

Which e-Business Is RIGHT for Your Supply Chain?

By Sunil Chopra and Jan A. Van Mieghem

The short answer is that it depends ... on your industry, your corporate strategy, and your supply chain capabilities. The trick is to get all three in alignment. And then pursue the e-business opportunities that can be integrated into—and leveraged by—the aligned elements. The companies that do this successfully stand to capture the revenue enhancements promised by the Internet. Here's a simple framework to follow that can lead to success.

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The Internet is revolutionizing the way companies conduct business. Or is it?

A survey of companies with an online presence shows wide disparities in performance. Although Dell has used the Internet to boost revenues and earnings successfully, Amazon lost \$585 million on revenues of \$1.6 billion in 1999. We argue that the value of the Internet for a company strongly depends on the company's industry and on the strategy it pursues. The big winners will likely be those that fully exploit the revenue enhancements and cost-reduction opportunities offered by the Internet and optimally integrate e-business with existing channels. Toward this end, we propose a simple framework that managers can use to select the best e-business model to enhance their supply chain's performance.

Needed: A Strategic Framework

An Internet strategy must be considered within the context of the company's overall business plan. The framework starts from the premise that supply chain decisions must be evaluated in a strategic context based on the answers to the following three questions:

1. What is the firm's desired strategic position?
2. Given the firm's strategic position, what supply chain capabilities are needed to support the strategy?
3. Given the desired supply chain capabilities, how should the supply chain be structured?

The goal is to create a fit between the desired strategic position and the supply chain capabilities and processes used



Illustration by Eric Mueller

to satisfy customer needs and priorities.¹ A company defines its desired strategic position by first ranking its customers' top priorities and then articulating how it plans to respond to these needs. Typical customer needs include timeliness, accessibility, availability, customizability, quality of service, and price. At the same time, the company must consider the trade-off between how it would like to respond to customer needs and the supply chain costs incurred to meet those needs.

The *efficient frontier* represents the lowest cost of meeting a given level of customer need using the best available supply chain processes. Each point on the frontier corresponds to a particular supply chain structure, employing the best available technologies, managerial policies, and inputs to meet the desired level of a customer need at the lowest cost. As such, the efficient frontier constitutes the state of best practices at a given point in time.² It also shows the inherent

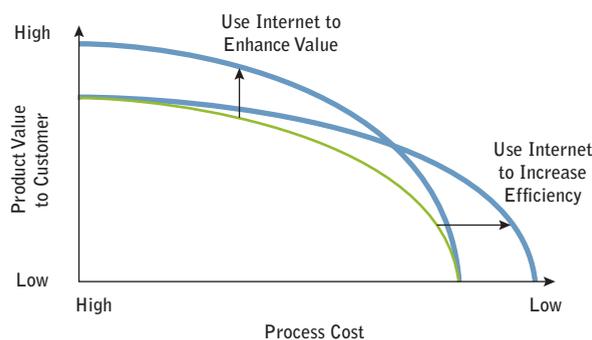
trade-offs that a company must consider when selecting its strategic position given limitations in *process* technology and policies.

With the Internet come new associated technologies and managerial policies that shift the frontier outward. (This shift is represented in Exhibit 1.) An outward shift represents either a decrease in cost for a given level of performance along a customer need or a higher level of performance at a given cost. The shift caused by adding the Internet will vary by industry. In some instances, the Internet may shift the

frontier by significantly decreasing the cost for existing levels of performance. In this case, the main advantage of e-business would be to increase efficiency by automating previous activities (i.e., substituting capital for labor). In other instances, such as the case of the online grocer Peapod, the Internet primarily enhances convenience without reducing costs significantly. (Later on we will argue that

EXHIBIT 1

Impact of Internet on the "Efficient Frontier"



costs actually may increase.) In that case, the main advantage of the e-business channel would be to offer higher value to a given customer need. Sometimes, e-business may shift the frontier out along both dimensions simultaneously. Dell Computers, for example, delivers both lower process cost and higher customer value through customization and responsiveness.

We are interested in characterizing the conditions under which e-business is most likely to *increase cost efficiency* or most likely to *enhance value* in terms of some nonprice factors like responsiveness, variety, or quality. Companies can use such a characterization to decide how they can best use e-business initiatives to support their strategic position.

Revenue and Cost Impacts of e-Business

The next step in the framework, then, is to characterize and understand how e-business would affect a company's revenues and costs using a simple scorecard. These impacts are discussed in detail below.

Revenue Impact of e-Business

e-Business affects revenues in seven key ways, which are explained below.

First, e-business allows companies to enhance revenues by *direct sales* to customers. Manufacturers and other supply chain members that do not have direct contact with customers in traditional retail channels can use the Internet to shrink the supply chain by bypassing retailers and selling direct to customers. For example, Dell Computers sells PCs online direct to customers.

An Internet strategy must be considered within the context of the organization's overall business plan.

As a result, Dell enjoys higher margins than do traditional PC manufacturers that must share some margin with retailers. Clearly, retailers are in a weaker position to exploit this e-business opportunity than are other members of the supply chain. For example, going online would benefit an airline more than a travel agent.

Making online product and other information accessible to all members of the supply chain allows *flexibility on price, product portfolio, and promotions*. The Internet makes information located at a central source (the seller's Web server) available to anyone with Internet access, so that a change in price, product portfolio, or promotions only requires one database entry. A traditional mail-order company would need to mail new catalogs to all customers to change prices or products. Using its e-business channel, however, L.L. Bean only needs to update the price on its Web site. This allows

dynamic "revenue management" where prices reflect actual demand and inventory positions, very much like airline yield management. For example, Dell uses the Internet to change prices and delivery times for different PC configurations regularly, based on demand and component availability.

Online product information allows a much *faster time to market* because a product can be "introduced" as soon as the first unit is available. Speed is particularly valuable to industries with short product life cycles, where e-business provides an advantage over a "physical" product information model. A new-product introduction in a traditional model requires a substantial volume of new product to be manufactured and transported to fill the physical channels.

Negotiating prices and contracts with customers and suppliers online allows *price and service customization*. By accommodating individual requests, the e-business may customize and price its product/service accordingly. Keeping customer profiles and having clients "log in" facilitates such price and service discrimination by allowing subsequent customer-specific routing. (By contrast, individualizing the purchasing experience is difficult in a physical store because the store layout cannot be changed for each customer.) After logging in at the Schwab Web site, for example, clients with a substantial investment portfolio have access to additional "signature services." Aside from such *service discrimination*, an e-business could *price discriminate* and alter prices based on the buying power of individual customers to enhance revenues. Auction sites like eBay and exchanges like Commerce One allow people to bid for goods and services, with different people potentially paying different prices. Other e-businesses offer customers a menu of services at various prices, allowing

them to select the desired level of service. For example, Amazon.com provides a customer ordering multiple books with shipping times for each book. Some titles may be available for next-day shipping, while others involve a week's leadtime.

Customers can choose to receive one order after a week at a lower price or separate shipments in order of availability at a higher price.

Global access at any time from any place in terms of order placement allows an e-business to enhance revenues by attracting customers who may not be able to place orders during regular business hours. For example, customers can place orders at industrial supplier Grainger.com even at times when the Grainger stores where they will pick up their orders are closed. Grainger has observed a surge in online orders after store closing times. (Similar access convenience may be important in Europe, where many supermarkets are closed in the evenings, exactly the time when many customers who work could place their orders.) e-Business also allows a small specialty store with one location near Chicago, for instance, to reach customers worldwide.

The Internet also enhances revenues by offering *informa-*



tion aggregation and a wider product portfolio from many sources. For example, Yahoo! Shopping provides product information from a large number of retailers. This information aggregation enhances revenues because it attracts customers who know they are likely to find the product they are seeking. Physical retail store chains could similarly aggregate product availability information from all their stores on the Internet and direct interested customers to the appropriate location. In contrast to direct sales and “eliminating the middle man,” it has become popular to create hubs or portals to link customers to other companies and their products. These hubs and portals improve shopping and fulfillment through a one-stop method with the hosting firm receiving revenues through commission fees and advertising. For example, Amazon announced that it earned \$606.5 million from renting some of its Web site to other e-tailers.

Finally, e-business can enhance revenues by speeding up collection of funds. An example comes from John McCain’s 2000 presidential campaign. Within 48 hours of his primary victory in New Hampshire, McCain’s campaign collected \$1 million over his Web site. Receiving and processing \$1 million in checks would have taken considerably more time and effort than the online collection did.

Cost Impact of e-Business

Companies also must understand the effects of implementing an e-business plan on cost. In our book, *Supply Chain Management: Strategy, Planning, and Operation*, we argue that companies can better understand the impact of e-business on supply chain costs by considering four key drivers of supply chain performance—facilities, inventory, transportation, and information.

Facility costs (including both site and processing costs). e-Businesses can centralize facilities because online sales allow the separation of order placement and order fulfillment. Site costs may decrease as direct customer-manufacturer contact and geographical centralization eliminate or reduce retail sites. For example, Amazon supplies its customers from a few warehouses, while Borders and Barnes & Noble must incur facility costs for all their retail stores. In addition, bookstores have a higher space cost per square foot and lower asset utilization than warehouses do.

An e-business can decrease processing costs if it can increase the level of customer participation. For example, customers purchasing online from L.L. Bean do all the work of selecting the product, placing an order, and paying. This is in contrast to a call center where an employee is involved in the order process. In some instances, however, e-businesses

may face higher processing costs because they have to perform tasks now done by the customer at a retail store. By separating fulfillment from order placement, an e-business can smooth the order-fulfillment rate. This reduces the peak load for order fulfillment and, thus, resource requirements and costs. Finally, a direct-sales manufacturer can reduce handling costs because fewer supply chain stages are involved in the product flow to the customer.

Inventory costs. Many e-businesses can centralize inventories because they do not have to carry inventory close to the customer. This geographical centralization reduces required inventory levels because of increased economies of scale in the supply end and reduced aggregated variability in demand. In some instances, given the time lag between when an online order is placed and filled, e-businesses can

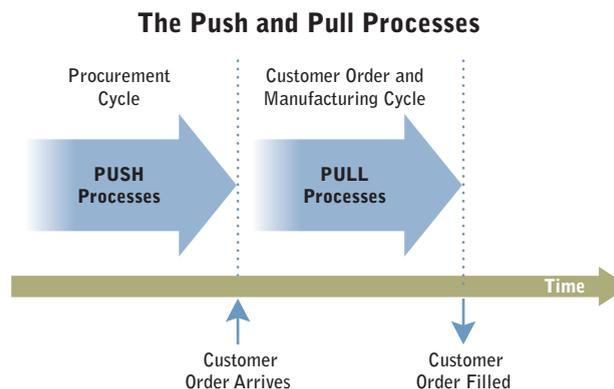
reduce inventories by postponing product differentiation until after the customer order has been placed. Postponing assembly or product differentiation allows a company to “assemble to order” customized products from common components. Conceptually, postponement decreases the supply processes that are operated in “push” mode (i.e., in anticipation of a customer order, as shown in Exhibit 2), while increasing the processes that

operate in “pull” mode (i.e., after a particular customer order arrives). By separating ordering from fulfillment, e-business increases flexibility in operations and allows the company to implement postponement.

Transportation costs. Inbound and outbound transportation costs need to be differentiated: A company incurs inbound costs to bring a replenishment order in from a supplier; it incurs outbound costs to deliver the product to the customer. Typically, replenishment orders enjoy lower unit transportation costs than customer orders because of economies of scale. Physical centralization increases the distance traveled by a customer order while decreasing the distance traveled by a replenishment order. Thus, compared with a business with several physical outlets, an e-business will tend to have higher transportation costs per unit. Obviously, transportation costs are eliminated for downloadable information goods.

Information-processing costs. An e-business can easily share demand and other information (such as inventory positions) across the supply chain to dampen the bullwhip effect and improve coordination. Sharing planning and forecasting information further improves supply chain coordination and reduces overall supply chain costs while better matching demand with supply. Information-processing costs also tend to be lower for an e-business if it has successfully integrated systems across the supply chain.

EXHIBIT 2



A Scorecard for e-Business Evaluation

The different revenue and cost factors influenced by e-business are summarized in a scorecard, as shown in Exhibit 3. Evaluating the various factors gives insight into how e-business affects a particular supply chain and whether this value can most easily be captured by existing players or by new entrants. For example, if opportunities mostly accrue on the revenue side of the scorecard, the e-channel may be best positioned as a value enhancement of the product offering. If, on the other hand, the e-channel mostly improves cost, a focus on efficiency may be more appropriate.

At the risk of oversimplifying, the scorecard does suggest some key conditions that will allow the supply chain to exploit the maximum benefit of going online. These conditions include:

- The supply chain is able to exploit all potential revenue-enhancing opportunities of e-business.
- Centralization reduces facility costs significantly.
- Going online reduces processing costs.
- Centralization yields significant inventory benefits. This is most likely if there are considerable economies of scale or if the goods are new products or low-volume, high-variety products, which have high demand uncertainty and benefit most from statistical aggregation.
- Supply chain processes can be realigned to increase the pull processes and respond more closely to actual demand, rather than rely on forecasts.
- The supply chain can postpone product differentiation.
- Outbound transportation to the customer is a small fraction of total product cost.

Notice that downloadable information goods satisfy all these conditions: Facility costs are minimal as physical storage and personnel (handling and management) requirements are minimal. Inventory requirements vanish as one copy of the file on the server is sufficient. With a sufficient, nondepletable inventory position of one, pull and postponement have no incremental value and thus become irrelevant. Finally, outbound transportation costs are minimal over the Internet. For example, it is much faster and less costly to let customers download a mutual fund prospectus than to mail or fax it. In addition, downloadable products also can exploit all the revenue opportunities.

EXHIBIT 3

e-Business - Supply Chain Scorecard

Revenue Opportunities

- Direct sales:
 - Increased margin from eliminating intermediaries
- Product information:
 - Flexibility on price and promotions
 - Wider product portfolio offering
- Time to market:
 - Faster time to market
- Negotiating prices and contract terms:
 - Price and service customization
 - Downward price pressure due to increased competition
- Order placement and tracking:
 - Access at any time from any place
- Fulfillment:
 - Increased availability by aggregating information
 - Shorter response time
 - Increased choice of delivery options
- Payment:
 - Efficient funds transfer may improve cash flow

Cost Opportunities

- Facility costs:
 - Site costs: eliminate intermediaries or retail and distribution sites
 - Processing costs: customer participation, smoothed capacity requirements
- Inventory costs:
 - Reduced cycle stock (geographic centralization)
 - Reduced safety stock (statistical aggregation)
 - Postponing product differentiation to after order placement
- Transportation costs:
 - Inbound
 - Outbound
- Information sharing improves supply chain coordination:
 - Reduced bullwhip effect
 - Shared planning and forecasting

Thus, downloadable information goods are the perfect fit for the e-business channel. For them, the Internet moves the frontier out along both dimensions, simultaneously increasing efficiency and value. This, however, is the exception to the "rule." For nondownloadable products, most supply chains should make a clear choice on the positioning of the e-channel—either as increasing value or as increasing efficiency. We illustrate this with four examples: two of which are supply chains catering to the consumer (business-to-consumer, or B2C), while the other two are business-to-business (B2B) supply chains. In only two of these examples, Dell and W.W. Grainger, was the supply chain able to increase both value and efficiency. We will provide the actual scorecard for the first two examples.

B2C in the Computer Industry: Dell Computer Online

Dell Computer is one company that has succeeded in using the Internet to increase both value and efficiency. The success story of how Michael Dell started selling computers directly to the consumer in 1984 has become a classic introduction to the "direct business model," as it is called. Recently, the Internet has become a logical extension of Dell's direct model. This becomes apparent by analyzing the scorecard for e-business in Dell's supply chain, as summarized in Exhibit 4.

On the revenue side, the e-business channel continues Dell's direct sales model with increased margins compared with a traditional computer manufacturer with resellers. The company's ability to change prices and delivery times on the fly has been leveraged effectively to manage demand based on component availability. The faster time to market for new-product introductions is a considerable benefit when product

With the Internet come **new associated technologies** and managerial policies that **shift the “efficient frontier” outward.**

life cycles are measured in months. Having direct customer contact allows Dell to provide customization and a wide selection on its customer-specific “Premier” Web pages. It enables customer-dependent service, such as pre-installed software images and priority routing, with customer-negotiated pricing. Furthermore, through continuously updated “recommended configurations,” Dell can steer customers toward products that are in ample supply. Similarly, by sharing dynamic inventory information with suppliers, Dell can work both on the input and output ends of the supply chain to match demand with supply.

Customers, for their part, have the convenience of ordering anytime and anywhere, while Dell may track all corporatewide purchases. As such, Dell becomes a virtual IT department in addition to just being a corporation’s PC vendor.

Finally, by tracking and managing cash flow very tightly and maintaining low inventories, Dell gains a negative cash-conversion cycle of a few weeks; the company gets paid before it pays its supplier, exploiting direct payment with postponed delivery. Increased response time is perhaps the only negative-revenue risk compared with traditional bricks-and-mortar retailers.

On the cost side, the direct model eliminates intermediaries. In addition, long-term relationships with high-reliability suppliers, such as Sony, allow Dell to ship monitors directly

from the supplier to the customer. This eliminates warehousing costs and the delays associated with additional inventories. Not only are warehousing costs decreased,

ordering personnel costs are transferred to the customer!

The greatest inventory cost benefits accrue from a fast, well-coordinated supply chain that enables the separation of the procurement cycle from the customer order and manufacturing cycle. Although procurement is initiated in anticipation of demand, manufacturing and fulfillment begin only when an order arrives. Dell makes this postponement possible by adopting common platforms and components for various products. While finished-goods inventory is eliminated (or already paid for), Dell greatly reduces the input inventory by exploiting economies of scale and statistical aggregation over the common components.

Similarly, high volumes of a relatively limited set of common inputs may reduce inbound transportation costs or even eliminate them if the supplier is co-located. Perhaps the only negative cost impact of the e-channel is the increased outbound transportation costs to customers. Those costs, however, are relatively small when dealing with higher-end computers and on high-volume corporate accounts.

In short, the e-business opportunities are significant in the computer industry. To exploit them well, the supply chain must move product customization to the pull phase and hold inventories as common components during the push phase. The opportunities are most significant for new, hard-to-forecast products, where aggregation offers the greatest

benefit in terms of inventory reduction. Nevertheless, self-reliant ordering assumes a somewhat experienced customer who requires less handholding. As such, the e-channel may complement the strength of existing retail channels with a focus on service and educating consumers to choose low-cost computers.

B2C in the Grocery Industry: Peapod.com

The scorecard approach can also be used to evaluate the opportunities for online grocers.

Peapod.com is one of the oldest online grocers. The company started in Chicago in a collaborative arrangement

EXHIBIT 4

Scorecard for e-Business in Dell Supply Chain

Revenue Opportunities

Direct sales:
 \$\$ Increased margin from eliminating intermediaries
 Product information:
 \$\$ Flexibility on price and promotions
 \$\$ Wider product portfolio offering
 Time to market:
 \$\$ Faster time to market
 Negotiating prices and contract terms:
 \$ Price and service customization
 -\$ Downward price pressure due to increased competition
 Order placement and tracking:
 \$\$ Access at any time from any place
 Fulfillment:
 0 Increased availability by aggregating information
 -\$ Shorter response time
 0 Increased choice of delivery options
 Payment:
 \$ Efficient funds transfer may improve cash flow

Cost Opportunities

Facility costs:
 \$\$ Site costs: eliminate intermediaries or retail and distribution warehouses
 \$\$ Processing costs: customer participation, smoothed capacity requirements
 Inventory costs:
 \$ Reduced cycle stock (geographic centralization)
 \$\$ Reduced safety stock (statistical aggregation)
 \$\$ Postponing product differentiation to after order placement
 Transportation costs:
 0 Inbound
 -\$ Outbound
 Information sharing improves supply chain coordination:
 \$ Reduced bullwhip effect
 \$ Shared planning and forecasting

Impact: Very Negative -\$ -\$ 0 \$ \$\$ Very Positive

EXHIBIT 5

Scorecard for e-Business in Peapod.com Supply Chain

Revenue Opportunities

- Direct sales:
 - 0 Increased margin from eliminating intermediaries
- Product information:
 - \$ Flexibility on price and promotions
 - \$ Wider product portfolio offering
- Time to market:
 - 0 Faster time to market
- Negotiating prices and contract terms:
 - \$ Price and service discrimination
 - \$ Downward price pressure due to increased competition
- Order placement and tracking:
 - \$\$ Anytime and anywhere
- Fulfillment:
 - 0 Increased availability by aggregating information
 - \$ Shorter response time
 - 0 Increased choice of delivery options
- Payment:
 - 0 Efficient funds transfer may improve cash flow

Cost Opportunities

- Facility costs:
 - \$ Site costs: eliminate intermediaries or retail and distribution warehouses
 - \$ Processing costs: customer participation, smoothed capacity requirements
- Inventory costs:
 - 0 Reduced cycle stock (geographic centralization)
 - 0 Reduced safety stock (statistical aggregation)
 - 0 Postponing product differentiation to after order placement
- Transportation costs:
 - 0 Inbound
 - \$ Outbound
- Information sharing improves supply chain coordination:
 - 0 Reduced bullwhip effect
 - 0 Shared planning and forecasting



with the supermarket chain Jewel where Peapod's pickers would fill an order before delivering it. Peapod now has moved to supplying orders from centralized fulfillment centers in areas that the company serves. Each fulfillment center is much larger than a supermarket and is comparable to a warehouse.

An online grocer such as Peapod can offer several services of value to the consumer. Online grocers allow order placement anytime and from anywhere. They can attract customers who do not like to go to a supermarket (who does?). They have flexibility on pricing and promotions. They could provide a large variety of goods, including specialty items such as ethnic foods—although Peapod does not offer significantly more variety than a typical supermarket does. In addition, they can bundle menus and recommended ingredients with specialty items, based on tracked online shopping behavior and histories. A supermarket store has no knowledge of what has been purchased until a customer checks out or of the substitution patterns for goods that were stocked out. Peapod, however, can guide online shopping behavior with real-time suggestions. Peapod can use its data for targeted interactive advertising and discounts. This revenue boost is significant because most e-grocers, at this stage, have lost money in the actual sale of groceries but have made money on the sale of consumer choice data to suppliers.

On the cost side, however, e-grocers have several disadvantages compared with their bricks-and-mortar counterparts. Although the virtual store reduces facility costs by eliminating retail sites and checkout clerks, it incurs processing costs for activities such as picking, packing, and handling. In a traditional supermarket, customers do their own pick and pack, while handling is done in high-volume pallets instead of "eaches." The inventory savings resulting from centralization also prove marginal because supermarkets already achieve sufficient forecast accuracy from their large size. Inventory benefits from aggregation are higher, however, for e-grocers such as EthnicGrocer.com that focus primarily on slower-moving specialty items.

Online grocers also have significantly higher transportation costs than traditional supermarkets do because of home delivery. They require a specialized delivery fleet whose cost

will be a high fraction of product value. The nature of home delivery precludes centralization on a large national or even regional scale. Indeed, most e-grocers have warehouses in each metropolitan area that they serve. In addition, depositing the groceries at the customer's home is much less flexible than putting a book in the mailbox. With fresh goods, consumers need to be home to receive the delivery, which creates significant peaks in requested delivery times in the early morning and after 5 p.m. Finally, while delivery density in cities may be sufficiently high, achieving an acceptable number of delivery stops per hour in a spread-out suburban area will be difficult. (Many e-grocers strive for gaining market share to improve delivery density and may extend into general home delivery of other goods. Yet it is questionable whether such a strategy can ever compete with parcel companies, like UPS or FedEx, that not only deliver but also pick up, which results in double efficiencies.)

This scorecard analysis, summarized in Exhibit 5, suggests that e-grocers have negligible opportunity to compete on cost in general grocery items, especially fresh food. Indeed, the e-grocery model possesses none of the earlier-listed key conditions for capitalizing on the cost benefits of the Internet. e-Grocers, therefore, must compete on convenience or some other form of value added. For example, opportunities do exist for specialty or ethnic segments. Also, convenience can be added by automating the purchasing activities that most households perform each week. Once a weekly basket is set up on the Web, repetitive ordering is greatly accelerated. In addition, the supply chain may exploit recurrent patterns by smoothing and leveling the load and delivery process—provided a solution is found so that the customer's presence is

not needed for delivery. (Peapod competitor Streamline.com, for example, allows unattended delivery by installing refrigerated storage boxes with keypad access systems at its customers' homes.)

The greatest e-channel opportunity, however, may be for incumbent supermarket chains, which already own their own regional distribution centers. They can set up the additional e-channel as a focused "plant within a plant" to expand their value offering. In addition to picking their orders themselves in the stores, customers could choose to have supermarket personnel pick for them with the customer providing the outbound transport. Alternatively, the supermarket could provide home delivery at the highest price. Among supermarket chains, Albertson's has taken the lead in combining e-business with traditional stores. Part of the store is a fulfillment center for online orders, while the other part is a supermarket. This provides the company with economies of scale on inbound transport while keeping delivery distances to customers short on outbound. Our analysis would suggest that such a dual-pronged approach is the most effective positioning of e-business in mass-market groceries where pure online grocers are likely to be less effective.

B2B in the Parts-Supply Industry: W.W. Grainger

W.W. Grainger is an example of a company that can seize both revenue and cost-saving opportunities by going online. W.W. Grainger is a business-to-business distributor of maintenance, repair, and operating (MRO) supplies ranging from consumables, like machine lubricants, to hardware items, like nuts and bolts for repairs. Grainger is famous for its four-inch thick catalogs with thousands of parts that customers can order over the phone or buy at one of its 380 U.S. branches, which are similar to large retail stores. In 1995, the company set up Grainger.com, allowing customers to place orders on its Web site, which offers more than 200,000 products.

Going online provides considerable revenue opportunities: 24-hour access for order placement with a very large selection available through an easy electronic search. Product information is updated easily, allowing price and promotion flexibility. New products can be added to the "virtual catalog" immediately, improving time to market drastically. Allowing industrial customers to place an order anytime is a considerable convenience for people on night shifts. They no longer have to notify day purchasing to place orders but instead can do it immediately, reducing response time. Grainger can estimate not only delivery times for each order using up-to-date inventory status but also can alert the customer automatically (through e-mail) regarding order status. A downside of online ordering is increased ease of comparison shopping, which is expected to drive down prices and margins. Yet Grainger realized that it was better to cannibalize its own bricks-and-mortar channel than to let others do it.

Considerable cost opportunities also exist compared with the phone or mail-order channel. Order-taking costs decrease as the customer participates. More importantly, errors are greatly reduced as duplication of data entry is eliminated. Catalog-printing costs also decline significantly. By integrating the suppliers, Grainger can improve synchronization over the entire supply chain as customer orders automatically trigger supply orders when inventories need replenishment. Inventory and transportation costs, however, are affected marginally, as the fulfillment system remains largely unchanged. Likewise, inventory and facility costs at Grainger will not change significantly by going online unless the company decides to close some of its branches.

The sale of MRO supplies is an example where the Internet is ideally suited to eliminating the weaknesses of the current system. The basic supply chain remains unchanged but going online allows both buyers and sellers to decrease the transaction cost of placing and fulfilling orders and to increase the product portfolio. The use of the Internet to replace existing channels of order placement is likely to grow at a significant pace in the B2B arena.

B2B Auctions in Procurement: Internet Exchanges

Companies also can use the scorecard technique as they decide whether and how to use an Internet exchange.

Internet exchanges create electronic markets and communities where businesses can obtain information and buy and sell products. Exchanges bring together many buyers and many sellers from an industry. The technology can be used to facilitate online buying transactions and hold auctions for B2B commerce.

Companies need to fully understand how e-business would affect their revenues and costs.

On the one hand, exchanges can enhance the revenue opportunities for sellers by enlarging the set of buyers. On the other hand, buyers can seize upon cost-saving opportunities by being able to search across multiple suppliers when looking to procure an item. By substantially lowering barriers to entry in the bidding process, Internet auctions drive down supply prices. This may seem to imply that buyers should use exchanges to conduct auctions where suppliers compete against each other.

There are, however, considerable downsides to this approach if it is implemented indiscriminately because other supply chain costs are ignored. Purchase of all products using auctions may lower the purchase price but will tend to increase the total cost of purchase for a company. The ability



to reduce supply chain costs requires long-term relationships within the supply chain. Indeed, the movement toward lean operations, as exemplified by Dell, depends heavily on a few suppliers who become "long-term partners." In the auto industry, the last two decades of the 20th century focused on improving supply chain relationships so that suppliers and auto manufacturers could work closely to improve the way products were designed, manufactured, and delivered. Chrysler significantly improved its performance by getting suppliers involved in the new-product design phase. This level of supplier involvement is only possible given a long-term relationship between suppliers and manufacturers.

Thus, core products that a buyer requires in significant and steady quantities should not be handled through an auction hosted by an intermediary. In this case, Internet exchanges should be used to reduce the transaction costs of order placement and fulfillment and improve information exchange for collaborative planning across the supply chain. A good example of this approach is Dell and its use of e-business when dealing with suppliers. Dell does not use the Internet to create a marketplace where suppliers compete against each other for Dell's orders. Rather, the computer maker uses the Internet to exchange demand, production, and inventory information with its suppliers. This allows suppliers to set appropriate production levels and help the Dell supply chain better match supply and demand.

When it comes to utilizing excess or surplus capacity (i.e., any capacity left after utilizing base capacity), the story is very different and online auctioning may provide significant opportunities. Exchanges provide the ability to aggregate and display all available surplus capacity across an entire industry. As such, a market is created to better match *surplus* capacity with unmet demand. For example, a manufacturer in need of unforeseen additional transportation may place an emergency shipment out to bid if its regular motor carrier has no trucks available. By matching uncertain components in demand to aggregated surplus capacity (supply), online auction markets may improve the overall match of demand with supply obtained from long-term contracting. Our analysis would suggest a two-pronged purchasing strategy: For stable, recurrent demands, the Internet focus should be on reducing transaction costs and improving supply chain performance, while online auctions may be used to satisfy uncertain demand where the value of aggregation is the greatest.

Incentive problems and credibility issues suggest that the auction market is best provided through a neutral intermediary. The key issue may be to account for the *total* cost in the auction, including product, transportation, and other relevant costs. For example, if a seller is offering a stamping press currently in Northern Italy, an offer from that region is more attractive than an identical offer from Belgium if the seller

incurs the transportation cost. Although incorporating such nonprice factors may be automated for commodity products, it is much harder for customized items.

Guidelines Going Forward

As the examples show, the scorecard provides a tool to analyze the impact of the e-channel on a supply chain and how that e-channel is best positioned. It also points to areas for potential concern, which must be considered when setting up an e-business.

From a supply chain operations perspective, the following guidelines may help the e-business in practice:

- Think about integrating the Internet with the existing supply chain network rather than setting up a separate e-business. Integration will leverage and improve current processes, while separate channels may add inefficiencies to the supply chain.
- Structure e-business logistics to accommodate packages instead of pallets. The goal should

The Internet enhances revenues by offering information aggregation and a wider product portfolio from many sources.

be to mitigate the loss of economies of scale due to increased volume in smaller sizes. This suggests new logistics opportunities such as order consolidation (merge in transit, mega distributors) and order pickup sites.

- Devise shipping pricing strategies that reflect the costs of activities. Disregarding or underestimating transportation costs has contributed to the losses incurred by e-grocers to date.
- Design the supply chain to handle returns efficiently. Because the Internet cannot match the traditional customer experience of feeling, testing, and even smelling the product before buying it, returns in an e-business will always exceed those of traditional stores.
- Keep customers informed throughout the fulfillment and returns cycle.

Footnotes

¹ M.E. Porter, "What Is Strategy?" *Harvard Business Review*, November-December 1996.

² Porter, 1996.

