. Even though total supply chain profit increases, sharing information does not always improve the profit for both supply chain partners when the supplier and the retailer are separate firms.

The Effects of Sharing Upstream Information on Product Rollover
Zhaolin Li, Long Gao

How can we coordinate product rollover in multi-echelon supply chains? Does information sharing always increase the profits of all channel partners? The answers to these questions are enormously important for the firms that face declining prices and short product life cycles. One answer is that that the supply chain can be coordinated if the wholesale

price, price protection rate, and end-of-cycle return price are properly selected. Under the optimal supply chain contract, the supply chain profit is proportionally split between the channel partners and the manufacturer has no incentive to mislead the retailer about a new-product introduction. The next answer is that if the supply chain is coordinated, then sharing the upstream information about a new-product introduction can increase the profits of both the manufacturer and retailer. However, if the supply chain is not coordinated, sharing the upstream information may increase one party's profit but decrease the other's.

Coordinating a Supply Chain System with Retailers Under Both Price and Inventory Competition
Xuan Zhao

Consider a firm selling substitutable products through multiple independent retailers who compete for end customers through both retail prices and stock availability. In such a decentralized supply chain system, incentive conflict exists not only in the vertical dimension of the supply chain (between the supplier and retailers), but also in the horizontal dimension, i.e., between competing retailers. The firm needs to decide how to design contracts to coordinate such a multichannel supply chain system to achieve the best performance of the entire system. A game-theoretic model provides insights into this. It is found that the commonly used buyback contract can be used to coordinate such a supply chain system. However, the choice of the contract terms should be closely related to the type of the market in which the supply chain operates. A market with fierce price competition requires that the supplier provide positive buyback rates to retailers, which subsidizes retailers for leftover inventories. A market where retailers compete fiercely on stock availability requires that the supplier punish retailers for overstocking behaviors, which discourages retailers from stocking too much and prevents inventory waste. Properly designed service-level maintenance contracts and retail-price maintenance contracts can also achieve optimal system performance.

Dynamic Procurement, Quantity Discounts, and Supply Chain Efficiency
Feryal Erhun, Pınar Keskinocak, Sridhar Tayur

Dynamic procurement, i.e., simple wholesale price contracts repeated over time (possibly with different prices), is a commonly observed practice in a vertical channel. To manage the demand risk, a buyer may prefer to procure capacity dynamically over time. Other commonly observed reasons for dynamic procurement include spreading payments over a period of time; minimizing potential capacity risks (supplier's or buyer's); supplier's decreasing cost over time, which may translate to lower prices (e.g., as in the electronics industry); and forward buying. The authors discuss yet another potential impact of dynamic procurement. They show that dynamic procurement benefits the players even under perfect foresight by allowing the buyers to strategically procure to influence the future prices. As the number of trading periods increases, the total output of the supply chain increases, and all the parties benefit from multiple trading periods. In equilibrium, dynamic procurement is similar to an incremental quantity discount where the supplier sets the prices and the buyer sets the breakpoints. It can thus be viewed as a sequence of bilateral negotiations between the supplier and the buyer, and it provides incentives to both parties to increase the total supply chain profits.

Approximations to Optimal k-Unit Cycles for Single-Gripper and Dual-Gripper Robotic Cells
H. Neil Geismar, Lap Mui Ann Chan, Milind Dawande, Chelliah Sriskandarajah

Intense global competition has compelled manufacturers to incorporate repetitive processing and automation for improving productivity. Many modern manufacturing systems use *robotic cells*—a particular type of computer-controlled system—in cellular manufacturing. The need to maximize the productivity of a robotic cell has operations managers focused on the problem of obtaining an efficient sequence of robot moves. Depending on the circumstances, managers can use optimal sequences and fast algorithms that produce easy-to-implement cyclic schedules of robot moves that can realize near-optimal productivity. The authors show how managers can assess the improvement in productivity improvements resulting from using a dual-gripper robot instead of a single-gripper robot; such an analysis can make a trade-off between the additional cost of acquiring and maintaining a dual-gripper robot and the potential benefits. The authors' theoretical analysis can also help managers identify bottleneck processing stages (i.e., those that prevent the productivity from being higher) in a cell and the options available to improve the productivity at such stages.