A Faster, Leaner, Supply Chain: New Uses of Information Technology

Jean Kinsey


Stable URL:
http://links.jstor.org/sici?sici=0002-9092%28200012%2982%3A5%3C1123%3AAFLSCN%3E2.0.CO%3B2-3

*American Journal of Agricultural Economics* is currently published by American Agricultural Economics Association.

Your use of the JSTOR archive indicates your acceptance of JSTOR’s Terms and Conditions of Use, available at http://www.jstor.org/about/terms.html. JSTOR’s Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at http://www.jstor.org/journals/aaea.html.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

JSTOR is an independent not-for-profit organization dedicated to creating and preserving a digital archive of scholarly journals. For more information regarding JSTOR, please contact support@jstor.org.

http://www.jstor.org/
Thu Mar 23 19:11:37 2006
A Faster, Leaner, Supply Chain: New Uses of Information Technology

JEAN KINSEY

Introduction

Links between economic agents known as food manufacturers, wholesalers, and retailers are complex, ill understood, changing rapidly, and decreasing in number. This paper focuses on the economics and the reality of a market for a business-to-business, e-commerce system; a system that will capture economies of scale and lower costs of food distribution toward the retail end of the food supply chain. Business-to-business e-commerce is a new way of doing business. It tends to follow a “reverse product cycle,” where process efficiency gains come first, followed by quality improvements to existing products and services, and finally the creation of new services and products appear (OECD). The e-commerce marketplace is one where strategy, expectations about others actions, and trust determine demand. For purposes of this paper, the buyers-users in this e-commerce market are retailers, wholesalers, and manufacturers who buy and sell products to and from each other. The seller is a service provider who can produce a reliable electronic logistics network that will improve communications and will speed up product flow. Using information technology in this way tends to build vertical alliances. It differs from a market discovery e-commerce (shopping sites) in that it involves an intimate relationship among market agents that lasts for more than one transaction and frequently covers several products, over multiple time periods.

Distribution Systems, New and Old

Initially (in 1992), there were two main distribution models at the retail end of the food chain. The first is the supply push model, where wholesalers purchase and warehouse food that is obtained from manufacturers or processors. If it is purchased at a discount, held in large quantities, without an order in hand, it is called a “forward buy.” Holding inventory is profitable when inflation is high. Wholesalers and/or manufacturers deliver products to stores after they receive an order, sometimes offering discounts to retailers who take large quantities. Sometimes manufacturers pay for shelf space or advertising to help ensure retail sales. The second is the Wal-Mart model, where information about consumer sales is shared electronically with manufacturers and they replenish inventory at the chains’ distribution centers or stores as needed. This system, known as continuous replenishment, with its faster turnover and leaner inventory, yields lower costs and everyday-low prices for consumers.

The competition created by the leaner Wal-Mart way of doing business was a wake-up call to the rest of the grocery industry. Additional warnings came from a growing loss of market share to food service establishments and stagnant sales growth in retail stores. In searching for a way to make the supply chain for groceries more efficient, retailers and manufacturers joined together to promote electronic exchange of consumer sales data and inventory management information, initially under the banner of efficient consumer response (ECR). This system was to rely on individual grocery chains establishing an electronic data interchange (EDI) system with their suppliers (either manufacturers or wholesalers) to facilitate a continuous electronic flow of information about product movement to manufacturers who could then arrange a continuous flow of product back to the stores, just in time to replace the shrinking inventory. This would prevent

Jean Kinsey is professor in the Department of Applied Economics, University of Minnesota, and director of The Retail Food Industry, which is funded by the Alfred P. Sloan Foundation.

The author is grateful to Hamid Mohtadi (University of Wisconsin, Milwaukee) for his insights and comments during the development of this paper.

This paper was presented in a principal paper session at the AAEA annual meeting (Tampa, FL, August 2000). Papers in these sessions are not subjected to the Journal’s standard refereeing process.

Amer. J. Agr. Econ. 82(5) (Number 5, 2000): 1123–1129
Copyright 2000 American Agricultural Economics Association
stock-outs at the retail store and would help manufacturers smooth out their production of products, preventing a buildup of inventory in their warehouse or the warehouses of wholesalers. Fully implemented, ECR was predicted to take more than $31 billion a year out of the distribution costs across the industry (Kurt Salmon). It was a grand vision that required an ambitious set of new business practices, partnerships, and attitudes among numerous large and small retailers, to say nothing of adopting a new trusting culture among traditionally adversarial manufacturers and retailers (Senauer and Kinsey, Kinsey and Senauer). ECR was not satisfactorily implemented its first five years, mostly because only the largest retailers and manufacturers found it beneficial to invest in the hardware, software, and human capital necessary to implement EDI in a meaningful way.

In 1998, only 24% of stores responding to a survey by the Food Marketing Institute (FMI) reported using EDI with at least some suppliers. Data collected in 1998–99 from 100 stores in the Supermarket Panel by The Retail Food Industry Center at the University of Minnesota show that stores that had implemented more of the data management and coordination activities associated with ECR are larger, have greater sales per square foot, greater sales per labor hour, more inventory turns, and much higher sales growth (table 1) (The Retail Food Industry Center). With one year of data, one cannot say which came first, ECR management practices or a well-organized and progressive organization, but they are highly correlated.

The EDI logistics systems adopted by the largest chains competed with the well-developed system being used by Wal-Mart. Those who were using these systems could benefit even more if a larger number of grocery stores and manufacturers were participating in the same or similar business-to-business e-commerce systems. The more stores from whom a manufacturer receives sales data and can make delivery forecasts and agreements, the better they can schedule their production lines and the more efficiently they can operate. The more efficiently the manufacturers operate, the lower are their costs and the lower are the prices to all grocers and, ultimately, to consumers.

The Market for Information Systems

The economics of a search for a faster and leaner logistics system can be captured, in part, by the economics of network externalities and network effects (Katz and Shapiro, 1985, 1994; Besen and Farrell; Liebowitz and Margolis; Belleflamme). The concept was defined by Katz and Shapiro (1985, p. 424) when they wrote:

“There are many products for which the utility that a user derives from consumption of the good increases with the number of agents consuming the good.” and “The utility that a given user derives from a good depends upon the number of other users who are in the same network.”

This concept is most easily understood in the context of a personal communication network that requires some initial investment in hardware like a telephone, fax machine, or personal computer and subsequent investments in software or services to make them work. The usefulness of these products increases as the number of other people who use compatible products increases. Thus, the demand for these products is a function of their price and the expectation that a criti-

---

Table 1. The Adoption of Efficient Consumer Response Practices by Retail Stores and Productivity

<table>
<thead>
<tr>
<th>Level of Adoption</th>
<th>Weekly Sales Per Square Foot</th>
<th>Annual Sales Growth</th>
<th>Inventory Turns-Year</th>
<th>Sales Per Labor Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>$6.88</td>
<td>11.9%</td>
<td>20.0</td>
<td>$98</td>
</tr>
<tr>
<td>Middle</td>
<td>$6.15</td>
<td>2.6%</td>
<td>18.6</td>
<td>$87</td>
</tr>
<tr>
<td>Low</td>
<td>$5.27</td>
<td>2.7%</td>
<td>14.4</td>
<td>$89</td>
</tr>
<tr>
<td>Direction of relationship</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
<td>Positive</td>
</tr>
</tbody>
</table>

Source: Supermarket Panel Report to the Board of Advisors, The Retail Food Industry Center, University of Minnesota, 1999 (prepared by Dr. Robert King, Professor, Department of Applied Economics, University of Minnesota).
cal mass of other users will participate in the same network.

As the number of users grows, the benefits to each user grow above the price they paid for joining the network. That is, the marginal social benefits curve rises above the demand curve and we have a classic case of underutilization of a socially beneficial good or system. In addition, the demand rises as the expected number of users increases and, if the marginal cost of providing the network is falling, the socially optimum number of users could be infinite. The economics literature on this topic quibbles about when this is a technological externality where the outcome represents a market failure that calls for government intervention and when it is a pecuniary externality that will be mitigated through the transfer of wealth (Liebowitz and Margolis). When externalities are positive and the net value of an agent’s action is increased when other agents take equivalent actions, it is called a network effect. This effect is pervasive in markets for products and services that have public or semipublic goods characteristics. It can arise due to economies of scale, where marginal cost declines with the number of users. It can also arise from ordinary technological progress, where the supply curve shifts outward. Both lead to lower prices with a larger number of buyers.

Katz and Shapiro (1994) articulate three critical issues in the market for systems. They are expectations, coordination, and compatibility. These seem particularly appropriate for examining the adoption of a business communication and coordination system by the agents in the downstream food chain. First, there are many small agents (126,000 grocery stores of which 19,000 (15%) belong to large chains, with up to 9000 vendors) whose demand for a new system depends on its cost and on their expectations that their peers will join. Knowing that smaller businesses have neither the resources nor the inclination to invest in business-to-business e-commerce systems, the expectations about the usefulness of adopting information technologies on the part of most food retailers were low, and the price was high. Second, any compatibility of the hardware and software that grocers and manufacturers may have had would have been a happy accident. The inability of computer systems to talk with each other readily was a major stumbling block to developing a relationship that required electronic communication.

That brings us to coordination which was difficult when manufacturers and retailers did not trust each other. They were on opposite sides of the negotiating table, each trying to extract a share of the rents. They were not ready to become partners in forecasting, planning, and coordinating deliveries based on a shared set of data that retailers owned. If the retail food industry was to succeed at cutting costs in the distribution channel, it would have to coordinate its efforts, to raise the expectations of the smaller agents to induce them to join the network, to convince them that their future participation will reduce their costs, and to provide compatibility that would drive down the initial investment cost as well as the ongoing service fees. A program to do just that is in progress now. It is called UCCNet and it will be discussed later in this paper. It was instigated by the larger chains who already had experience conducting business via electronic ordering, paperless invoices, and sharing scanner data with their vendors. They could see that there were great positive network effects to be realized by more retailers and vendors joining together in a common system of communication and operation.

Options for attracting more users to a system include owning a system and offering the services to additional users for a nominal price. This puts the owner in the position of a monopolist who could give away the hardware and make profits on the sale of subsequent services. No retailer who has an EDI system, including Wal-Mart, has decided to offer this option. Another option is to sponsor a network and then to encourage others to join. Smaller users may free-ride on larger users, but the net gain to the sponsors is still greater than the costs. Alternatively, large users could offer an “open system,” under which third parties are permitted to supply components to the sponsor’s system on a royalty basis. This resembles the development of the UCCNet by the nonprofit Uniform Code Council. Finally, both vertical and horizontal alliances can be established between retailers and/or retailers and manufacturers who commit to adopting compatible hardware and software systems, agree to (long-term) partnerships whereby retail point-of-scale information will be exchanged with suppliers, and delivery schedules can be made. This option is being explored by some of the largest retailers with Internet alliances such as the GlobalNetXchange announced by Sears,

Regardless of the method of attracting new users to a network and of coordinating their efforts, compatibility must still be accomplished. The two most common methods are through an industry standard board or some form of an adapter. Given the number of competing systems already in place, the adapter method seemed to be the only viable option for the retail food industry. The World Wide Web (Internet) happens to provide a perfect place to plug in an adapter between the software systems of numerous retailers and other systems of numerous manufacturers and/or wholesalers to create a seamless communication network between disparate computer systems being operated by persons with disparate skill and needs.

Realizing the Efficient Consumer Response Vision: Building on History

Trade associations of retail food companies and manufacturers such as the Food Marketing Institute (FMI) and Grocery Manufacturers of America (GMA) have long led the industry in adopting information technology. In the early 1970s, with the high cost of labor, amplified by price inflation, the grocery store industry saw great potential in automating pricing activities. The Ad Hoc Committee on Universal Product Codes was established with representatives from major retailer and product manufacturing associations to develop a set of standards for identifying products that both the retailers and manufacturers could agree upon. Two years later, the committee decided to adopt a 10-digit, universal product code (UPC) as its standard (Walsh). The now ubiquitous bar codes were born and the first supermarket to implement scanning was in Troy, Ohio in 1974. The first grocery store chain to implement scanning chain-wide (Giant Foods) did not do so until 1980. In 1989 eight states still had individual-item pricing legislation (Walsh). Today, virtually every supermarket uses scanners, though they are not widely adopted in convenience stores.

Designing and adopting bar codes and scanning technology is an example of achieving compatibility by adopting an industry standard. Coordination is through a third party (UCC) who monitors and upholds the standard by issuing the bar codes for new products. It was the last big productivity increase in the retail food industry until recent times. The combination of scanners and faster cash registers increased productivity significantly at checkout. If 45% of all units were scanned, productivity was expected to be increased by 12 to 14%. It was projected that if 90% of all units were scanned, productivity would increase by 30% (Walsh).

When it became apparent that the vision of ECR was not being met, FMI and GMA once again facilitated their members’ leadership in approaching the UCC for help. Leading companies, including The Proctor and Gamble Company, Frito-Lay, Inc., The Kroger Company, SUPERVALU, Inc., and others, formed a pilot group to propose to the UCC that it design an Internet platform that could operate on the World Wide Web—a universal adapter that would allow electronic exchange of information and services between retailers and vendors. The adapter is an open access Internet platform that can transform industry practices by establishing a common highway on which data can be transmitted from retailers to manufacturers and over which communication lines can be kept open in a secure, encoded environment. It is the ultimate ‘black box’ that provides the compatibility and the coordination needed for retail companies of all sizes to implement business-to-business e-commerce with their vendors. This wholly owned, not-for-profit subsidiary of the UCC is called UCCNet. Figure 1 illustrates how point of sale (POS) data can be transmitted through UCCNet to food manufacturers-processors or to wholesalers.

![Figure 1. New partnerships: Business-to-business e-commerce](image-url)
in real time (along the heavy dashed lines) and they, in turn can deliver the product in the right amount and at the right time to keep the store shelves well stocked without building up inventory in anyone’s storerooms (along the solid lines).

Companies can use UCCNet on a subscription basis with the charges based on the company size and the number of users. This will encourage smaller companies to subscribe. After the foundational services, there is a modular pricing plan for services above the basic functions. UCCNet claims that the benefit-cost ratio from using this service is about ten. Figure 2 illustrates its foundational services and some of the extra modules, called solution providers, that will be available. The basic services provided include trading partner profiles, compliance checking, synchronized checking, recovery-auditing, and browser management (Benchener). Two of the special solutions are cooperative planning, forecasting, and replenishment (CPFR), and scan-based trading (SBT). These more sophisticated uses of electronic data interchange promise to change the way retailers conduct business in fundamentally important ways.

Cooperative Planning, Forecasting, and Replenishment

Cooperative planning, forecasting, and replenishment is a system pioneered by Wal-Mart that involves the manufacturer and the retailer each using scanner data to forecast sales over some future time period, share their forecasts, and agree to deliver and to receive merchandise on a prearranged schedule. With this system, scanner data are transmitted in real time to suppliers via an Internet interface. The supplier is responsible for monitoring the flow of sales and for adjusting the agreed upon deliveries to keep the shelves stocked. A subset of CPFR is scan-based trading where ownership of the products in the store stays with the vendor until it is sold. The key to CPFR is the development of a compatible electronic system and a trusting relationship between the manufacturer and the retailer. Wal-Mart keeps track of all the sales in all its stores over the previous sixty-five weeks. In 1999 it had electronic data interchange with 20% of its 91,000 vendors and a CPFR agreement with 8% (IGD). Twenty-six percent of food retailers and 43.5% of wholesaler reported planning to try CPFR in 1999 (Blair).

Scan-Based Trading

About 30% of food is delivered to retail stores under a system called direct store delivery (DSD). DSD vendors are manufacturers that deliver their own products directly to individual stores and arrange it on the shelves. Finding ways to streamline the supply chain and to reduce inventory in the system has led to experiments in scan-based trading between DSD manufacturers and many of the larger retailers (Weinstein). Under this system, the store receives inventory on consignment from vendors whose products have a relatively short average shelf life (seventy days or less) and turnover in a store 1.6 times as often as products delivered from a wholesaler. Direct delivered products are usually beverages, sweet and salty snacks, bread, and ice cream. They represent over 25% of a typical store’s sales and over half of its profits (Progressive Grocer). The advantages of this system to the vendor lies in the real time information they receive from the store’s scanner data so they can monitor product movement and so they can replenish the shelves, making sure they are always full. It increases their sales. The advantage to the store is in not owning any inventory until after it is sold. Not only do they have less capital tied up in inventory, but they own fewer assets and they have working capital between the time of the sale and when the invoice is due, which could be as short as seven days or as long as thirty days. It improves the store’s cash flow and return on assets. In effect, the DSD vendors lend the store an interest-free
loan. In addition, the vendor can bring in the product anytime of the day or night, since it does not have to be checked in at the back door and an experienced representative stocks the shelves and manages the inventory in the store. This saves stores an estimated 95–100 labor hours a week across all 60,000 DSD vendors and all the stores they serve (Progressive Grocer). Scan-based trading does have some demands, however. It depends on mutual trust and on 100% accurate scanning. By 1999, 59% of retailers and 16% of wholesalers reported plans to test an SBT system (Blair).

This does not mean the demise of third-party wholesalers, but their role will change. They will serve more of the niche food retailers with specialty foods, unique shopping experiences, and a great variety of ready-to-eat foods. Another survival strategy for third-party wholesalers is to buy up retail chains until they begin to look and to act like a “virtual self-distributing chain.” SUPRERVALU chose this strategy on its way to becoming one of the largest wholesalers-retailers in the country.

Conclusions

Using information technology, the supply chain between food processors-manufacturers and retailers is struggling to become more efficient. Accomplishing this depends on finding a system that competes with the Wal-Mart system and allows many agents to enter. Network effects predict that the number of agents adopting a compatible system will need to be large for economies of scale to be realized. Coordinated efforts to engage the UCC to design and to set up such a system are promising and are consistent with the criteria needed for success. UCCNet views large internet alliances such as GlobalNetXchange not as competing systems, but as users of UCCNet.

The question of optimum network size is barely addressed in the literature but is worth contemplating. Thakor muses about these types of information systems in the financial services industry, where most do not yet share a common information system. He predicts that more standardization and shared information systems will emerge. However, in the next phase of evolution, he suspects that disintegration will occur as more specialized players emerge. In other words, the current consolidation of financial services and information service firms may unravel.

There may be a lesson worth noting here. Consolidation in the retail food industry, though rampant and focused on economies of scale and price competition, may be self-limiting. Not all consumers desire the type of food or shopping experience delivered by a fast and lean distribution system. Retailers and producers who cater to the specialized needs of consumers may well opt out of large information networks, but the availability of an open platform like UCCNet cannot
decrease their efficiency and should still benefit their consumers.

References


