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Business-to-Business Electronic Commerce

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To improve efficiency, some large retailers, suppliers, and distributors have begun to conduct business-to-business commerce electronically. This practice could grow rapidly if the Internet becomes the primary low-cost network for such transactions. Before the Internet can fully support business-to-business commerce, however, companies must overcome several technological and security obstacles.

In recent years, a number of companies have reported gains in operating efficiency through the use of business-to-business electronic commerce, or the movement of information electronically between businesses over computer networks.¹ This success could have important implications for U.S. industry. By extending the benefits of computers to the exchange of information between suppliers, manufacturers, and retailers, business-to-business electronic commerce may give companies the added advantage that they need to achieve measurable productivity gains.²

The idea of using computers in commerce is not new—many business processes have been automated over the past decade. Until recently, however, most companies have used the computer primarily as a tool for storing and analyzing proprietary data related to internal operations or to customers. Today, several advances in computer network technology are helping companies to extend the use of computers to the procurement, production, and distribution processes. Through the electronic exchange of information with suppliers, distributors, and retailers, companies can better direct the production, inventory, and distribution of goods and more promptly alter prices and production strategies.

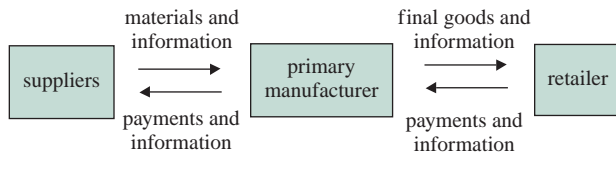
This edition of *Current Issues* looks at how business-to-business electronic commerce can help companies more efficiently manage the various steps involved in bringing goods to the market. In addition, we examine some of the obstacles that have hindered the widespread use of electronic commerce between businesses. Finally, we consider how the computerization of information exchange between companies might affect business-to-business relationships and industry overall.

The Logistics of the Supply Chain

To understand the potential benefits of business-to-business electronic commerce, we need to look at the supply chain, or the flow of intermediate goods and services from one business to another. The movement of these goods and services on a timely basis is critical for effective inventory management, accurate production scheduling, and the successful delivery of goods to the retail market.³

Figure 1 gives a simple example of a supply chain. The figure is meant to illustrate the basic exchange of goods and information between suppliers, manufacturers, and retailers. The flow of information depicted in the figure is broadly representative of the functioning of a supply chain; in practice, however, most supply chains

Figure 1
Simple Example of the Supply Chain



are much more complicated. Companies that sell inputs to large manufacturers, for example, typically must rely on their own suppliers for parts. And manufacturers themselves often produce both intermediate and final goods. On the retail side, companies are likely to purchase finished products from more than one manufacturer and to sell products at a number of outlets. These complicated relationships create supply chains that overlap and go many layers deep.⁴

A key factor in successfully moving products through the supply chain is information management. Consider a brief overview of the steps involved in the process: First, companies must forecast final demand for their products. Using these projections, companies then plan production schedules and alert suppliers about incoming orders. Suppliers, in turn, plan and schedule production runs and arrange for the delivery of intermediate goods. Once production is completed, companies must manage the shipping process and the tracking of the finished product through the distribution network. Finally, companies need to monitor final sales relative to the initial forecast to avoid the unintended accumulation of inventories or shortages of products at the retail level.

At each stage in the process, tremendous amounts of data must be coordinated, updated, and ultimately communicated to the appropriate parties. Paper-based systems for managing this flow of information are relatively slow, prone to error, and difficult to update. In addition, a large and complex supply chain creates a huge number of documents, including catalogues, specification documents, order forms, shipping notifications, invoices and billing, remittance and payment information, and inventory management records. This extensive paper trail must be kept up to date and can entail a considerable expense, prompting many companies to seek a more efficient alternative for exchanging information between members of the supply chain.

Electronically Managing the Supply Chain

Some larger companies have successfully computerized their supply chain using private networks that specialize in electronic data interchange (EDI).⁵ These EDI networks allow vendors and buyers to exchange infor-

mation using centralized electronic mailboxes. The network operator typically establishes the technical standards—or common language and document format—that will be used by participants. The operator also maintains the network's messaging services, the telecommunication links, and the appropriate security tools.⁶ Some networks also process information on a point-to-point basis rather than using a central facility to store messages. This type of EDI network is less common, however, because it requires the receiver's computer to be in a ready-to-receive mode whenever the sender's computer releases information.

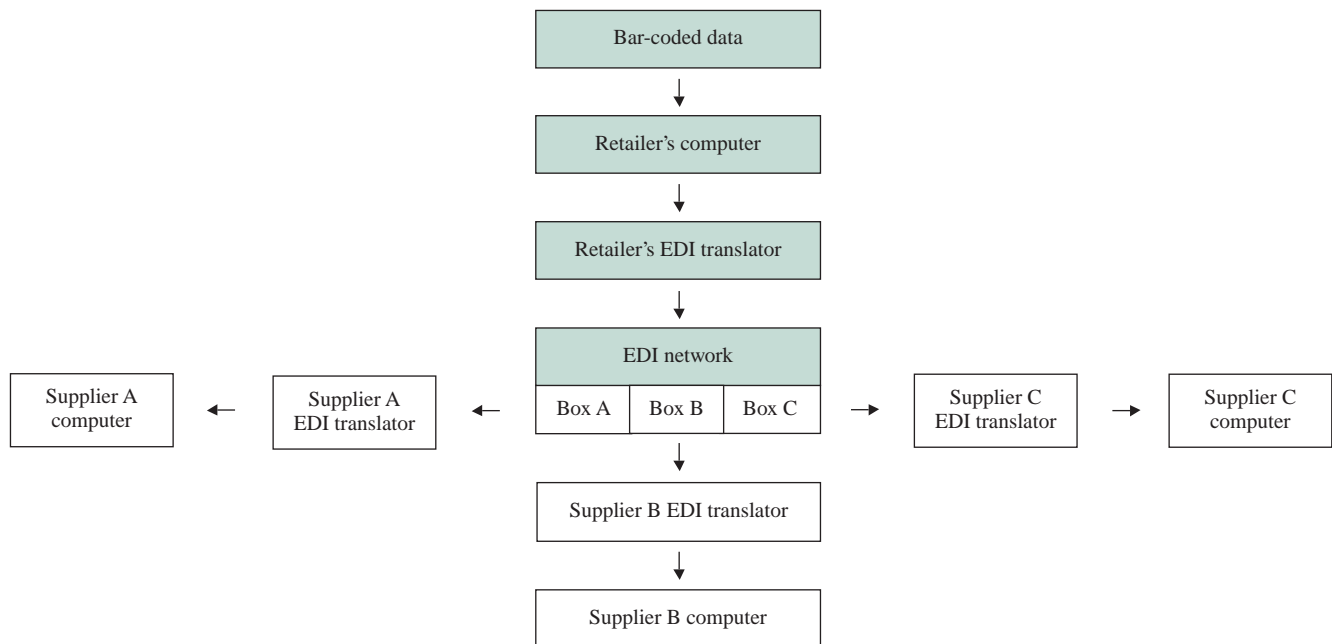
Figure 2 gives an example of an EDI network in which a retailer and three suppliers share sales information. The primary benefit of an EDI network is that members can send information to other participants using one network connection. Without the network, each participant would have to communicate with the other suppliers through separate connections. Other key advantages of the exchange of information over electronic networks are:

- *Compatibility of computer languages.* To participate in an EDI network, each member must maintain an EDI translator to convert information to and from its computer language into the common EDI language. Thus, although participants might use different computer languages internally, they can communicate easily within the context of the network.
- *Reduction in security risks.* Rather than give a member direct access to another member's computer files, an EDI network establishes a central facility where data are stored for subsequent retrieval. Sharing information at a third-party site reduces the risk of security breaches and data corruption.

An integral part of the EDI system is the use of bar-coding technology. Bar coding refers to the universal code now attached to most goods, final and intermediate, that identifies the particular product and its manufacturer. This scannable code allows a manufacturer to track its goods electronically as they move through the distribution chain—from the supplier's warehouse to the primary manufacturer and finally to the retailer.

The main advantage of the electronic exchange of information between individual companies that are linked along the supply chain is improved speed and accuracy, which can lead to greater efficiency. By communicating quickly and accurately at all stages, companies can better manage inventories, keep close track of goods in transit, and provide superior customer service. In addition, the high cost of moving information from computers to paper and then back to computers is eliminated.

Figure 2
Operation of an EDI Network



Obstacles to the Spread of Business-to-Business Electronic Commerce

Despite the obvious advantages of business-to-business electronic commerce, many factors have limited its use. One important obstacle is the high technological demands companies face in transferring data to electronic networks from computers designed primarily for storing data. Even for companies that possess such expertise, the conversion to a fully electronic system is considered relatively expensive unless large volumes of transactions can be processed to offset the high initial fixed costs.

Because of cost considerations and technical barriers, smaller businesses have not used EDI networks extensively. Many larger businesses have also experienced difficulty in moving toward a totally electronic environment because parts of their operations continue to rely on specialized computer environments and software.⁷ Even in instances when a company does use an EDI network, problems can arise because the company's vendors may not be linked to the same network as the company itself. Some EDI operators have attempted to link their networks so that electronic transactions can take place even when the sender and the receiver are on different networks. This arrangement, however, creates another problem—it is not always clear who is responsible for the fees as data flow across networks. The outcome of fee negotiations among EDI networks could depend on the bargaining power associated with the relative size of the various networks competing for customers.⁸

In the long term, the effectiveness of business-to-business electronic commerce depends on how extensively electronic services are used. For individual companies, the benefits of computerizing the data exchanges along the supply chain will fully emerge only when the majority of retailers and suppliers begin accepting electronic transmittals from external sources. Until then, most companies will continue to maintain parts of their paper-based systems. With the use of the Internet exploding, however, the ability of companies to conduct business electronically could grow significantly in the years ahead.

The Internet and Business-to-Business Electronic Commerce

Several technology companies have already developed software that makes business-to-business electronic commerce viable over the Internet. These Internet-based systems are often called "EDI lite" because many of them do not contain all the features of conventional EDI networks.⁹ Despite their limitations, however, these systems may eliminate—or significantly reduce—the costs that companies face when using privately owned electronic networks, making it easier for smaller companies to afford EDI.

At the most basic level, a large manufacturer can facilitate the electronic exchange of information with suppliers by creating an interactive web site on which production plans, component specification requirements, and the timing of likely outgoing orders for parts are made available to suppliers. Suppliers can then

bid on the jobs using standardized forms available at the web site. For smaller vendors, this arrangement makes bidding on jobs fairly inexpensive; the vendor need only invest in an Internet connection and browser. For large manufacturers, the web site is beneficial because it can create an “electronic auction market,” ensuring that the company receives a wide range of competitive quotes from vendors. This approach, however, only automates one piece of the procurement and distribution process.

To manage all aspects of information exchange over the Internet, the companies in a supply chain would need to adopt a common technology. Any number of computer developers could provide such technology; these developers would set the common standards and language, provide EDI translators to participants, and maintain the electronic mailbox facilities. Before Internet-based EDI can spread, however, companies will need to overcome a number of obstacles.

Support of Multiple Technologies

Although the Internet would provide a common network for business-to-business electronic commerce, some competing EDI developers are building incompatible technologies. Unless a dominant provider emerges or companies establish common standards, suppliers and retailers will need to support several Internet-based EDI systems. Thus, the incompatibility of EDI products developed for the Internet may continue to pose challenges for companies.

Security Maintenance and Coordination

Because the Internet is an open network, electronic messages flowing over it are not as secure from interception and tampering as are messages transmitted within a proprietary EDI network. Members of Internet-based supply chains will need to evaluate their security needs and employ encryption technology and other electronic security tools to protect confidential data. Such security devices would most likely be provided by the technology companies that ultimately offer Internet-based EDI services. Efforts to protect proprietary information as it moves across competing technologies, however, would need to be coordinated by a reliable third party. For example, banks could extend their services to their account holders by offering identity certification for business-to-business electronic transactions.¹⁰

Operational Responsibility

The responsibility for the successful management of a private EDI network clearly falls to the network operator. By contrast, in an Internet-based system, responsibility for serious problems such as lost or late messages may not be easily traced to a particular source—the Internet service provider, the supplier of the browser, or the company providing the EDI technology. This difficulty in assigning clear responsibility when problems occur

in an Internet-based system may make some potential participants reluctant to join.¹¹

If these problems can be overcome, large volumes of business-to-business electronic messages could be processed over the Internet at very low cost. Moreover, EDI could be made available to businesses of all sizes.

The Effects on Industry and Business-to-Business Relationships

If the Internet leads to the spread of business-to-business electronic commerce, companies should realize cost savings at many points in the manufacturing and distribution process. For example, in the ordering process, cycles that took weeks in paper-based systems can be reduced to just a few days. This short turnaround time has the potential to improve the efficiency of the purchasing and procurement process.¹² In addition, companies would no longer need to hold precautionary inventories because the delivery of parts would be swifter and more predictable.

Cost savings might also be realized at the production facility itself. If intermediate goods are delivered on a more timely basis, interruptions in production resulting from parts shortages would disappear. The electronic tracking of goods in storage and shipment would enable suppliers to divert intermediate goods already in the pipeline to locations where supply is more critical. Bar-coding technology, which identifies the product and the manufacturer, can help companies identify the source of defective parts and improve quality control. Some companies produce intermediate products themselves

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to ensure that parts are available and to reduce the complexity of their supply chains. Because business-to-business electronic commerce makes managing the flow of information easier and more efficient, some of these companies might choose to outsource production and save on operating costs.¹³ Ultimately, by speeding up the flow of information among suppliers, manufacturers, and retailers and by increasing the efficiency of supply-chain management, electronic data interchange could help companies produce goods more efficiently.

Business-to-business electronic commerce could also change the relationships among different groups of companies in the supply chain.

Supplier-Manufacturer Relationships

Some large firms have initiated vendor-managed inventories, a process that makes vendors responsible for monitoring the manufacturer's need for intermediate goods. Through Internet-based EDI, the purchasing firm supplies vendors with information on how rapidly an intermediate product is being used relative to the company's projections. The vendors are expected to use that information to plan production and make deliveries. The vendor can also calculate expected incoming payments based on

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the electronic information available on inventory depletion and deliveries. Electronic payments are issued automatically by the company at the end of the month on the basis of this common information source. This approach eliminates several steps from the inventory management and billing cycles.

Supplier-Supplier Relationships

By setting up electronic communities, small vendors could more easily locate partners to help design and produce the intermediate goods supplied to large firms. These electronic communities, often called electronic business-to-business yellow pages, are easy to search and contain more detailed information on potential partners than many paper-based systems. Enhanced communication among suppliers could also lead to greater specialization as companies recognize their individual strengths and outsource those operations that their partners perform more efficiently.

Manufacturer-Retailer Relationships

The expansion of electronic commerce will give manufacturers an incentive to sell products directly to consumers over the Internet. By eliminating retailers and the typical distribution network, this strategy may improve efficiency and lower prices to consumers. To date, however, manufacturers have been reluctant to adopt direct selling over the Internet for fear of alienating the distributors and retailers that handle important segments of their businesses.

In the long term, what kind of impact might business-to-business electronic commerce have on the underlying structure of industry? Improvements in supply chain management should make it less expensive to buy goods from outside the firm. As we have seen, one possible consequence is greater specialization among companies. Because the spread of business-to-business electronic commerce could make the outsourcing of production easier and more cost-effective, companies might choose to focus on a few key areas of expertise.

Notes

1. The movement of business-related information over computer networks is also called electronic data interchange, or EDI. Stein and Sweat (1998) review some interesting case studies where the use of EDI by companies has led to improvements in efficiency. For additional case studies, see U.S. Department of Commerce (1998).
2. For more information, see Rothchild (1993) and Sichel (1997). Some economists speculate that the output associated with the increased use of computers—such as improved service—may not be adequately measured or that computers may increase the ability of firms to compete for customers without necessarily increasing aggregate output (see Bailey and Gordon [1988]).
3. For more information on the concept of the supply chain, see the Supply Chain Council web site (www.supply-chain.org). For examples of highly sophisticated supply chain management, see Metz (1998).
4. The term “supply change management” is used primarily by industry groups, often interchangeably with the term “value chain management.” For an overview of how the operations and management information systems literature treats the supply chain concept, see Croom (1998).
5. See McGuffog (1998).
6. The basic components of information security are data integrity, repudiation, confidentiality, and timeliness. Typically, companies use complex cryptographic technology that can scramble data, detect tampering in transit, and allow verification of the identities of the information senders. For more information on security tools, see Bank for International Settlements (1996).
7. Because data must be moved to and from more than one computer system at a given company for EDI to produce its greatest benefits, suppliers of EDI also provide system integration technology that links a company's internal computer systems.
8. When two networks consider forming a link that would enable their respective customers to communicate, the larger network generally provides the greater value-added because it is providing a service to a larger number of endpoints. This relative advantage could give the larger network additional bargaining power in establishing the fees for messages that flow across the two networks.
9. For more information, see Johnson (1998).
10. Recently, a group of banks announced a joint effort to coordinate Internet security for business-to-business electronic com-

merce. For more details, see Buckley (1998). Banks are also actively exploring opportunities to offer services such as cash management, accounts receivable and payments management, inventory control, and electronic payments to smaller businesses through electronic systems. Finally, some banks are helping small businesses set up electronic operations on the Internet with the idea that this technical assistance might prompt the businesses to turn to banks for lending and payments services.

11. In addition, limited bandwidth (the capacity to move information over network connections) has proved to be an obstacle to the spread of electronic commerce over the Internet. Several technology companies are developing ways around this problem. One such solution entails giving users the ability to access the Internet through high-speed cable networks.

12. See Warner (1998).

13. See Blackman (1998).

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