Working Paper 03-01
The Food Industry Center
University of Minnesota
Printed Copy $25.50

E-COMMERCE: A NEW BUSINESS MODEL FOR THE FOOD SUPPLY/DEMAND CHAIN

Jean Kinsey and Brian Buhr

February 2003

Jean Kinsey, Professor, Department of Applied Economics, and Co-Director, The Food Industry Center, University of Minnesota, St. Paul, MN 55108-6040, e-mail: jkinsey@tc.umn.edu.

Brian Buhr, Professor, Department of Applied Economics, University of Minnesota, St. Paul, MN 55108-6040, e-mail: bbuhr@apec.umn.edu.

The work was sponsored by The Food Industry Center, University of Minnesota, 317 Classroom Office Building, 1994 Buford Avenue, St. Paul, Minnesota 55108-6040, USA. The Food Industry Center is an Alfred P. Sloan Foundation Industry Study Center.

E-COMMERCE: A NEW BUSINESS MODEL FOR THE FOOD SUPPLY/DEMAND CHAIN

Jean Kinsey and Brian Buhr

ABSTRACT

The use of electronic commerce for quality control and cost cutting efficiencies by the food and agricultural industries in the United States is the focus of this paper. The food industry engages in e-commerce through 1.) Internet shopping for consumers called business-to-consumer (B2C) e-commerce 2.) Business-to-business (B2B) Internet market discovery exchanges used by food suppliers at any point in the supply chain, and 3.) Business-to-business (B2B) relationships that reduce costs and increase efficiencies in the procurement, storage and delivery of food to retail stores or distribution centers. This third use of e-commerce is the most highly developed and widely adopted. It allows retailers to share information about consumers' purchases and preferences with food manufacturers and farmers and for tracking food products' characteristics, source, and movement from production to consumer. This circle of information allows high quality and consistent products to be consumed at lower prices.

This paper is about the development of e-commerce in the food industry, the economic concepts and goals that it meets, and the changes it brings to the industry. E-commerce both fosters and demands vertical coordination. It favors consolidation of firms. It changes the business culture from one of adversarial relationships to one of cooperation and trust. It changes the historical supply chain into a supply/demand loop while it lowers the cost of food. Policy issues arise around monopoly power, privacy, a diminution of variety, and the demise of small, undercapitalized firms.

Working Paper 2003-01
The Food Industry Center
University of Minnesota

E-COMMERCE: A NEW BUSINESS MODEL FOR THE FOOD SUPPLY/DEMAND CHAIN

Jean Kinsey and Brian Buhr

For information on other titles in this series, write The Food Industry Center, University of Minnesota, Department of Applied Economics, 1994 Buford Avenue, 317 Classroom Office Building, St. Paul, MN 55108-6040, USA; phone The Food Industry Center at (612) 625-7019; or E-mail tfic@apec.umn.edu. Also, for more information about the Center and for full text of working papers, check our World Wide Web site http://foodindustrycenter.umn.edu.

TABLE OF CONTENTS

Theoretical Basis for Information Technology 2

Terms of Competition Before Information Technologies 3

Business-to-Consumer E-commerce 6

Market Discovery, Business-to-Business E-Commerce 9

Business-to-Business E-commerce for Market Coordination 12

Why Information Technology Lags in Smaller Companies 18

E-commerce: Research Challenges 22

E-Commerce and the Trend Toward Tracability 25

Legislative Implications Associated with E-Commerce 26

Conclusion 27

References 28

E-Commerce: A New Business Model for the Food Supply/Demand Chain

Food and agricultural industries make up nine percent of the gross domestic product of the United States; 60 percent of that comes from wholesale/retail activity. The industry employs more than 14 percent of all workers; 71 percent in wholesale and retail activities. Retail food stores, restaurants and bars sell more than $890 billion in food and drink each year. About half of these sales are in grocery stores with one to two percent of grocery sales purchased over the Internet. American consumers spend less than 12 percent of their after tax income on food, less than any other country. This follows from relatively high incomes and from efficiencies in agriculture and the food distribution system.

The use of electronic commerce and information technology by firms that deliver food and other goods to retail food stores promises to deliver high quality food even more efficiently. By gathering and sharing quality information about consumers' purchases throughout the supply chain and tracing the origins and quality of food from farm to fork, the cost of delivering food should decline while the quality and consistency of food should increase. The focus of this paper is how food firms are adopting electronic commerce and Internet technologies to further increase efficiencies in the food chain. The food industry engages in e-commerce through 1.) Internet shopping for consumers called business-to-consumer (B2C) e-commerce 2.) Business-to-business (B2B) market discovery exchanges connecting food suppliers and buyers at any point in the supply chain, and 3.) Business-to-business (B2B) arrangements between retailers and their supply chain that reduce costs and increase efficiencies in the procurement, storage and delivery of food. This third use of e-commerce is the most highly developed and widely adopted. It allows retailers to share information about consumers purchases and preferences with food

manufacturers and farmers and for tracking food products' characteristics, source, and movement from production to consumer.

Theoretical Basis for Information Technology

Links between food manufacturers, producers, wholesalers, and retailers are complex, ill understood and changing rapidly. The economics and the reality of e-commerce markets are such that the food supply chain captures economies of scale and lowers costs of food distribution. Business-to-business (B2B) e-commerce is a new way of doing business. It tends to follow a Areverse product cycle@ where gains come from process efficiency first, followed by quality improvements to existing products and services and finally, the creation of new services and products (OECD). The e-commerce marketplace is one where strategy, expectations about others actions, and trust determine demand for e-commerce services.

The economics of 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) in the *American Economic Review* 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 AThe 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 critical mass of other users will participate in the same network.

As the number of users grows, the benefits to each user rises above the price they pay for belonging to the network. That is, the marginal social benefits curve rises above the demand curve and we have a classic case of under utilization of a socially beneficial good or system. In addition, the demand for this system rises as the expected number of users increases. If the marginal cost of providing the network is falling, the socially optimum number of users could be infinite.

When externalities are positive and the net value of an agent=s action is increased while 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 semi-public goods characteristics. It can arise due to economies of scale, (falling marginal costs) or it can arise from ordinary technological progress where the supply curve (marginal cost curve) shifts outward. Both lead to lower prices as a larger number of participants enter the market. The economics literature on this topic debates whether this is a technological externality where the outcome represents a market failure that calls for government intervention or a pecuniary externality that will be mitigated through the transfer of wealth (Liebowitz and Margolis).

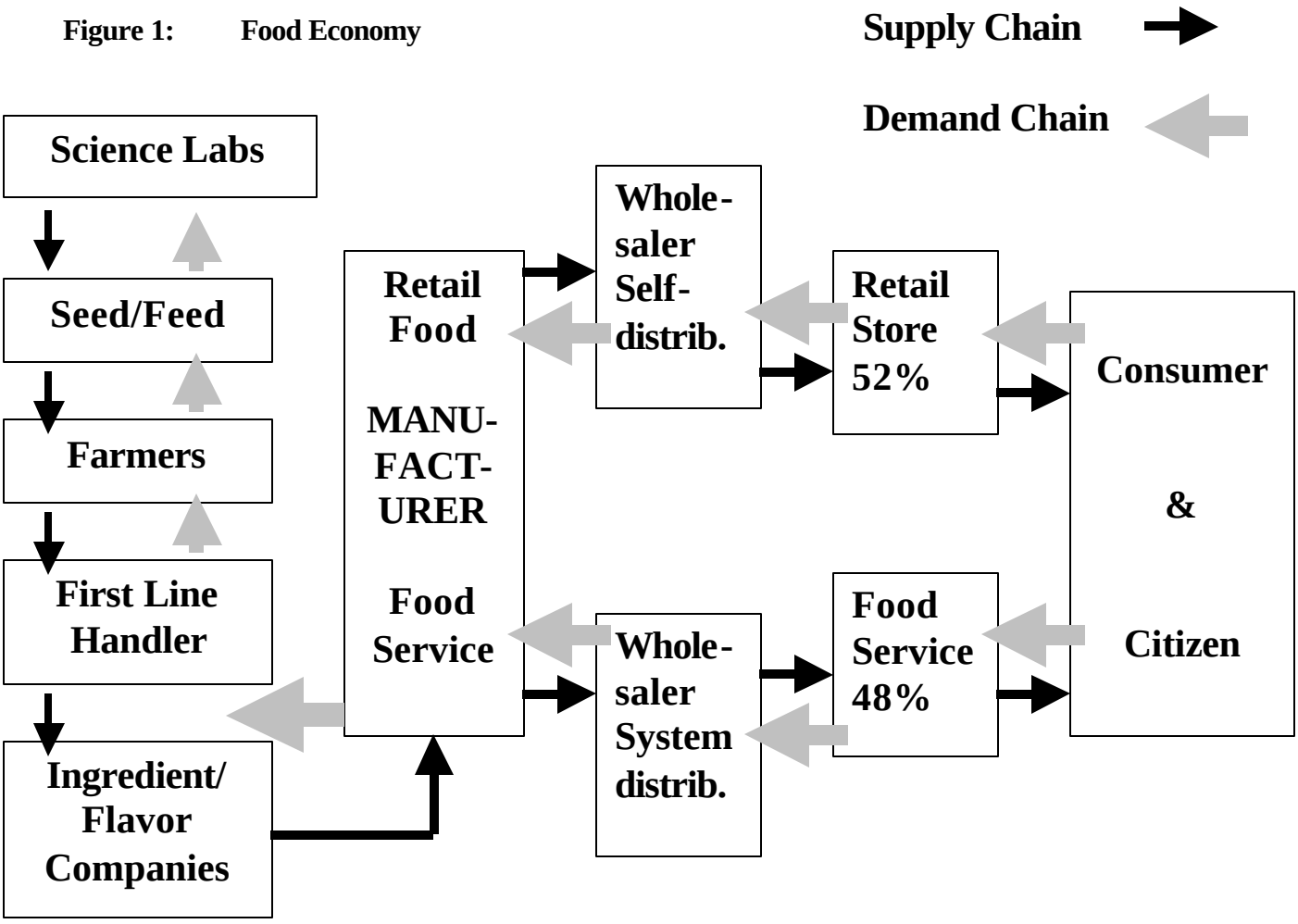
Terms of Competition Before Information Technologies

Food and agriculture has been an industry dominated by many small independent businesses at both ends of the supply chain. There were many farmers, many retailers, and relatively few manufacturers and distributors. Farmers and retailers each felt that the larger companies in the middle were profiting at their expense. Farmers= defense was to organize into buying or selling cooperatives and/or lobby for government price supports and access to foreign

markets. Retailers= strategy was to buy low and sell as high as possible, consistent with increasing customer sales in a highly competitive sector. There was little vertical integration or organization. There was little information shared among firms along the supply chain. Perhaps this was because the producers of raw commodities at one end of the supply chain and retailers at the other end were widely dispersed across the landscape. Agriculture production is tied to local tradition and appropriate climate and soil conditions while grocery stores have to be located in each village where people live. For a variety of reasons, the many independent farmers and retailers valued their independence and believed in their value to society. Figure 1 illustrates the supply/demand chain in the food industry. The larger arrows going from consumers to farmers and beyond depict the demand chains along which information about preferences and demand travel. The narrower arrows going from scientific laboratories to consumer depict a traditional supply chain along which products and services travel on their way to being purchased and consumed.

In the late 1980's, a single fierce competitor called Wal-Mart entered into this fragmented and fiercely independent system. It was able to lower retail prices by developing an integrated supply/demand chain driven by sharing information about retail sales with suppliers in real time. Electronic technology made the collection, analysis, and transmission of data possible, but Wal-Mart adopted, developed, and perfected an information collection and analysis system that turned raw data into information that management could use to become more efficient. It is fair to say that they forced the rest of the retail industry to adopt e-commerce for business practices and to build new relationships with their suppliers.

Figure 1: Food Economy



Ironically, food retailers had owned, but largely ignored, a key resource for improved efficiency in this supply chain since the mid 1970's. The data scanned every day at their check out counters was the beginning of the information chain for business-to-business e-commerce relationships. Only in the late 1990's were they learning to use that data and to begin changing the old supply push food system into a demand pull system. The power of the Internet (which Wal-Mart did not have when they first developed their B2B distribution system) to facilitate connections between diverse buyers and sellers also changed the distribution of power along the demand chain and initiated whole new ways of conducting business. It is still changing a culture

of adversarial buyers and sellers into partners who collaborate to decrease costs while they share information about consumer purchases, quality specifications, and delivery schedules.

Business-to-Consumer E-commerce

Consumers ordering of food over the Internet for home delivery is a modern version of an old practice in retail food, a practice that was abandoned because it was too expensive. In the first half of the twentieth century, small town or neighborhood grocery stores carried customers= credit accounts, took phone orders and delivered food to their homes. But, with product proliferation, consumers needed to see the new products in order to make choices. With automobiles consumers became mobile making it easy and desirable for them to drive to and shop in self-service grocery stores. Consumers used their own time to provide Afree labor@ for shopping and delivering groceries to households. Groceries became cash and carry stores, then suburban supermarkets, and now supermarket chains and supercenters where customers bag and haul their own groceries. New, using the Internet, customers can once again purchase on credit and have food delivered to their homes.

What has changed to make home delivered groceries attractive once again? The advent of Atime starved@ consumers and their access to the Internet makes home delivery look like a solution to a modern consumer problem. Most surveys show that consumers do not like grocery shopping, considering it a drudgery task. This type of shopping is ripe for Internet competition. In contrast, weekend or occasional shopping is leisure (Hughs and Ray). It is entertainment, fun, an adventure and a social event. The Internet cannot compete with this leisure activity by selling and delivering product to the household=s doorstep.

The advent of e-commerce for home shopping increased competition for some traditional retail food stores and offered a new form of business to others. Initially, Internet sellers partnered

with bricks-and-mortar retailers and used their stores or distribution centers as the source of the food they picked and delivered to households. The partner stores may even have gained some business in these cases. But, picking groceries from a retail store, with its own markup already on the product only raised the cost of Internet selling, a cost that consumers were generally not willing to pay. The next step was for Internet sellers to establish their own distribution centers where cost-of-goods-sold is lower and groceries could be picked faster. But the capital investments in real estate, inventory, and equipment also added to their costs. In the early 2000's, Internet food companies lost money continuously, even as they increased sales and revenue. The fixed and variable costs of procuring and servicing every new customer was far greater than the revenue generated. They overestimated the number of consumers that would regularly use their services and the amount of money they would spend on each order.

One reason it was, and still is, so hard to make a profit in this business is that Internet food companies lack the power of volume buying that is enjoyed by large food retailers. They simply cannot obtain the goods they sell at the lowest prices. Another is consumers become dissatisfied with a merchandise mix that does not have enough variety. And finally, a delivery charge of $10 per order, covers only about 60 percent of the delivery costs. The delivery costs for Internet companies approximately off set the labor costs for bricks-and-mortar stores (Dell).

This has led to the traditional bricks-and-mortar companies buying up Internet food retailers. David Ignatius, a reporter for the Washington Post, calls it the "Revenge of the Dinosaurs' (4/19/2000). On April 14, 2000, Ahold, a Royal Dutch parent company of Giant Food, bought 51 percent of Peapod with the right to purchase up to 75 percent. Safeway worked with tesco.com to develop strategies for selling groceries on line and has partnered with Groceryworks.com to offer customers home delivered foods (http://www.safeway.com). Tesco,

one of the leading food retailers in the U.K., claims to be the largest on-line grocery company in the world (http://www.tesco.com). Large bricks-and-mortar retailers can spread the costs over far higher volumes and, they have the brand recognition and consumers' trust that Internet retailers do not enjoy. It is widely believed that business-to-consumer Internet sales will be dominated by "bricks-and-clicks" companies in the future but finding the right mix of integration and separation will be a challenge to individual companies (Gulati and Garino).

In a demand driven system of food sales, long-term success of B2C e-commerce will depend on consumers' adoption of Internet shopping. In economic parlance, if it reduces their search costs and increases their utility (delivers superior quality products at lower time and money costs) it will be used. Economic theory of consumer behavior predicts that as household incomes rise and the value of time increases, consumers willingness-to-pay for the costs of food delivery will increase. But the value of the service and the quality of the food delivered via an Internet seller must exceed that which can be had by shopping for oneself if it to be a sustainable business. In a study of why Internet shoppers come back, the number one reason was level and quality of customer service followed by on-time delivery. Price was the last of eight other reasons (Hanrahan). This type of grocery shopping does not suit households on a limited budget with time to shop the traditional way. It does serve upper income households who find shopping onerous or who have limited access to food stores.

One example of new uses of Internet grocery shopping is by `emigrés in the United States who have accumulated enough wealth to support families back home, especially in Latin America. Instead of sending money, they go on-line and order groceries to be delivered to relatives in Argentina or Peru. They can ensure that their money is spent on food for their loved ones and they avoid money transfer fees. Retailers like Disco SA, a unit of Ahold NV in

Argentina, Pao de Acucar in Brazil and E. Wongs SA in Peru are promoting this type of international shopping by way of the Internet as is Visa International (Wall Street Journal 11/6/02). This only serves to illustrate the creative marketing strategies that B2C e-commerce can devise and the opportunities for consumers to use it to accomplish old goals in new ways. As of 2002, consumer shopping via the Internet continues to grow, slowly but surely, in local cities and across international borders.

Market Discovery, Business-to-Business E-Commerce

A growing use of e-commerce is for market discovery between a large number of widely dispersed buyers and sellers. These Aonline market makers@ are fundamentally different from the retailer/supplier relationships that operate on the principle of sharing information and agreeing to buy and sell from each other a given amount of goods over a set period of time. That relationship is typically contractual and expected to last at least through the next selling period. In food retailing this has resulted in tying and contract agreements wherein the manufacturer agrees to manage supplies and the product is priced via a formula without actual direct negotiation. The efficiencies of inventory control provided by a contract with a single provider out-weigh any merits associated with market discovery of prices and quantities. However, as these information systems for logistics along the supply chain improve, it is likely that more B2B marketing exchanges will successfully emerge. The ability to communicate across multiple suppliers and manage logistics seamlessly will likely lead to bargaining and therefore viable B2B markets for both quantity and price discovery.

On-line market discovery and exchange markets facilitate shopping by buyers at all stages of the supply chain. Kaplan and Sawhney call them e-hubs. They aggregate together a large number of small suppliers (Forward Aggregators) or a large number of diverse buyers

(Reverse Aggregators) for the purpose of matching buyers with sellers and facilitating their trading goods and services for money. These market makers rarely own any of the merchandise that is traded through them, they simply help buyers find the best price or value available and help sellers identify buyers. Since there are a large number of diverse producers at one end of the food supply/demand chain and a large number of diverse retailers at the other end, this model fits the food industry very well.

Early commercial applications of B2C e-commerce such as E-bay and Priceline.com included the development of markets for trading products which formerly did not have well established markets. E-bay is still referred to as a place where individual buyers and sellers can price and exchange single or multiple items with very low transactions costs of searching out each other. Priceline.com provided an alternative strategy for markets with excess capacity which otherwise would go unsold by the primary provider of the good. These B2C applications were quickly observed and attempts were made to capitalize them into market discovery applications for B2B transactions. Early entrants included VerticalNet and Ariba who attempted to provide exchanges for common inputs to manufacturing and business operations. Applications also arose in the food industry, including E-Markets.com, Xsag.com, Produce.com and ProvisionX.com. In nearly all cases these B2B "market makers" failed to gain a substantial foothold in market discovery processes. Why has this occurred and what is the future for market discovery using e-commerce in the food industry?

One of the fundamental differentiating attributes of food marketing is that most products are perishable. Even breweries now place 'born on' dates on their products with hopes of promoting freshness to their customers, but it artificially imposes perishability on a product that, in antiquity, was a way to create a "shelf-stable" drink. Perishability imposes tremendous

pressure on supply chain management to turn over products; there are large inventory costs associated with all products. Therefore, quantity management is paramount in importance, even more important than price.

There is a relatively strong literature regarding market discovery. The idea of such auctions is not new relative to the age of the Internet. Beam, Segev, and Shanthikumar have attempted to determine how sellers should optimally auction their goods (i.e., how much should be auctioned at any given time) based on the equilibrium price predicted by their model. More recently, Gallien and Wein have looked at the buyer's side problems of Internet auctions by designing and analyzing smart markets for industrial procurement. They remark that while online B2B auctions are expected to grow rapidly in the first decade of the 21st century. Early implementation was poorly adapted by suppliers in procurement markets where there are capacity constraints, transportation costs, supplier switching costs, and quality requirements. Gallien and Wein indicate that the transfer price is but one dimension of the overall transaction.

On a practical level, Roddy argues that since many buyers and sellers in open market exchanges must conduct complementary transactions of goods and services such as transportation, storage and insurance after the trade itself is completed, the time and money spent on the subsequent arrangements often eliminates the value created by the electronic exchange in the first place. That is, it may be necessary to involve other suppliers in the transaction and, therefore, an auction that combines several parties may be more appropriate. Gross and Licking remark that software has become available that will "allow buyers and sellers to bundle their requirements into far more complex and flexible bundles." In seeking to benefit from such efficiency gains and as a consequence of growing computer power, many firms have begun to offer software to deal with such auctions (deVries and Vohra).

As to problems of market liquidity, if multiple exchanges exist for the same type of product, problems of inadequate market participation in any given market could arise. Jordan remarks that if a large number of exchanges and related markets are to coexist, mechanisms must allow for cross-listing on separate sites thereby increasing the liquidity of each of the sites. Appropriate payment methods across exchanges could ensure that revenues are shared equitably among market makers. Similarly, as suggested by Wise and Morrison, such exchanges will need to evolve into a cooperative structure such that exchanges will no longer serve as for-profit centers but will be have a public good quality to them such that they operate at cost. Alternatively, different exchanges will merge. As noted earlier, recent mergers and acquisitions in the Internet sector seem to indicate that this is the direction in which firms are moving.

While the applications and use of auctions has had limited success, the Internet, coupled with other information technologies, offers a new beginning for these mechanisms to allow for greater transparency and to potentially increase efficiency of pricing as well as eliminate some of the administrative costs associated with contracting and the dynamic costs associated with the inflexibility imposed by contracts. The success of market discovery will depend on the ability to develop liquidity in the food industry increasingly characterized by bilateral oligopoly relationships. Developing seamless across-firm supply chain management solutions (the second type of B2B e-commerce is expected to) help in improving the potential for dynamic market discovery solutions using e-commerce.

Business-to-Business E-commerce for Market Coordination

The food industry in the United States is dominated by nationally and internationally recognized brands that are traditionally created within the research and development divisions of

food manufacturers. These new foods are tested in selected markets to see if they will sell, advertised heavily, and offered to wholesalers/retailers at deep discounts or with slotting fees (payments to retailers for new shelf space). It is a system with high transaction costs and risks of rejection by consumers. With B2B information systems, consumers help create the products through their interaction with the retailers and subsequent sharing of sales data with retail suppliers. This illustrates a reverse product cycle where the system of collecting information is designed first and then used to determine what products to produce and sell.

Business-to-business e-commerce, as it is being adopted by retail food stores and their suppliers, has focused mostly on ways to save labor costs, speed up ordering, delivery, and invoicing, and move the product through the system as fast as possible. The latest innovations have occurred because of new electronic technology, information management systems, and new competition. One thesis is that the competition for a larger share of the consumer stomach has forced food stores and their suppliers (wholesalers and manufacturers) to learn how to exploit the power of information available from point-of-sale (POS) scanner data. Food retailers are behind other industries in adopting programs of continuous-inventory-replenishment. The automobile industry adopted just-in-time delivery channels two decades ago and general merchandise and clothing retailers adopted Aquick response@ in the 1980s. Even though food retailers were early leaders in the development and design of universal product codes (bar codes) they are among the last to realize the payoff from their universal adoption and use (Walsh; Kinsey and Ashman).

A major motivation for learning how to use the information and information technologies for business-to-business transactions is the example set by the first mover, the early adopter, Wal-Mart. By the early 1990's Wal-Mart and some of their suppliers had designed an information logistics system to harness POS data. With compatible computer systems and the

mandate to share data with suppliers, information about what was moving over a scanner in a store was transmitted directly to suppliers - their own distribution centers and/or manufacturers. Manufacturers could, in turn, adjust their supplies (or production lines) according to consumer demand aggregated from each store. Theoretically, by making information about sales at all retail stores available to both the retailer and their suppliers simultaneously, a continuous loop was created whereby information about sales flowed in one direction and products flowed back, just-in-time to match the retail demand.

The concept of sharing information about sales with vendors and developing a continuous and coordinated flow of product was introduced to the rest of the retail food industry and institutionalized by a coalition of trade associations such as the Food Marketing Institute, Grocery Manufacturers of America, and food manufacturers and suppliers such as Proctor and Gamble, and a few big retail food chains such as Kroger, under the name of Efficient Consumer Response (ECR) in 1992. It had little to do with the consumer except that its goal was to track consumer purchases at the point-of-sale and share that data with suppliers so they could tailor the delivery of goods to match the volume being sold. The goal of ECR was to have each food store/company behave like Wal-Mart; to implement electronic data interchange (EDI) to order goods and slim down the offerings in each category in order to streamline delivery and the costs associated therewith. This lead to Acategory management@ which has had considerable success even though it may conflict with a goal of providing variety and service to consumers. In 1998, 24 percent of stores responding to a survey by the Food Marketing Institute reported using EDI with at least some suppliers. Of those who did, 53 percent used a third-party, value-added network (VAN). This is a network that connects different members of a retailer=s supply chain

using Web-type technologies and interfaces within a given company. Only 17 percent were using the Internet and the rest used both. (FMI).

Data collected in the Supermarket Panel at The Food Industry Center at the University of Minnesota shows stores that implemented more of the data management and coordination activities associated with ECR and/or (CPFR)[1] are larger, have higher sales per transaction and per labor hour but no higher annual rates of sales growth (Table 1). In the 2002 Supermarket Panel, with 866 representative stores from across the nation, the highest performers by three of four measures are stores that ranked highest on a Supply Chain Index. The index measures the percent of twelve different electronic technologies adopted along with complimentary new management practices. The mean supply chain index score for stores in the highest to the lowest quartile of performance is listed on Table 1. It ranges from 87 percent for stores in the highest quartile to 26 percent for stores in the lowest quartile (King et al, 2002).

1 Cooperative Planning Forecasting and Replenishment (CPFR) is a newer version of ECR designed to build cooperative sharing of sales data and forecasting of future demand. Full use of CPFR leads to vender-managed inventory (VMI).

Table1 The Adoption of Information Technology and Management Practices by Supermarkets and Their Performance in the United States, 2002.

Level of Adoption as measured by the Supply chain Index*	Gross Profit as a Percent of Sales	Annual Sales Growth 2001-2002	Sales per Transaction	Sales per Labor Hour
Highest Quartile Mean Score 87	26%	12.%	$25.00	$133.70
Third Quartile Mean Score 75	23%	1.6%	$23.57	$128.48
Second Quartile Mean Score 58	24%	1.8%	$19.60	$107.14
Lowest Quartile Mean Score 26	24%	2.2%	$16.59	$ 87.01

* Percent of information technologies and logistics management practices adopted.

Source: King et al. *The 2002 Supermarket Panel Annual Report*, The Food Industry Center, University of Minnesota. http://foodindustrycenter.umn.edu

Table 2 The Adoption of Information Technology and Management Practices by 866 Representative Supermarkets in the United States by the size of the Group or Chain to Which They Belong, 2002.

Store's Group Size and Mean Supply Chain Index*	Adoption of : Internet/Intranet link to headquarters or key suppliers	EDI for orders to vendors	Vendor Managed Inventory	Scanning data used for automatic inventory refill
>750 Stores (80)	90%	77%	38%	33%
51-750 Stores (69)	81%	83%	40%	27%
11-50 Stores (66)	78%	78%	18%	4%
2-10 Stores (40)	59%	85%	21%	3%
Single Stores (28)	54%	75%	18%	2%

* Percent of information technologies and logistics management practices adopted.

Source: King et al. *The 2002 Supermarket Panel Annual Report*, The Food Industry Center, University of Minnesota http://foodindustrycenter.umn.edu

Table 2 shows the percent of stores that have adopted four of the twelve supply chain management practices by the size of the group/chain that the store belongs to. A high percent of stores have adopted the use of Internet/intranet links to corporate headquarters or key suppliers and use of electronic transmission (EDI) to place orders to vendors/suppliers. But when it comes to using vendor managed inventory and scanning data for automatic inventory refill only a few stores in smaller groups have adopted these practices. However, the percent who have adopted these technologies has increased over time. For example in 2000, 25 percent of the stores in the largest groups used scanning data for automatic refill compared to 33 percent in 2002 (King et al. 2000; 2002). In 2001, 83 percent of stores in the largest groups used Internet/intranet links to headquarters compared to 90 percent in 2002 (King et al. 2001; 2002). Results show that single store retailers and stores in groups with up to ten stores are the slowest to adopt information technologies and supply chain management practices. The largest, mostly self-distributing retailers adopted the most number of the information technology practices but self-distributing chains were only slightly ahead of the multi store, non-self-distributing chains on the building of relationships with suppliers (King et al. 2000). This means that stores who use third party wholesalers for their supplies are still in a good position to compete with the larger chains. These findings support the positive Anetwork effects.@ Using information technology both allows and demands larger sized organizations and networks are effective at lowering costs and increasing logistic efficiencies. Stores in smaller ownership groups may not need or want to use information technology since they often appeal to niches of customers that demand special products not suited for large-scale distribution systems. For example in many stores in wealthier neighborhoods with unique, often imported products, do a very good business without the benefit or the cost of elaborate information management systems.

Further analysis of the data collected in the 2002 Supermarket Panel shows that the supply chain score was a significant driver of gross profit as a percent of sales and a lower payroll cost as a percent of sales after accounting for other factors such as being a price leader or being in a self-distributing chain. In other words, all else being equal, stores that employed more sophisticated information management systems to control inventory had high profits and lower costs.

Why Information Technology Lags in Smaller Companies

A major stumbling block to adopting management practices advocated under the umbrella of ECR is that EDI requires compatible computer systems which are expensive to set up and operate. ECR suffered from a lack Anetwork effects@ that can be realize with multiple users on the same network (Belleflamme 1998; Katz and Shapiro 1994). Network effects yield economies of scale and open up opportunities for large retailers to grow by offering lower prices to consumers because they have lower operating costs themselves. As the number of users of a network grows, the benefits to each user increases and there exists a classic case of positive externalities. The network begins to look like a public good; its use is nonrival and nonexclusive. If in addition, as the number of users rise, the average and marginal costs of providing network services fall, the network could be in the position of being a natural monopoly in the same way we formerly thought of electric power utilities and telephone companies as being natural monopolies. The development of B2B e-commerce is a long way from this stage in 2003, but the vision of vertically integrated supply chains points in this direction. The network, like the old-fashioned phone lines, would provide the compatible, ever ready, and seamless communications between retailers and manufacturers or other suppliers.

Under the ECR vision, establishing a set of individual, workable communications networks with computers at all stores that could communicate with computers of all suppliers was asking more than the industry could deliver. The technical problems of incompatibility and a cultural resistance to sharing store level data with suppliers resulted in very slow adoption. As expected, and verified by the Supermarket Panel Studies discussed above, the largest chains adopted first.

Smaller retail stores were simply not willing or able to participate in electronic data interchange (EDI) necessary to participate in an efficient response relationship with suppliers. But, apparently the largest chains, already in supplier networks, believed that there were industry wide economics of scale to be gained if more retailers and suppliers could be convinced to join. In other words, they envisioned the benefits to the whole industry and themselves if more retailers and manufacturers could be enticed into the Anetwork.@ In 1999 several large retailers such as H.E.Butts, Kroger, and Wal-Mart went to the Uniform Code Council (UCC), who had originally negotiated the design of the bar code, and asked if they could help design an Internet platform that would allow virtually any retail store to communicate directly with their suppliers without having to invest in special hardware and software. The UCC responded with UCCNet, a wholly owned subsidiary of the non-profit UCC. It is designed as an open format, electronic Internet platform for retailers to use to build business-to-business relationships with their suppliers. It was launched in July, 2000 with 75 companies using the industry-designed, standards-based foundation for electronic commerce (Ghitelman). UCCNet provides access to e-commerce to small and large companies alike with its single computing language, eXtensive Markup Language (XML).

UCCNet facilitates vertical business-to-business e-commerce, the type that builds an intimate and cooperative relationship between retailers and manufacturers. They do not see the horizontal networks like GlobalNetXchange, a proprietary supply network founded by Carrefour and Sears Roebuck and Co., or WorldWide Retail Exchange, a cooperative network started by an alliance between K-Mart, Target, Tesco, Marks and Spencer, Albertson's, Safeway and others as competition but as users of the UCCNet (Coleman). UCCNet simply provides the Internet platform for the exchanges to use to transmit data back and forth between parties in the supply chain. Three Internet based exchanges serve much of the world's food industry: 1) GlobalNetXchange (GNX) with Carrefour, Sears Roebuck & Co., Daiei, Kroger, Metro AG, Coles Myer and J Sainsbery in 2002. 2) Worldwide Retail Exchange (WWRE) with Casino, Delhaize Group, Royal Ahlod, and Supervalu in addition to those mentioned above and 3) Transora with more than 50 of the world's consumer producer companies such as Coca-cola, Diageo, Kraft Foods, Proctor and Gamble, and Unilever. Wal-Mart has declared that it will not join with any of these supply chain alliances since is has its own system (Retail Link) that has been in place since 1991; they already have at least 10,000 vendors participating with them in business-to-business e-commerce and supply chain management (Janoff 2001). Most of these exchanges including Retail Link use UCCNet as their Internet "software" in order to transmit data. With this power for data analysis, new and improved management programs for sharing data have been devised and promoted.

CPFR was pioneered by Wal-Mart and took the 1992 ECR vision and implemented it through vertical exchanges of information between retailers and manufacturers. Sharing retail point-of-sale (POS) information with the food manufacturer on a daily basis provides the basic data for this system. Then, with a historical record of consumer sales, the manufacturer and the

retailer each forecast sales over some future time period, share their forecasts, and negotiate anticipated future sales if necessary. Manufacturers agree to deliver merchandise on a prearranged schedule and manage the inventory of their products in each store. This system obviously demands an accurate scanning information and some Internet interface over which data can travel securely. It also demands a willingness to share data and the responsibility for the products on the shelves. An Internet connection for ordering, invoicing and communicating between retailers and suppliers does not necessarily imply a full-blown CPFR program. But using an electronic network is a necessary step to establishing CPRF relationship with suppliers. "The whole intent of CPFR is to establish trust between retailers and manufactures" (Robinson). Wal-Mart was using CPFR with over 8 percent of their suppliers by 1999 (IGD). Shulman suggests that this system is a B2B2C system since the information truly starts with consumers= purchases and responds to their purchases with replenishment that matches. It is a system where manufacturers produce to meet consumer demand not to meet the capacity of their plants. It is truly a new way of thinking and doing business all up and down the supply chain. These trends will transform a fragmented and costly distribution system from a supply push to a demand pull system.

Lest this seem easy, caution from Andrew Grove (CEO of Intel) implies that we should be careful about what we ask for. Business-to-business e-commerce network systems involve nothing short of re-engineering the business process, changing the culture, and integrating data from one place to another; from a retailers= sales floor to a decision system that involves a manufacturer, somebody=s warehouse and a transportation system, and being able to evaluate and change options on the fly (Grove). He further says that if the markets become as efficient as planned, it will be a very hard way of life. There will not be as many profits to go around and

managers will have to find new ways to make money in a super competitive world. This is consistent with the theory of network creation and network effects (Belleflamme). As everyone's costs decline in a large efficient network, competition will increase and new networks will arise to define unique niche markets.

E-commerce: Research Challenges

E-commerce is a relatively new phenomenon. Use of the Internet has penetrated over 25 percent of U.S. households in less about 5 years, the personal computer in about 15 years (Cox). In 2002 about 60 percent of U.S. household had access to the Internet. Ways to study the rapidly evolving products and services that emanate from the use of the Internet are not immediately obvious, because as in the reverse product cycle where the process comes before the product, the business models, startups, failures and successes have to occur before most academics can know how to think about them. Recall that it is a new way to do business. That means that we need new theories and models to study them. One economic model borrowed from the economics of public goods with positive externalities was used throughout this paper to identify the network effects of large numbers of sellers and/or buyers cooperating and interacting with a standard protocol. It fits the processes we observe among businesses conducting Business-to-business e-commerce, either to market goods or build vertical alliances.

Other economic theories that might be used to explain and predict firms: behavior in the supply chain were proposed by Venturini and King. They focused on vertical integration that would ensure consistent and predictable quality in the inputs to food manufacturers, but one can envision how each of their theories might apply to e-commerce behavior closer to the retail end of food chain. For example, transaction cost economics examines and predicts how organizations choose governance structures in order to minimize transaction costs. It can be used to explain

greater vertical coordination where capital investments are expensive (developing hardware and software to collect and use very large sets of data), highly specific to the industry (food sales in grocery stores where all goods do not have bar codes), and the level of uncertainty about the quality of a product is high (seasonality of fresh produce, inability to judge quality by inspection, and a huge number of small, diverse, and uncoordinated sellers). It might be used to explain the development of CPFR, scan based trading, and other processes that demand the sharing of data between levels of the supply chain, or processes that reduce the asymmetry of information and reduce the moral hazard of dealing with many small buyers and sellers.

A shifting of power within a supply chain as e-commerce develops is a curiosity and a concern. Transaction cost economics and other models dealing with principal-agent behavior might be used to explain the sharing of risk between retailers and manufacturers who share data and negotiate the responsibility for who owns merchandise in the store, who decides on displays, inventory depth, and category management. Principal-agent models examine how the principal party (the one with the power such as an employer) incents the agents they buy from or sell to, to behave in a way that maximizes the returns to the principal. They typically treat technology as fixed, but given the institutions of e-commerce, how various parties emerge as principals and how they share the risks and incentives with their agents could be fertile ground for research.

Ownership patterns and who has the right to benefit from ownership is the purview of property rights theory. It might be used to assess whether or not integration of two or more segments under common ownership will improve system-wide performance (Venturini and King). It comes into play with private label products, with the sharing of scanner data, and with the use of consumers private demographic and buying pattern information. In a number of research and development projects, be they related to the design of food or of communications

software, property rights can be an issue. Owning the right to information (or other assets) usually implies the right to benefit from its sale to another party. When information is shared and used by parties on both ends of the supply chain, the party with the right to benefit and how those benefits are shared or redistributed could be the subject of investigation.

The last theory posited by Venturini and King is a resource based and capability theory that comes out of the strategic management literature. It extends the transaction cost models by allowing for a dynamic view, focusing on rent (profit)-creating behavior through ownership and exploitation of unique resources and capabilities. This approach is promising for explaining the development of e-commerce networks where outside firms can create value that can be spread across many other firms by way of standardized protocols for communication. The resource-based view emphasizes the importance of capabilities that foster cooperation and trust, the very purpose of UCCNet and other e-commerce facilitators in the food supply chain. Trust dampens moral hazard and opportunistic behavior that creates barriers to sharing of data and cooperative planning for inventory replenishment. The value created by firms with unique network resources has proven to be very large already. How this value is shared and how it is passed on to consumers may be studied under this economic framework.

Household economics and the value of time would be a useful framework to study consumers= likelihood of adopting internet shopping and the mode of delivery they choose. It leads to broader questions of tradeoffs between labor and capital in other segments of the supply chain considering adoption of e-commerce options.

Other academic disciplines will bring additional research questions and models to the table when it comes to examining and predicting the impacts of e-commerce on business viability and consumer welfare. Thanks to the thinking of Venturini and King and to the

contribution of the economics of positive externalities of public goods, we have some ideas about how to conduct research on the new ways of doing business that the Internet, computer technology and e-commerce brings to our economy.

E-Commerce and the Trend Toward Tracability

As the capacity to collect large amounts of data from retailers increases and the ability to analyze and forecast demand for individual food products with individual attributes increases it is only logical that there will be demand for more complete information about those attributes. Couple this with other trends like more diverse consumer preferences, new fears about bio-technology being used to manipulate the genes in food, new food-borne illnesses, and global sourcing of food from strange lands, and one can predict that retailers and consumers will be asking for detailed information about the genetics, the source, and the processes used to produce their food. Tracability is the code word used for a variety of processes and technologies that will allow the end consumer to know exactly where in the world their meat (or other food) were raised and how it was slaughtered and processed. Systems that can tag and keep track of crops and animals all the way through the supply chain are largely in the experimental stages. One of the primary advantages is the ability to deliver consistent quality product to meet consumers' expectations and manufacturers' specifications. Systems are more advanced in tracing livestock from farm to table. Even though these systems allegedly started in response to consumers' demand to know the origin and processes used to produce their food, it is also an efficient supply chain management tool. Knowing where every food item has been on its way to the retail store allows retailers and manufacturers to conduct more targeted recalls in cases of food borne illness or other food safety problems.

An irony in the call for tracability by consumer activist groups and those who are concerned with the preservation of small farms and independent producers is that in providing tracability, the food supply chain becomes more and more vertically coordinated and the firms in the chain become bigger. One cannot achieve tracability on a large scale with small independent firms. Consistent with other uses of information technology this requires big businesses with lots of financial and human capital. If tracability systems are fully implemented, the food delivery system will probably become even more efficient and consumers will benefit from lower food costs, safer food and more knowledge, but they will not end up feeling closer to nature or in support of small, land based agriculture or boutique farm production.

Business-to-business networks that utilize information as a basis for their operations create barriers to entry for non mainline food firms, but in this market there is plenty of room for niche, neighborhood, and regional players. Food is needed in every local. Many people like to select local, fresh, and natural foods. They are willing to pay more for variety, experiences and service with their food and large, low cost operators do not excel at providing these characteristics. The personal touch and local flare will be provided by local food retailers and the foodservice sector. To the extent that there is profit to be made in selling local fresh and natural foods, even large retailers will have an incentive to form buying alliances or contracts with local producers who will guarantee these quality characteristics.

Legislative Implications Associated with E-Commerce

The use of the Internet for e-commerce has heightened concerns with anti-trust policies. Consolidation of control at all levels of the supply chain is raising questions of monopoly power and a potential increase in consumer prices. Exploitation of private information about consumers and the potential for electronic fraud opens new public policy and regulatory possibilities. The

general direction of public policy and regulatory authority is toward greater national control as opposed to states rights. Just as the network effects of joining large, standardized national and international business networks push for more global standards, being able to provide national standards of regulation allow more efficient operations. After all, being able to share and aggregate data depends on common definitions of products, common standards of performance and a common language. It remains to be seen who sets these standards and whether private companies can and will agree to workable standards, and whether these standards are perceived as trade barriers or discriminate against vulnerable groups of consumers or producers.

Conclusion

The multiple impacts of the Internet and its use in e-commerce will evolve for decades. Whether it leads to more consolidation, more homogeneous markets, or more fragmentation remains to be seen. We know that it is changing our concepts of business relationships, of speed, and of time. It is changing our correspondence practices. We know that an enormous amount of energy is being used to reinvent, re-engineer and reorganize the way business is conducted. Fisher et al. calls it Arocket science retailing@ and questions how fast retail firms and supply chains can adopt. In any case, the advent of information technology streamlines the food system, makes it more responsive to retailers and manufacturers specifications and to consumers' diverse preferences. For every new opportunity that arises, old practices fall away, leaving consumers and firms alike wondering if they should "be careful what they ask for."

References

Beam, C., A. Segev, and J.G. Shanthikumar. 1999. "Optimal Design of Internet-based Auctions." Working Paper-98-WP-1034, University of California, Berkeley, Haas School of Business, January.

Besen, M.B. and J. Farrell. 1994. "Choosing How to Compete: Strategies and Tactics in Standardization." *J. of Ec. Perspectives.* 8 (2): 117-32.

Belleflamme, Paul. 1998. "Adoption of Network Technologies in Oligopolies." *International Journal of Industrial Organization*. 16 (4): 415-44.

Coleman, C. Y. 2000. "Big Retailers in U.S., Europe Form Exchange." *Wall Street Journal* April 3: B19.

Cox, Michael. 2000. Data collected and the Federal Reserve Bank of Dallas, http://www.dallasfed.org

Dell II, Frank, CMC. 2000. "E-commerce Economics." http://ideabeat.com/Exchange/CuttingEdge/CE_article2.html

deVries, S. and R. Vohra. 2000. *Combinatorial Auction: A Brief Survey*. Munchen, Germany: Zentrum Mathematik, TU.

Fisher, Marshal L., Ananth Raman, and Anna Sheen McClelland. 2000. "Rocket Science Retailing is Almost Here, Are You Ready?" *Harvard Business Review* 78 (4): 115-24.

FMI (Food Marketing Institute). 1999. *Electronic Marketing Survey of Food Retailers, 1998*. Washington, D.C.: Food Marketing Institute.

Gallien, J. and L.M. Wein. 2000. "Design and Analysis of a Smart Market for Industrial Procurement." Mimeo, MI T: Sloan School of Management, October 15.

Ghitelman, David. 2000. "UCCNet: Quick Adoption for Standards for B2B Likely." *Supermarket News* 48 (31): 1,44.

Gross and Licking. 1999. "Cyberauctions You Can Finesse." *Business Week* May 17.

Grove, Andrew. 2000. As interviewed by David Hamilton. "Inflection Point." *Wall Street Journal* April 17: R48.

Gulati, Ranjay and Jason Garino. 2000. "Get the Right Mix of Bricks and Clicks." *Harvard Business Review* 78 (3): 107-14.

Hanrahan, Timothy. 2000. "Price Isn=t Everything.@ *Wall Street Journal* July 12: R20.

Hughs, David and Derek Ray. 2000. *Developments in the Global Food Industry: A Twenty First Century View*. University of London, U.K., Wye College Food Industry Management Group Working Paper.

IGD (International Grocery Distribution). 1999. *Wal-Mart in the U.K.* England: Letchmore, Heath Watford.

Ignatius, David. 2000. "Revenge of the Dinosaurs." *The Washington Post* April 19: A27.

Janoff, Barry. 2001. "B2B 2001: A Special Report on E-Commerce." *Progressive Grocer* February: 49-53.

Jordan, M.S. "MetaAuctions: Liquidity on Tap for Net Markets." Trade Dynamics Corporation.

Kaplan, Steven and Mohanbir Sawhney. 2000. "E-Hubs: the New B2B Marketplaces." *Harvard Business Review* 78 (3).

Katz, M.L. and C. Shapiro. 1985. "Network Externalities, Competition and Compatibility.@ *Am Ec. Rev* 75 (June): 424-40.

Katz, Michael L. and Carl Shapiro. 1994. "Systems Competition and Network Effects." *Journal of Economic Perspectives* 8 (2): 93-111.

King, Robert, Paul Wolfson, and Jonathan Seltzer. 2000. *The 2000 Supermarket Panel Annual Report*. The Retail Food Industry Center, University of Minnesota. http://foodindustrycenter.umn.edu

King, Robert, Jonathan Seltzer, and Elaine Jacobson. 2001. *The 2001 Supermarket Panel Annual Report*. The Food Industry Center, University of Minnesota. http://foodindustrycenter.umn.edu

King, Robert, Elaine Jacobson and Jonathan Seltzer. 2002. *The 2002 Supermarket Panel Annual Report*. The Food Industry Center, University of Minnesota. http://foodindustrycenter.umn.edu

Kinsey, Jean and Sara Ashman. 2000. "Information Technology in Retail Food Industry." *Technology in Society* 22 (1): 83-96.

Liebowitz, S.J. and S.E. Margolis. 1994. "Network Externality: An Uncommon Tragedy." *J. of Ec. Perspectives* 8 (2): 133-50.

OECD (Organization for Economic Co-operation and Development). 1999. *The Economic and Social Impact of Electronic Commerce: Preliminary Findings and Research Agenda*. Danvers, MA: Organization for Economic Co-operation and Development (From conference in Ottowa, CA, 1998).

Robinson, Alan. 1999. "The Circle is Broken." *Food Logistics* June 15: 43.

Roddy, D. 2000. "The Evolution of Digital Markets." *A Business White Paper*. Mimeo, Tradeum, Inc., January.

Shulman, Richard. 2000. "What B2B can Learn from Amazon." *Supermarket Business* June 15: 41-42.

Venturini, Luciano and Robert P. King. 2000. "Vertical Coordination and the Design Process for Supply Chains to Ensure Food Quality." (Forthcoming in proceedings) The Eighth Joint Conference on Food, Agriculture and the Environment cosponsored by The Center for International Food and Agricultural Policy, University of Minnesota, and Padova University and the University of Bologna, Italy, June, 12-14.

Wall Street Journal. 2002. "Émigrés Send Food Online to Old Country." November 6: B3.

Walsh, John P. 1993. *Supermarkets Transformed: Understanding Organizational and Technological Innovations*. New Jersey: Rutgers University Press.

Wise, R. and D. Morrison. 2000. "Beyond the Exchange: The Future of B2B." *Harvard Business Review* November-December: 86-98.