Impact of Electronic Data Interchange on Small Firms

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The points of view or opinions stated in this report are those of the authors and do not necessarily represent the positions and policies of the U.S. Small Business Administration.
# Table of Contents

Executive Summary ................................................................. ES-1

Chapter I: Introduction ......................................................... I-1

Chapter II: Definition and Typology of EDI and Technical Framework for Understanding Its Impact ......................................................... II-1
   Introduction ......................................................... II-1
   Definition and Typology of EDI ..................................... II-1
   Technical Requirements for EDI ....................................... II-6
   Proprietary/Direct Networks .......................................... II-7
   Value Added Networks ................................................ II-8
   EDI Over the Internet ................................................ II-10
   Service Bureaus ..................................................... II-12
   User Groups ......................................................... II-14
   Standards ..................................................................... II-15
      Proprietary Systems ............................................... II-16
      Industry-Specific Standards ...................................... II-17
      ANSI X12 ............................................................ II-17
      UN/EDIFACT .......................................................... II-18
      Alignment of ANSI X12 and UN/EDIFACT ....................... II-19
      X400 Standards ..................................................... II-20
   Conclusion ................................................................. II-20

Chapter III: Analytical Framework for Assessing the Effects of EDI ................................................................. III-1
   Theory of Competitive Advantage ..................................... III-1
   EDI and Competitive Advantage ....................................... III-3
   Standards and the Competitive Advantage of EDI ................. III-7
   Cost/Benefit Tradeoffs of EDI ........................................ III-8

Chapter IV: Research Methodology for Performing the Case Studies ................................................................. IV-1
   Introduction ............................................................. IV-1
   Methodology .................................................................. IV-1
      Case Study Selection ................................................. IV-2
      Identification of Data ............................................... IV-3
      Collection of Data .................................................... IV-4

Chapter V: EDI in the Retail Industry ........................................... V-1
   Introduction ............................................................. V-1
   The Role of Information Technologies in the Retail Industry .... V-1
   The Evolution of EDI in the Retail Industry ......................... V-4
      Standards in the Retail Industry .................................. V-6
      Interview Focus and Hypotheses .................................. V-8
   Findings: The Use of EDI in the Retail Industry ................... V-9
      Characteristics of the First Movers ................................ V-9
      Response by Small Suppliers ....................................... V-10
Table of Contents (Continued)

| Response by Small Retailers                                      | V-12 |
| Costs and Benefits                                               | V-15 |
| The Impact of VICS Standards and the UCC on Small Firms          | V-18 |
| Long Term Impact of EDI on Small Firms                           | V-20 |
| Implications for Other Industries                                | V-22 |
| Recommendations to the SBA                                       | V-23 |

Chapter VI: EDI in Healthcare Networks

Introduction                                                   VI-1
Background on Community Health Information Networks         VI-2
  Applications for EDI and Other Technologies within a CHIN VI-5
  Standards as an Impediment to CHIN Development           VI-8
  Other Impediments to the Development of CHINs              VI-10
  Small Player Focus in the CHIN                               VI-11
Findings                                                       VI-11
Costs and Benefits                                             VI-13
Recommendations                                               VI-14

Chapter VII: EDI in Mortgage Lending

Introduction                                                   VII-1
Background on the Mortgage Lending Industry                   VII-1
  Life Cycle of a Typical Loan                                 VII-1
  Structure of the Mortgage Lending Industry                  VII-4
  Applications for EDI and Other Technologies                VII-7
  Standards                                                   VII-10
  Small Firm Focus                                            VII-11
Findings: Effect on Small Firms                                VII-12
Costs and Benefits                                             VII-13
Conclusion                                                    VII-16

Chapter VIII: EDI and the Federal Government

Introduction                                                   VIII-1
EDI and the Department of Defense                              VIII-2
  Background                                                  VIII-2
    Standards                                                 VIII-4
    Costs and Benefits of GATEC to DoD                         VIII-4
    Small Firm Focus                                          VIII-5
  Findings: Effect on Small Firms                             VIII-6
  Costs and Benefits                                          VIII-7
  Implications/Recommendations                                 VIII-9
EDI and the Customs Service                                    VIII-12
  Background                                                  VIII-12
    Standards                                                 VIII-14
    Costs and Benefits to U.S. Customs Service                 VIII-15
    Small Firm Focus                                          VIII-16
### Table of Contents (Continued)

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Findings: Effect on Small Firms</td>
<td>VIII-16</td>
</tr>
<tr>
<td>Costs and Benefits</td>
<td>VIII-19</td>
</tr>
<tr>
<td>Recommendations</td>
<td>VIII-22</td>
</tr>
<tr>
<td>Chapter IX: Innovative Use of EDI by Small Firms</td>
<td>IX-1</td>
</tr>
<tr>
<td>Introduction</td>
<td>IX-1</td>
</tr>
<tr>
<td>Coyne Leasing</td>
<td>IX-4</td>
</tr>
<tr>
<td>Anderson Graphics</td>
<td>IX-7</td>
</tr>
<tr>
<td>Massachusetts Library Network</td>
<td>IX-10</td>
</tr>
<tr>
<td>Conclusions</td>
<td></td>
</tr>
<tr>
<td>Chapter X: Summary and Recommendations</td>
<td>X-1</td>
</tr>
<tr>
<td>Policy Recommendations</td>
<td>X-4</td>
</tr>
<tr>
<td>Areas for Future Research</td>
<td>X-7</td>
</tr>
<tr>
<td>Chapter XI: Bibliography</td>
<td>XI-1</td>
</tr>
<tr>
<td>Glossary</td>
<td>A-1</td>
</tr>
</tbody>
</table>
Executive Summary

Electronic Data Interchange (EDI) can be broadly defined as the computer-to-computer exchange of routine information typically contained in paper documents by one organization to others. EDI is part of the third generation of information technology and evolved out of firms' desire to automate the interorganizational exchange of data among trading partners. EDI is becoming an important component of daily business operations and it is important that all businesses, large and small, take advantage of the opportunities that this technology provides for managing information and interorganizational communication more efficiently. The Small Business Administration (SBA) has contracted with Innovation & Information Consultants, Inc. (IIC, Inc.) to study the effects of EDI on small firms including identification of factors affecting the adoption of the technology, the costs and benefits realized from the technology, and impediments to the efficient use of EDI, and to recommend policies which the SBA might consider to promote the use of this technology among small organizations.

In the report, we provide a description of the forms of EDI that are being used today, discuss the various components of the technology, including how small firms can become "EDI capable" and examine the importance of standards on the development and use of the technology. Then we present a framework for understanding the potential impacts of EDI technology, focusing on the likely benefits that EDI offers. Then we discuss the various case studies we have performed, examining the effects of EDI in specific circumstances.

We selected six case studies based on a review of the literature, development of various selection criteria, and discussions with others knowledgeable about EDI. The case studies included: retailing, mortgage lending, community health information networks in healthcare services, U.S. Customs' interface with brokers, the Department of Defense's GATEC program for small business procurement, and innovative uses of EDI by small firms. The case studies indicated certain common themes regarding the effects of EDI. Standards were found to be a critical element in the adoption of this technology and the existence of open, industry-wide standards has been very important for small firms. Standards reduce the costs of implementing EDI and accelerate the rate of adoption. Small firms are disadvantaged somewhat in the standards-setting process, although in most cases
it was felt that these disadvantages arose from small firms' lack of participation rather than large firms' intent to use standards to the disadvantage of small firms.

We found that value added networks (VANs) assist small firms implementing EDI. VANs often provide valuable consulting services that are especially beneficial to small firms. By providing information about standards, trading partners, and software options, VANs can make the investment a small firm must make in implementing EDI much more manageable and affordable. Within organizations, the case studies showed that firms that had an "EDI leader" were more successful in implementing the technology. This person pushed the technology from within, understood its ramifications, and how the organization had to adapt to the new technology. In addition, firms that had related technologies in use for internal applications were more likely to benefit from EDI and implement it sooner than their competitors.

The dollar costs of EDI are not viewed as being a substantial barrier to the implementation of the technology. Some technical barriers exist due to the fact that technology has not improved to make EDI cost-effective for all applications. Large firms and government still tend to be the leaders and first movers in adopting the technology in many industries. One reason for this may be the greater number of trading partners that large organizations have contact with as well as the fact that small firms tend to adopt new information technologies in a reactive mode than from a proactive perspective. Many small firms were found to have adopted EDI strictly as a means of satisfying trading partners' mandates. Only as EDI is integrated with other information technologies do firms fully realize the benefits of EDI. Finally, we found that user groups were especially helpful in assisting small firms in implementing and using EDI technology.

We have developed several policy recommendations for SBA to consider regarding EDI. An important role for SBA is to act as a clearinghouse for information on EDI and trends in the technology. Many small firms voiced concern over a lack of knowledge and understanding about EDI; information provided by SBA could help overcome this void as well as emphasize the value of user groups. SBA could also emphasize the business aspects of EDI, providing basic education about the technology. In a more proactive role, SBA could also organize regional seminars to disseminate information about EDI and the costs and benefits of EDI to small business. Emphasis should be placed on many of the fundamental aspects of EDI together with information about the different forms of EDI and how to select an optimal system.
SBA could also encourage small firms to become more involved in the standards process and possibly nominate business representatives to serve on various standards committees to serve the interest of small business. Finally, SBA along with other government agencies must recognize the potential effects of EDI on small business, especially when it is mandated by larger firms. The SBA should determine which government agencies are promoting EDI and how it affects small business, and how it can interact with those agencies to represent the interests of small business.
Chapter I
Introduction

EDI can be broadly defined as the computer-to-computer exchange of routine paper documents by one organization with others. The use of EDI to control and accelerate the flow of information between trading partners is increasingly becoming an integral component of the way companies operate on a day-to-day basis across many industries and throughout the federal government. The projected market for EDI products and services is expected to grow to over $3.0 billion by 1997 (Ferguson and Masson 1993) and by the year 2000, it is estimated that as much as 70 percent of American business will be using EDI. The federal government has recognized the significant impact of EDI on the American economy, touting it as the "most important tool for business expansion since the telephone" (U.S. Congress 1990, 2). In addition, in October 1993, President Clinton (1993, 791) mandated that the federal government use EDI and related technologies to streamline the procurement process which involves the government expenditure of $200 billion annually on goods and services and involves more than 500,000 vendors (Chisa 1994, 4).

As EDI increasingly pervades our economy, it is important that all American businesses utilize fully this technology, thus enabling us to compete more effectively in the global economy. Although many believe that EDI helps to "level the playing field" between small and large firms, others have expressed concerns that small business has been slow to adopt EDI and disadvantaged by the manner in which it has been implemented in certain industries (U.S. Congress 1990). The purpose of this report is to examine the use of EDI in several industry settings to improve our understanding of the factors affecting its adoption and use as well as its costs and benefits. Our focus is on the impacts on small business, analyzing whether small firms have taken full advantage of the opportunities offered by the technology and to identify any barriers or problems which have prevented small firms from realizing these potential benefits. We have also examined whether the Small Business Administration or other government agencies can implement policies that would ameliorate any difficulties which small firms have encountered in using EDI.

Information technologies, including EDI, evolved out of the need for firms to control and manipulate large amounts of data internally and among external trading partners. The first generation of information technology was introduced in the mid-1950s when electronic data processing
systems were introduced to automate repetitive, labor-intensive, data processing tasks within an organization. However, it was not until the late 1970s that the appearance of low-cost, powerful mini- and micro-computers and prepackaged software for common business applications increased the development of these computer-based information systems within firms. The second generation of information technology is characterized by the linkage of these application-specific systems within an organization such that the data frequently needed for different applications could be shared in a central database. The integration of previously isolated internal systems within an organization resulted in more efficient transactions processing, lower transaction costs, and improved coordination between intraorganizational processes (Pfeiffer 1992, 1-3).

EDI, part of the third generation of information technology, evolved out of firms' desire to automate the interorganizational exchange of data between trading partners. Early EDI systems date back to the 1960s. Front-runners in EDI development included large retailers such as K-Mart and Sears, automobile manufacturers such as General Motors, and large pharmaceutical suppliers such as McKesson. These early adopters of EDI developed proprietary data networks between themselves and trading partners to electronically exchange routine business documents such as purchase orders, invoices, and shipping notices. As the use of EDI spread across certain industries, industry specific groups such as the Transportation Data Coordinating Committee and the Automotive Industry Action Group were formed in the 1970s and early 1980s to enable the development of standardized, industry-specific data formats. The widespread availability of EDI software and services, the emergence of third-party commercial EDI networks and service bureaus and the development of national and international voluntary EDI standards have further enabled the diffusion of EDI within and across industries during the 1980s and 1990s such that in many industries this technology is a necessary component to doing business.

As the use of EDI and other information technologies increases across industries, the effect of this type of technology on small business must be ascertained. EDI can provide certain benefits to a small firm previously only realized by large firms. Through EDI, a small firm may be able to improve upon relationships with customers and trading partners and establish internal efficiencies and cost savings through reduced transactions costs, improved cash management, quicker transaction turnaround time, and reduced inventory levels. The use of EDI by the federal government in its procurement process may improve access to federal contracting opportunities for small firms. EDI may enable small firms to expand into industries previously dominated by large firms in which they
would not otherwise be able to compete. Also, innovative uses of EDI by small firms may allow them to create niche markets for information-intensive services.

However, EDI may also have a negative impact on small firms in any given industry. Preliminary research on industries where EDI has taken hold indicates that firms that do not successfully implement EDI technology will eventually lose business to those who do. If small firms lack the resources or knowledge to successfully implement EDI, they may suffer a competitive disadvantage. Because EDI is often initiated by the largest firms within an industry, small firms may be foreclosed from contributing to how the technology evolves within that industry. Often the evolution of EDI data standards begins with the proprietary data formats of large, early adopters and may be biased against small firms. Small firms may be forced to implement EDI out of competitive necessity without sufficient knowledge of the technology and without the financial and technological resources necessary for successful implementation and may not realize the full benefits of this technology.

The costs for implementing EDI systems vary significantly depending on industry and application and may not necessarily be prohibitive to small firms. However, the cost of reengineering the workplace to realize the full benefits of EDI can be quite substantial. A small firm implementing EDI to satisfy its trading partners may not have the resources to fully integrate it into its core business applications, thus missing out on the substantial cost savings that this technology provides. In fact, large firms, when they mandate that their trading partners use EDI, may not take into account the financial implications of this type of directive on their smaller trading partners. In addition, small firms that are coerced into EDI implementation may suffer from a lack of knowledge about the technology and therefore may not be able to successfully integrate the technology into their internal operations.
Small firms have historically made significant contributions to the U.S. economy. Small firms play a substantial role in job creation, new product introduction, and technological innovation. According to the 1993 State of Small Business report, during the period September 1991 to September 1992, small business-dominated industries generated 177,700 new jobs in contrast to large business-dominated industries which showed a decrease in jobs of 400,000 (p. 11). The number of innovations per employee in firms with fewer than 500 employees is 2.4 times that of large firms (U.S. SBA 1992, 84-85).

Small businesses are often the first to enter into developing industries (U.S. SBA 1992, 64). It is often small firms who serve new markets for providing information-related services. The 1992 State of Small Business report (p. 61) states that the small business community has been among the first to adapt to the "third structural revolution," which is fueled by the evolution of information technology and is illustrated by an increased demand for information-enabled services and amenities. Given the importance of small firms to the U.S. economy, it is necessary to ascertain the impact of EDI on small business such that measures can be taken to ensure that this technology becomes a tool which small firms can use to remain competitive with larger firms rather than an obstacle to small firm competitiveness.

Given the importance of small business to our economy, we have focused on how EDI affects small businesses: investigating the diffusion of EDI, its benefits and adverse effects, the development of standards and the role of the federal government in making this technology accessible to

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1The Small Business Administration's Office of Advocacy generally uses employment data as a determinant of firm size, with firms of fewer than 100 or 500 employees defined as small. The ambiguity in this definition stems from the fact an accurate definition of firm size is dependent on the average firm size within the particular industry being studied. A more precise breakdown follows:

- <20 employees = very small
- 20-99 employees = small
- 100-499 employees = medium
- >500 employees = large


2The term "small business-dominated" refers to industries in which 60 percent or more of the work force is employed by firms with fewer than 500 employees (U.S. SBA 1993, 52).

3Out of the ten industries generating the most new jobs during this same time period, seven were small business-dominated (U.S. SBA 1993, 57).

4The first structural revolution was the agricultural revolution via which increased agricultural productivity allowed more workers to contribute to factory employment, leading to the growth of industrial cities. The second structural revolution was the industrial revolution which provided an increase in the quantity of manufactured goods and raised the overall standard of living.
This report uses a case study approach to analyze five different applications of EDI and the effect of each on small firms. In addition, this report presents examples of the use of this technology by small firms to gain competitive advantage in niche markets. In order to determine the impact of EDI on small firms we have relied upon an extensive literature review as well as interviews with EDI users, vendors, standards organizations and other key players.

Chapter 2 defines EDI, discusses its technological requirements and introduces the role of EDI and related information technologies in achieving electronic commerce and the "virtual corporation." In addition, Chapter 2 discusses third-party service bureaus, EDI over the Internet, EDI standards development and user groups. Chapter 3 presents an analytical framework for assessing the impact of EDI, discussing the role of EDI in gaining a competitive advantage and outlining the types of costs and benefits that can be realized through EDI. Chapter 4 outlines our approach to this analysis, summarizing the methodology used and presenting some general hypotheses concerning the diffusion of EDI and its effect on small firms. Our case study analyses of industry-specific EDI applications are presented in Chapters 5-9: Chapter 5 presents EDI use in the retail distribution chain; Chapter 6 investigates EDI use in the healthcare industry; Chapter 7 analyzes EDI use among mortgage brokers; Chapter 8 presents EDI use by the federal government including the U.S. Customs Service's interface with customs brokers and the Department of Defense's GATEC program; Chapter 9 discusses the innovative use of EDI by small firms to gain competitive advantage. Each case study chapter presents an application of EDI, patterns of its use within the selected industry and its effect on small firms. Chapter 10 provides conclusions regarding the overall effect of EDI on small firms and recommendations of ways in which the SBA and other government entities can aid small firms in successfully implementing EDI technology. Chapter 11 provides an annotated bibliography of the literature sources used in conducting this study.
Chapter II
Definition and Typology of EDI and Technical Framework for Understanding Its Impact

Introduction

EDI technology can take many forms depending on the industry in which it is used and the user’s relationship with its trading partners. In order to understand differing applications of EDI and how they affect small firms, it is necessary to understand what EDI technology is and the range of hardware, software and telecommunications components available for its implementation. In addition, as the range of EDI applications varies within and across industries, so can the rate of diffusion of EDI. Some technical factors which affect the diffusion of EDI within an industry include the existence of Value Added Networks, service bureaus and user groups, and the evolution of EDI standards. This chapter serves as a primer, addressing the technical components of EDI and developing the background necessary to understand the competitive effect of EDI, its costs and benefits, the rate of diffusion of differing EDI applications and how EDI affects small firms.

Definition and Typology of EDI

EDI technology is considered a part of a broader category of information technologies and interorganizational systems. Information technology refers to any technology which facilitates the electronic generation, manipulation and/or transmission of informational data. Information technology facilitates the control of information-intensive processes such that they are more efficient and streamlined and enables this control within an organization and, through the use of interorganizational systems, across organizational boundaries. Interorganizational systems, such as EDI, refer to the elements of information technology which facilitate the electronic sharing of informational data between different organizations or groups.

EDI applications can take many forms. A retailer can use EDI to electronically transmit purchase orders from its purchasing system to its suppliers’ order entry systems. A distributor can use EDI to dial into the Ocean Carriers’ Electronic Access Network (OCEAN) from its PC to electronically book freight transportation and receive shipping instructions, bills of lading, invoices and cargo status on ocean shipments through several ocean carriers (Radosevich 1993b). A manufacturer
may use EDI to electronically exchange computer-generated engineering plans with an engineering consultant. Despite the many types of EDI applications, the basic components of EDI remain the same. As illustrated in Figure II-1 data flows from one company's computer application, through a mapping interface, to its EDI gateway (such as a PC server) where it is translated into a format agreed upon by sender and recipient. The reformatted data then flows over a telecommunications network to the gateway computer of the recipient and through the recipient's interface to the recipient's computer application.

![EDI Data Flow Diagram]

Perhaps due to the wide array of EDI applications, definitions of EDI vary greatly. A broad definition of EDI is the "computer-to-computer exchange of routine paper documents by one company with others" (Thierauf 1990). Although this basic definition may be agreed upon, there is some disagreement concerning more precise definitions of the technology. For instance, while one definition requires that data be transmitted from "application to application . . . without human intervention" (Thierauf 1990), another definition includes the exchange of magnetic tapes, diskettes and CD roms as EDI requiring only that the data be keyed into a computer system once (Metzgen 1990). Concerning the type of information transmitted, it is generally agreed that to constitute EDI, the
information must be formatted according to a standard agreed upon by sender and recipient. However, one definition states that, "EDI is specific to data and not text" (Metzgen 1990). Conversely, another source identifies the information transmitted by EDI more generally as "standardized business transaction information" (Seideman 1991c).

For the purposes of this study, it may be more useful to refer to EDI as a "tool." The broad definition of EDI as the paperless flow of business information from one organization's computer to another organization's computer serves as a basis for understanding this concept. A greater understanding of EDI can be obtained by examining its objective. The broad goal of EDI and other related technologies is electronic commerce; electronic commerce may be defined as conducting business through an electronically integrated trading community. The ultimate goal of electronic commerce is that the trading community approaches the "virtual corporation": a dynamic network of trading partners operating within a single electronic infrastructure toward cooperative goals. EDI is one of several information technologies that can be utilized to achieve electronic commerce and the virtual corporation.1

Figure II-2 illustrates how EDI enables a firm to transmit and/or receive data electronically with its trading partners. Within a firm, there are different degrees of EDI capability. For example, a supplier may be informed by a customer that it must be able to receive purchase orders electronically or lose that customer's business. In order to become "EDI capable," the supplier may receive these purchase orders electronically, but then print them out and rekey them into its order entry system. This firm is not performing EDI in the formal sense and is not realizing the full benefits of EDI, but this firm is "EDI capable" because it is satisfying its business partners' EDI mandate. When the firm achieves a seamless interface between the electronic receipt of the purchase orders and its order entry system such that the purchase orders are transmitted to the order entry system without human intervention, the firm is performing EDI in a more formal sense. When the firm reconfigures its business processes such that this seamless interface exists throughout the entire organization, it is performing EDI in the most formal sense. For example, as the purchase order is processed through the order entry system, the order is recorded in the inventory database, the

1Other information technologies which may be used to achieve electronic commerce include: bar coding, optical imaging, computer-aided design (CAD), computer-aided manufacturing (CAM), E-mail and inventory control systems such as point of sale (POS).
distribution department is notified to ship the item and electronically transmit a shipping notice, and the accounting system is notified to issue an electronic invoice, all without human intervention.

Electronic commerce exists when through the use of EDI and/or other information technologies, a seamless interface exists between a firm and all of the members of its external trading community. Trading communities can consist of members from several industries. For example, the retail trading community or distribution chain spans several industries, consisting of suppliers of raw materials, manufacturers, distributors, shippers, retailers, and numerous other middlemen. As electronic commerce evolves, the trading community approaches the "virtual corporation." A trading community operating as a virtual corporation is not only achieving seamless data interface among all members of the community, it is constantly reengineering the business processes of the community as a whole to achieve the maximum benefit allowed by information technology at any given moment. Members of the virtual corporation are co-dependent, with business relationships that are more cooperative than adversarial. In the virtual corporation, one electronic infrastructure exists as opposed to many.
EDI applications can vary according to the nature and scope of the data being transmitted. Benjamin, De Long and Scott (1988) give a typology to classify different types of interorganizational systems. We have adapted their definition as it relates to interorganizational systems to fit our broader concept of EDI as a capability and a tool for achieving electronic commerce and the virtual corporation. EDI can be perceived as performing either routine transaction processing or providing non-routine task support for analytical, managerial or design functions. An example of transaction processing EDI would be the electronic transmission of purchase orders or invoices. An example of EDI as task-support would be Just-in-Time (JIT) manufacturing through which a manufacturer collects inventory information electronically from retailers enabling it to alter its manufacturing process to produce only the types and quantities of goods needed in the immediate future. A firm which implements EDI to perform routine transaction processing may find that this use of EDI also generates additional information which can be used to perform non-routine task support functions. For example, the retailer using an inventory control technology combined with EDI to send electronic purchase orders to its manufacturers may find that in addition to eliminating paper flow and decreasing turnaround time, this process also creates a database of information that may allow the retailer to forecast consumer buying trends.

Benjamin, De Long and Scott also classify interorganizational systems technologies according to whether they are used in an electronic hierarchy or in an electronic market. Hierarchical EDI provides seamless information flow between designated parties in a vertical information channel. An example of EDI use in a hierarchical structure is again the electronic transmission of purchase orders between a manufacturer and its supplier of raw materials. The nature of EDI in an electronic market is that it broadens the information available. An example of EDI in an electronic market is a travel agent’s use of EDI to shop around for the cheapest airfare. Another example of EDI used in an electronic market is the electronic retrieval of information from a remote database. Some applications of EDI may exist in both an electronic market and an electronic hierarchy. For instance, the manufacturer who initially implemented EDI technology to send electronic purchase orders to its raw materials suppliers may also find that the technology allows it to shop around for the best price among several suppliers.

2Benjamin, De Long and Scott admit that theirs is a fairly narrow definition of EDI and that others may define the technology more broadly.
Technical Requirements for EDI

As the definition of EDI is somewhat amorphous, so are the technological requirements for conducting EDI. Rapid advancements in hardware, software and telecommunications technology as well as substantial differences in the way EDI can be applied contribute to the dynamic nature of EDI technology. For instance, early EDI applications relied upon the use of a mainframe computer for EDI transmission. However, the rapidly increasing sophistication of PCs has made a PC-based EDI system a popular method for EDI transmission. Many firms currently use PCs for their internal applications and may not need to invest in significant additional hardware to perform EDI. There exists no universally preferred EDI platform. Often, a firm can design its own combination of hardware, software and telecommunications links to accommodate its cost and technological constraints to achieve some sort of EDI capability. In the same way there is no easily pinpointed cost to implementing EDI. The cost of implementing an EDI system can range from a few hundred dollars to well over $100,000.

EDI capability in its simplest form may only require access to a third-party EDI service bureau. Many small firms opt to outsource their EDI applications to service firms which perform the actual electronic data receipt and/or transmission. However, this is typically a short-term solution. Firms may implement EDI in this way in the short run to comply with trading partner mandates while still investigating their long-term EDI needs. Firms with PCs can run simple EDI by investing in only a modem and basic translation software. Many firms send and receive EDI transmissions from trading partners via a PC, printing or rekeying the documents to integrate them into their applications system. While this may not be an ideal use of EDI and may not offer significant cost savings, this technique allows small firms to become EDI-capable in the eyes of their trading partners. As the volume of EDI transmissions increases or as they sign on with multiple electronic trading partners, these firms can consider implementing a more seamless interface between their EDI system and their core applications to achieve greater cost benefits.

Many companies choose their EDI hardware based upon the hardware used to run existing internal applications. For firms running their core applications on a PC-based system, the purchase of a mid-level or mainframe computer to run EDI applications may not be necessary. Third-party software vendors are expanding their offerings to cater to the increased sophistication of PCs by developing various levels of EDI software that work in PC-based environments. In fact, a firm with
a mid-level or mainframe-based applications system may use a PC to serve as the gateway for EDI transmission.

EDI software consists of mapping and translation software. Mapping software translates data from EDI syntax into the format recognized by a firm's internal applications software. Translating software reformats data from a firm's internal applications format to standard EDI syntax. Pioneers of EDI in an industry may need to write their own software requiring a substantial investment in time and money. However, as EDI applications mature within an industry, the availability of commercial software offering varying degrees of sophistication becomes more widespread. A greater range of commercially available software can make EDI in some form accessible to virtually anyone. Software prices vary according to the type of hardware it is designed to run on, the complexity of the data being transmitted, and whether interactive EDI is being performed. Large firms requiring EDI capability of their trading partners may offer software free of charge.

Telecommunications choices consist of several options including: proprietary networks which can be either switched networks or dedicated networks, subscription to a third-party Value Added Network (VAN), or the use of an existing network such as the Internet. A firm's choice of network for EDI depends not only on cost but also on the number of trading partners, the transmission speed required, and the volume of data being transmitted.

**Proprietary/Direct Networks**

Often a direct or custom designed telecommunications network is the best option for a firm conducting EDI. For a small firm with few data transmissions, EDI via a modem over a standard telephone line may be the most suitable and cost-effective solution involving only the costs of a PC, modem, file transfer software, and a telephone line. For firms with large, constant volumes of EDI or the need for an interactive relationship with trading partners, a more advanced proprietary network may be appropriate. The cost of more advanced proprietary networks includes telecommunications hardware costs and installation costs for cable and router network, which links the trading partners, and ongoing usage costs. Proprietary EDI networks can be either switched or dedicated.

A switched network is suitable for periodic data transmissions or multiple trading partners. The user must dial into the network to set up the link with the recipient. A switched network allows
the flexibility to establish a data link from point A to any other telephone number in the world. In addition to installation costs, a user pays for a switched network connection based solely upon usage. The least expensive and most basic way to conduct EDI is via modem over a standard telephone line. Because a standard phone line is a switched, analog network designed only to transmit voices not data, the digital data signal must be converted to an analog recognizable format, thus slowing the data transmission speed. Firms requiring faster transmissions may use switched digital lines which are designed to accommodate data transmission. An Integrated Service Digital Network (ISDN) is an example of a high speed switched network. ISDN accommodates both voice and data transmission without translation.

A dedicated line is a leased, permanent, direct connection between point A and point B. In addition to installation costs, a user pays a fixed monthly charge for the connection regardless of how often data are transmitted. A dedicated line provides instantaneous access and higher transmission speeds than a switched line because the routing is fixed. A suitable application of EDI over a dedicated circuit would be for a company that has a constant flow of high-volume EDI transmissions from multiple locations back to a central site and requires instantaneous access or high transmission speeds.

**Value Added Networks**

A Value Added Network (VAN) is a third-party service that functions as an electronic "postal system" for EDI. Acting as a clearinghouse for EDI transactions, a VAN can furnish users with services such as message storage and forwarding, transmission tracking and acknowledgement, data translation and additional security. Because VANs support several data formats and network protocols, for a firm with several trading partners, a VAN can lessen the burden of supporting multiple standards. In industries in which proprietary standards predominate, such as the insurance industry, VANs can offer the flexibility and cost effectiveness of common standards. A subscriber need not support all of its trading partners' various protocols in house, but can instead dial into the VAN to transmit and receive data in its preferred format, relying on the VAN's translation capabilities to accommodate the assorted formats of its various trading partners. As illustrated in Figure II-3, a VAN subscriber need only have one connection, to the VAN, in order to access all of its trading partners rather than separate connections for each trading partner. Most major VANs are interfaced
with one another, allowing a company subscribing to one VAN to send EDI messages to a company subscribing to another VAN via VAN interconnects.

EDI With Multiple Trading Partners Through a VAN

![Diagram of EDI with Multiple Trading Partners Through a VAN](image)

An August 1994 estimate finds that well over half of U.S. companies with EDI programs use VANs (EDI News, 1994a). For a firm feeling coerced into EDI by its trading partners, VANs can accelerate and ease the process of implementation. For a small firm reluctant or unable to invest in extensive hardware and software, VANs offer the flexibility to choose from a wide array of services. VANs allow more flexibility in the choice of EDI software because they support all protocols and allow almost instant access to worldwide trading partners. Most VANs provide their own software for specific EDI applications. In addition, network development and maintenance costs can be lower with VANs than with proprietary networks because VANs can spread these costs among many users. VANs also offer support services to assist with implementation such as selecting and implementing software and offering 24-hour EDI information. A VAN's charges range depending on transmission volume and the services required. Hub firms that are requiring EDI implementation by

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3 However, if a firm's trading partner prefers another form of connection over a VAN, it may require that VAN users pay all sender and receiver charges.
their trading partners may work with their chosen VAN to offer services at a lower cost. VANs may also offer off-hours transmission for companies looking for reduced rates.

Some of the larger VANs began by concentrating in specific industries. For example, COMMERCE, formerly Sterling Software Inc.'s ORDERNET Services Division, concentrated on pharmaceutical, healthcare and hardware industries. Tymnet began by offering VAN services in the grocery industry but has expanded to offer international services to many industries. Advantis, a merger between IBM Information Network and Sears Communications Co., began as the proprietary communications network for Sears, Roebuck and Co. and now offers VAN services for the retail and other industries. However, most large VANs have expanded to offer a broad range of services to several industries. In addition, several small VANs are emerging to provide more specialized services. For example, Simplix, a small firm, provides value-added services to firms conducting EDI with the federal government. Comtech and Harbinger are two other small VANs which offer innovative services to aid small businesses who are converting from paper-based transactions to EDI.

EDI Over the Internet

The Internet is the largest computer internetwork in the world, linking over 30,000 networks and over 2 million users worldwide. Of these users there are approximately 640,000 educational sites, 520,000 commercial sites and 220,000 government sites (MacKie-Mason and Varian 1994). The Internet evolved from the Advanced Research Projects Administration's (ARPA) ARPANET which was developed in the late 1960s to provide a link between universities and high-tech defense contractors. The current Internet is divided into non-profit and for-profit components. The non-profit and commercial portions of the Internet perform the same basic functions: serving as a conduit for E-mail and EDI as well as offering remote access to specialized information services and databases.

The National Science Foundation runs the NSFNet, the non-profit network portion of the Internet which was designed for academic research. The Acceptable Use Policy (AUP) of the NSFNet does not allow commercial traffic. The for-profit portion of the Internet uses a series of interconnected commercial networks operated by Advanced Network Services Inc. (ANS). The non-

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4 Simplix and another small VAN, Softshare, use the Internet as the network to which they are providing value added services.

5 The term "internetwork" is defined as a "network of networks" (Avolio 1994, 15).
profit and for-profit portions of the Internet are interconnected. In addition, several commercial, regional and international providers have grouped together to establish the Commercial Internet Exchange (CIX), a set of interconnected networks through which members can exchange information. The CIX is also connected to the NSFNet and ANS's for-profit portion of the Internet. By mid-1995 the NSF will cease to fund the non-profit portion of the Internet as a whole, instead funding the access of some universities and research institutions through government research grants. The NSF will hand over operation of the NSFNet to ANS, at which time the NSFNet will become commercially self-sustaining.

Commercial access to Internet can provide a low-cost way of performing EDI with trading partners. Access to Internet can be gained in two ways. Most universities and large organizations lease lines to non-profit regional networks. These regional networks are typically run by state agencies or a coalition of regional universities and are funded by subsidies from the NSF and state governments and by connection fees collected from users. An organization may also gain access to Internet by subscribing to one of the more than one hundred third-party access providers currently in existence. These access providers, which are dialed into locally through either leased lines or dial-up service, typically provide connections between small organizations or individuals and a regional network. EDI users usually pay a flat fee for access and send data transmissions, up to a certain volume, free of charge. Access to Internet is already a requirement for doing business with some entities. For example, NASA posts its requests for proposals (RFPs) to commercial engineering firms on the Internet. Firms without access to the Internet do not have access to the RFPs (Johnson 1994).

The most basic form of EDI communication over Internet requires a firm to log on to its trading partner's system via modem. This can be done with a PC acting as a dumb terminal. To post information for trading partners' access, a firm needs to become a server. At the simplest, this involves storing files in the file transfer protocol (FTP) format on a computer which can be accessed via modem. More advanced server applications exist for more sophisticated data transfers. Third-party access providers package Internet access with software programs. The providers who target residential users provide E-mail and access to the Internet, while those providers targeting corporate clients provide full Internet access, which allows for a complete exchange of many types of data.
There are significant security issues concerning commercial use of the Internet. Perhaps due to the non-confidential nature of the academic research for which the Internet was designed, the known absence of strict security measures has made the Internet a target for computer hackers. According to the Computer Emergency Response Team (CERT), there were 1,334 security breaches on the Internet in 1993, or approximately 111 per month (EDI News 1994d). As Internet moves away from its academic focus to a more commercial focus, its operators may pay more attention to security issues. The evolution of an "industrial strength" Internet has been forecasted which will include substantial improvements in security measures such as the Privacy-Enhanced Mail (PEM) standard currently being developed. In the interim, measures can be taken to ensure a higher level of security for commercial users. Commercial users of Internet may buffer themselves from direct access via the Internet through the use of user authentication software or access through a third-party gateway. VANs are getting into the business of providing Internet gateways, offering increased security and more easily traced audit trails than direct access to Internet.

For a small firm with limited financial and technological resources, performing EDI via the Internet may prove to be an affordable option. In an effort to sign on small trading partners, many large trading partners offer EDI via Internet as an alternative to other more costly methods. For high volume, high speed Internet transmission between trading partners, some firms may forego access via modem in favor of leasing dedicated data circuits between themselves and trading partners and the Internet.

Because the global infrastructure of Internet is already in place and it can serve as a conduit for other information technologies in addition to EDI, Internet may become the preferred user network for electronic commerce. One estimate finds that at current growth rates Internet will connect 25 million users by the end of 1995 (EDI News, 1994d). In order for electronic commerce to mature, in addition to providing a conduit for EDI and E-mail, Internet will need to expand to accommodate other interactive, PC-based information technologies (such as desktop videoconferencing, multimedia E-mail, and other electronic forums that allow for users interacting simultaneously).

Service Bureaus

A firm implementing EDI due to trading partner mandates may need to become EDI-capable in a short amount of time. A small firm lacking expertise in EDI as well as the technical, financial and
administrative resources required to quickly implement a full scale EDI operation runs the risk of either losing trading partners or implementing an inefficient system. One alternative may be to employ a third-party service bureau to either outsource the EDI process or to provide leased equipment and on-site technical assistance.

Outsourcing EDI can allow a firm additional time during which it can investigate the EDI marketplace for software and services and identify its EDI needs while accommodating the EDI mandates of its trading partners. Third-party service firms provide for different levels of technical sophistication. For example, as illustrated in Figure II-4, a firm on the low end of the technological spectrum can courier or fax a paper document to an outsourcing firm, relying on the third party to enter the document into its computer and electronically transmit it to a trading partner. In the same way, trading partners can electronically transmit data to the outsourcing firm, which then prints it out and relays it to its client. While this type of EDI capability does not offer any long-term benefits, the firm will be able to compete in the short run with EDI capable competitors.

Other EDI service bureaus provide leased hardware, software and onsite training for small firms that feel they do not yet have sufficient knowledge to make a substantial investment in these components. Through leasing EDI hardware and software, a firm can perform EDI in-house while...
at the same time investigating the marketplace for EDI components and determining its specific needs.

While using a third-party service bureau may not allow a firm to realize the full benefits of EDI, it is a beneficial temporary measure for small firms that are coerced into implementing EDI to satisfy trading partners. It is interesting to note that the majority of outsourcing firms are small firms themselves. This indicates that opportunities created by EDI and other information technologies place small firms in a position to provide information-intensive services to both small and large firms.

User Groups

User groups provide a valuable forum for firms investigating or performing EDI. EDI user groups can provide information on different EDI applications, the marketplace for EDI software and services and what competitors and trading partners, both current and potential, are doing. User groups generally fall under one of three categories: regional, vendor-sponsored, or industry-related.

Regional user groups are typically formed through a grassroots approach as different EDI users in a geographical location decide to get together to share their experiences with one another. Regional EDI user groups have members from several different industries and tend to serve the needs of executives rather than the needs of corporations as a whole, dealing with management issues and individual automation problems (Seideman 1991a). The format of the meetings varies depending on the group. The New England EDI User Group meets three times a year at day-long, lecture-style meetings; the EDI Forum of New York meets for a few hours every other month and has a more informal forum with speakers addressing members on suggested issues; the Connecticut EDI Users group sponsors trade shows to help educate members on marketplace offerings, while other regional groups try to maintain a "non-sales" environment (Falbowski 1994).

Vendor-sponsored EDI user groups are specific to certain EDI products. Hardware, software and service vendors are starting their own user groups in an attempt to educate customers, evaluate product-related problems and review product enhancement requests. In addition to interacting with the sponsor, members interact with one another to benefit from each other's experiences in using the same product (Falbowski 1994).
Industry-specific user groups or trade associations focus on education and information sharing as well as the development of industry-specific and cross-industry EDI transaction sets and implementation guidelines. The Chemical Industry Data Exchange (CIDX), the Petroleum Industry Data Exchange (PIDX), and the Uniform Code Council (UCC) are examples of industry-specific user groups (Falbowski 1994).

EDI user groups can also provide members with an opportunity to network and find additional trading partners. While some EDI user groups offer opportunities for large and small trading partners to interact in a non-threatening environment, there does not appear to exist a user group which solely addresses the concerns of small firms.

Standards

A necessary element of EDI is that the data exchanged are formatted according to an agreed standard between the sender and recipient such that it can be integrated into the computer applications of each without human intervention. EDI standards are a set of agreed upon rules by which data are structured into message formats such that transaction-related data can be exchanged in computer readable format. EDI standards can be proprietary, industry-specific, national, or international.

### Evolution of EDI Standards

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<tr>
<th>Proprietary</th>
<th>Industry-Specific</th>
<th>Cross-Industry</th>
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<tr>
<td>Company</td>
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<td>ANSI X12</td>
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<td>Specific</td>
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<td>Boards</td>
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- 1960s
- 1970s
- 1980s-1990s

**Source:** EDIA Seminar (February 1993) presented by Bob Lette

*Figure II-5*
As illustrated in Figure II-5, evolution of standards in EDI technology has typically begun with proprietary systems developed by the early adopters of EDI. These industry leaders, or “hub” firms, developed data formats which enabled them to communicate with their multiple trading partners, or “spoke” firms, using one common format. However, as the use of EDI spreads within an industry, it becomes inefficient for the spoke firms to support the different proprietary formats of several hubs. More intensive use of EDI in an industry typically leads to the development of industry consensus standards developed by either industry-specific trade groups or national bodies. In several industries, trading partners have grouped together to develop industry specific standards which facilitate the relationships between firms and multiple trading partners within an industry. To further aid the development of common data standards for EDI transactions, the Accredited Standards Committee (ASC) was chartered in 1979 with the role of developing national standards across U.S. industries. These standards are commonly referred to as ANSI X12 transaction sets. Data standards outside of the United States are addressed by UN/EDIFACT which was commissioned by the United Nations in 1985. This section addresses the chronological evolution of data standards for EDI, beginning with proprietary systems.

Proprietary Systems

The use of proprietary systems is common in industries such as automotive manufacturing and retail in which EDI use is relatively mature. The forerunners of EDI found it necessary to develop their own EDI software due to an absence of commercially available packages. In order to integrate their EDI operations with their core business applications, these companies developed standards that were specific to their particular applications. It can also be argued that firms developed proprietary EDI systems in order to create a captive audience among trading partners such that the cost of maintaining more than one EDI system or switching to another would lock out the competition and prevent trading partners from using EDI to comparison shop.

The use of proprietary systems has decreased as EDI technology has diffused. Many hubs such as Wal-Mart, JCPenney, and Ford which previously accommodated only proprietary data formats will now accept ANSI X12 as a secondary format. In addition, many firms operating proprietary networks allow interconnects from VANs. For example, Harbinger offers interconnects to the private networks of GM, Ford, Chrysler, Caterpillar, Rockwell and Texas Instruments.
Industry-Specific Standards

In industries in which EDI use is relatively mature, the proprietary systems of the hub firms have evolved into industry-specific EDI standards. For instance, the transportation industry has been using EDI for several years for the electronic transmission of air cargo documentation. In 1975, the U.S. Transportation Data Coordinating Committee (TDCC) created the TDCC standard for this application of EDI (Hall 1990). 6 For twenty years, TDCC standards were used by not only air cargo shippers but by motor carriers, ocean carriers, and railway carriers. Other industry-specific trade organizations involved in standards development include:

AIAG: Automotive Manufacturing
COMMNET: Medical-Surgical Supplies
COPAS: Oil/Gas Industry
EAGLE: Retail Hardware
ICOPS: Office Products
IVANS: Insurance
ORDERNET: Wholesale Pharmaceutical
TDCC: Freight Transportation
TOP: Optometrists
UCS: Grocery
VICS: Retail
WINS: Warehousing

As the use of EDI increases across industries, ANSI X12 is increasingly being used in conjunction with these industry-specific standards. The TDCC standards were adopted by ANSI X12 in the early 1990s. Other industry-specific standards are in varying stages of alignment with ANSI X12 in order to establish uniform procedures for their adoption and distribution. However, it is predicted that these industry-specific standards will never be completely homogenized under the umbrella of ANSI X12 since different trading groups have unique business needs (Zorfass and Michel No Date).

ANSI X12

The American National Standards Institute (ANSI) is the national coordinator of the voluntary standards system in the United States. In 1979, ANSI chartered the Accredited Standards Committee (ASC) X12 to develop standards for electronic data interchange. DISA, which currently has over

6 This was the first variable-length, industry-specific set of standards published for EDI use defining what information was needed for electronic exchange of information contained in a motor, ocean, or air freight bill (Thierauf 1990, 29).
650 members, is the secretariat for ASC X12. Membership to DISA is open to any organization interested or engaged in electronic data interchange. ASC X12 subcommittees develop recommended standards which they present to ANSI for approval. Each subcommittee deals with X12 standards for a particular industry or function. For example, existing subcommittees include: Communications & Controls, Product Data, Finance, Government, Materials Management, Transportation, Technical Assistance, Purchasing, Industry Standards Transition, Distribution and Warehousing, and Insurance. Within each subcommittee there are task or work groups that address specific concerns. For example, the Finance subcommittee has task groups in the following areas: payments/invoices, bank reporting, UN/EDIFACT, finance systems architecture, and lending.

Each business document approved by ANSI has an associated ANSI X12 transaction set which is identified by a three digit transaction number. For example, a standard purchase order carries the identifier 850, an invoice carries the identifier 810 and a ship notice carries the identifier 856. A transaction set is made up of segments which contain the actual transaction data. These segments appear in the transaction set in a certain order. Each transaction set is enclosed in an electronic "envelope" then grouped with like transaction sets in a functional group. Each functional group is enclosed with all other functional groups in an interchange envelope. This electronic interchange envelope contains the transmission.

Requests for new standards are submitted to the Data Interchange Standards Association (DISA X12), the secretariat for ANSI X12. DISA forwards the recommendation to the ANSI X12J Technical Assessment subcommittee which works in conjunction with any other relevant subcommittee to evaluate the request. If the standard request passes the approval of the ANSI X12 subcommittees, it is assessed by the procedures review board and then put to ballot. If the recommended standard is approved by ballot, it becomes a draft standard and is put to trial use. During this trial period, the draft standard is subject to ANSI public review after which it becomes an American National Standard.

UN/EDIFACT

United Nations/EDI for Administration, Commerce and Transport (UN/EDIFACT) is a United Nations international EDI standards organization that was formed in 1985 as an attempt to consolidate the differing standards of ANSI X12 used in North America and GTDI (Guidelines for Trade Data Interchange) used in Europe. UN/EDIFACT has regional rapporteurs which are nominated by local
governments to work with regional EDIFACT boards in addressing regional concerns and standards development. Regional EDIFACT boards exist for Africa, Asia, Australia/New Zealand, Eastern Europe, Western Europe and the Pan American board which serves North, Central and South America. The Pan American EDIFACT board also works in conjunction with ANSI.

A UN/EDIFACT business document or message is identified by a six character name such as INVOIC for invoices, or ORDER for purchase orders. Each EDIFACT message consists of three sections: header, detail and summary. Within each section is a collection of sequenced segments consisting of data elements that, together, define a precise concept. The header section contains information that applies to the whole message such as an address. The detail section contains transaction-specific information such as product descriptions and quantities. The summary section contains information such as transaction totals.

The UN/EDIFACT message development process begins with the submission of a recommended message format to a local representative, or "rapporteur." The proposed message is reviewed by the local rapporteur and any other interested rapporteurs. After review by the rapporteurs, the message is published for comment by the global membership to ensure there is no duplication. The message is then used by companies on a trial basis for at least one year. During this stage, any needed changes are identified. It is also during this process that the trial message is implemented in conjunction with any other messages with which it may interact. At the end of this process, the modified message is presented to the United Nations for approval.

Alignment of ANSI X12 and UN/EDIFACT

In an attempt to create an international EDI standard to facilitate global EDI, the membership of DISA voted to align ANSI X12 standards with EDIFACT standards in the future. DISA's Alignment Task Group recommended a target date of 1997 for the alignment of the two standards, however, our research indicates that the alignment of the two differing standards was put on hold after research revealed that out of the 50,000 companies conducting EDI worldwide, 35,000 of them operate in the United States and thus are predisposed to adopting ANSI X12 standards in order to communicate with their trading partners. According to one source, the alignment will now be "market driven" rather than mandated. Another source indicates that key members of ANSI have recently developed

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7 Estimated usage of ANSI X12 is at 30,000 companies (Harter 1993b).
a compromise that allows a 1997 migration to EDIFACT standards while at the same time allowing businesses to maintain ANSI X12 transaction sets for as long as the market deems it is necessary (EDI News 1994r).

**X400 Standards**

The X400 Message Handling System is the data specification for standardized electronic messaging or E-mail: the electronic transmission of text or free formatted messages from one person to another. X400 was developed by the International Telegraph and Telephone Consultative Committee (CCITT). Due to its global-messaging features, X400 has been identified as the ideal standard for transporting otherwise incompatible types of data including EDI, telex, fax and voice mail over one electronic messaging network using a single telecommunications link. Most E-mail network services have X400 interconnections to other E-mail networks, thereby creating a wide-reaching internetwork for all forms of electronic communication.

To facilitate the combined use of E-mail and EDI, the CCITT has developed an X435 standard which specifies how to use the X400 messaging standard for EDI transport. For companies with E-mail networks already in place, the X435 standard allows the transmission of EDI over the already existing infrastructure, reducing administrative and overhead costs. Data in an ANSI X12 format must be translated to the X435 format before it can be transmitted over the X400 network. Third-party software is available which performs the translation process. The X435 standard also facilitates VAN interconnects and assists in the transmission of EDI over the Internet.

**Conclusion**

EDI applications can vary broadly across trading communities, across industries and across firms. This variance is due in part to the wide range of hardware, software, and network options available for implementing EDI, the existence of different service organizations such as VANs, service bureaus and user groups, and varying stages of standards evolution within different industries. As the technical components of EDI vary so do the competitive effects of this technology, its rate of diffusion and the costs and benefits associated with differing applications. In the next chapter we build upon the technical framework provided by this chapter to present an analytical framework for determining the effect of EDI on small firms.
Chapter III

Analytical Framework for Assessing the Effects of EDI

In this chapter we will discuss various theoretical bases regarding how new technologies such as EDI are developed and adopted by firms in various industries. Also since we are examining the interaction of small and large firms within various industries in this report, it is important to distinguish factors that influence the innovation process and the rate of adoption of new technologies between small and large firms. In this chapter we present an analytical framework for understanding the innovation process, and in particular we identify conceptually those factors that may be particularly important in determining the rate of adoption of EDI and the perceived costs and benefits of EDI.

Theory of Competitive Advantage

The analytical model used in this report emphasizes strategy formulation and the interaction of firms in the marketplace as they strive to gain or sustain a competitive advantage (Porter and Millar 1985). In any industry, firms pursue various strategies depending on the environment of that industry and how firms choose to set up their organizations. Since the interaction of firms in the marketplace determines their performance, i.e., relative profitability and progressiveness, an examination of firms' strategies offers insights into their performance and whether small firms benefit or may be harmed from the use of a new technology such as EDI.

The competitive environment constrains and conditions firms' behavior. Elements of the environment include industry structure (including the size distribution of firms), the growth rate of the industry, nature of demand conditions, the stage of the product life cycle, government policies, industry standards, and opportunities for innovation. The organization of the firm represents the manner in which the firm has structured its financial, physical and human resources. Embodied in this organization are the firm's attitudes toward risk, managerial function and style. The organization is perceived to pursue various goals and objectives; profit maximization is believed to be the firm's long-term goal, but firms often follow other short-run objectives such as market share, revenues, etc.

Strategy formulation is the process by which firms specify their market behavior. Firms assess their internal strengths and weaknesses as well as external opportunities and constraints that
together allow them to formulate strategies; these strategies are applied to various factors such as the choice of products offered (differentiation), cost/price relationships, marketing/distribution, and technology. Competitive behavior represents the manner in which strategies are implemented in the marketplace. To gain a competitive advantage over its rivals, a company must either provide goods or services at a lower cost (cost advantage) or in a manner that provides premium value or prices (differentiation advantage) (Porter and Millar 1985).

One important element of competitive strategy is innovative behavior and the approach a firm takes toward new technologies (Ashton and Dalton 1983). For example, a firm may be a technological leader (i.e., an early adopter), a fast follower, or a pursuer of incremental innovations. There may be obvious benefits of being a leader in developing or adopting a new technology; these may be classified as "first mover advantages."

First mover advantages allow a firm to realize both cost and "value" advantages ahead of competitive rivals including the following:

- **Reputation**: a firm that moves first may establish a reputation as a pioneer or leader, thereby establishing customer loyalty and the ability to charge premium prices.

- **Learning curve advantages**: a first mover can gain cost advantages if it can move down the learning curve more quickly than later followers.

- **Standards**: a first mover may be able to affect the definition of particular standards which can sustain a firm's competitive advantage over time.

- **Profits**: a first mover can often earn supra-normal profits from its position.

- **Institutional barriers**: a first mover can sometimes protect its advantage through patents.

- **Favorable access to resources**: first movers often can gain favorable access to inputs or other resources giving it a cost advantage.

- **Switching costs**: if the costs to switch from one seller (or buyer) to another are high, a first mover can gain an advantage by locking in future sales.

Along with first mover advantages, there are also disadvantages with being a first mover. For example, a first mover may face substantial increased costs such as developing needed inputs, securing the needed infrastructure to implement the technology, education of users, or face risks that
the technology becomes obsolete, demand conditions change, or imitation is easy and relatively costless and as a result rivals face much lower costs of technology than do first movers.

The rate of adoption of a new technology (i.e., whether a firm is likely to be a first mover) is influenced not only by the competitive strategy of the firm, but also by various exogenous factors such as whether the technology was developed in response to a specific need (demand pull) as well as the role of government and quasi-government bodies. Mansfield (1968, 153-154) defined three factors as being particularly important in determining the rate of adoption of a new technology: expected profitability, the number of firms using the technology (saturation rate), and the amount invested in the technology. It is the interaction of these factors, including competitive strategy, which dictates the rate at which a new technology will be adopted and the degree to which various firms may succeed in gaining a competitive advantage from the early adoption of a new technology.

The "information revolution" has had a dramatic impact on competitive strategy and has given many firms significant opportunities to gain competitive advantages. We turn now to discussion of one aspect of that information revolution, EDI, and how the adoption of EDI is related to competitive strategy.

**EDI and Competitive Advantage**

EDI has been heralded as a gateway to competitive advantage in many industries. It provides opportunities for firms to outcompete their rivals and gain cost and differentiation advantages. However, as the rate of adoption of EDI in an industry accelerates, it is likely that many of the potential beneficial effects of EDI on a firm's competitive position will diminish. Benjamin, DeLong and Morton (1988) raise several interesting issues in their discussion of the effects of EDI on a firm's competitive position. They find that the majority of EDI applications will arise out of competitive necessity. Instead of improving a firm's strategic position within an industry or providing competitive advantage, EDI becomes "a cost of doing business." Furthermore, long-term cost advantages from EDI can be realized only through the redesign of basic work processes.

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1 Others have commented that due to "network externalities" any competitive advantage stemming from EDI is likely to be short-lived (Pfeiffer 1992).

III-3
Nevertheless, one expects that there can be substantial first mover advantages for those who adopt EDI early. In the early stages of EDI adoption in an industry, firms may more easily realize substantial benefits from implementing the technology. By being a forerunner in the implementation of a new technology, a firm differentiates itself from its competitors by handling transactions more efficiently. This efficiency offered to the "first mover" may lead to increased volume of business, improved reputation and possible learning curve advantages. The increased business alone may be enough to cover the investment in the technology. Also, standards development may take on a critical role at this early stage and first movers can play a substantial role in standards development and use this as a means of securing a competitive advantage. We refer to these first mover advantages as a "first tier benefit" of EDI.

As the number of competitors implementing the technology increases, and electronic commerce begins to evolve, firms will have greater difficulty realizing these first tier benefits. Followers may find that the benefit of implementing EDI is simply a necessity to remain in business. If a firm implements EDI to satisfy the mandates of its trading partners, the first movers, and succeeds in not losing business to other EDI capable competitors, it will realize certain first tier benefits of EDI. Nevertheless, this type of benefit is the result of EDI implementation out of "competitive necessity." At this stage, if competitive advantage is to be gained, it will be by those organizations who completely integrate the technology into their work processes, constantly modifying their systems to capture the cost savings allowed through increased productivity and decreased overhead. Cost advantages, not differentiation advantages, are most likely to be realized at this stage of adoption. These organizations will experience "second tier benefits" of EDI such as increased productivity due to more efficient work processes and decreased overhead due to decreased transaction processing costs.

Market structure may also influence the ability of a firm to gain a competitive advantage through the use of EDI. In industries characterized by both small and large firms, small firms that fail to adopt EDI quickly will miss out on the first tier benefits offered by EDI. Implementing the technology out of competitive necessity implies that a firm's competitors have already adopted the technology and the first mover advantages have already been realized by others. Small firms adopting out of competitive necessity are forced to make an immediate leap to the next step to realize the benefits of the technology. They must simultaneously implement the technology while
reengineering the work flow of their organization such that they realize the second tier benefits of EDI. This may be costly and difficult.

According to Hammer and Champy (1993), business reengineering is the reinvention of an existing organization. As noted above, competitive strategy is dependent in part on the structure of the organization and how it is best used to implement a set of strategies. For firms wishing to realize second tier benefits of EDI, reengineering of the organization may be required. Reengineering, in this sense, is formally defined as:

the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed (p. 32).

Reengineering involves reversing the industrial revolution. The result of the industrial revolution has been firms consisting of groups of specialized workers performing repeatable tasks, meaningless on their own, but contributing to the whole. Each division contains its own set of checks and balances and is overseen by managers who report to a hierarchy of executives. Using interorganizational technologies such as EDI to automate these tasks does not result in long term benefits. True benefits are gained through using the technology to achieve goals that were not possible before. Such technologies enable firms to break down divisions within an organization such that the flow of information within the firm is not upward throughout the hierarchy but interorganizational. Goals that were accomplished through serial processing can be accomplished through parallel processing with EDI. In addition multiple users can have access to information at the same time.

Obviously this type of organizational overhaul requires substantial forethought and planning and must be an integral part of the strategy of the firm implementing EDI at this stage of the process. Hammer and Champy (1993) acknowledge that companies cannot read about a technology one day and implement it the next. Benjamin, DeLong and Morton (1988) suggest that a pilot program approach may be the best method by which to invoke this change. However, for a firm operating on tight time constraints due to the mandates of trading partners or limited financial, technological, and administrative resources due to its small size, a pilot program may simply not be possible. It is likely that these factors combined with lack of knowledge or understanding about hardware, software and telecommunications options may compel a small firm simply to implement what their
trading partners suggest without further investigating other options which may be more suitable for its own current or future needs. The result is that the small firm either never realizes the second tier benefits offered by EDI and never recovers the cost expended on its EDI implementation or that it completely recreates its EDI system in the future in an attempt to realize some benefit at considerable additional cost.

Some applications of EDI offer more visible second tier benefits. For example, applications in extremely paper intensive industries will offer substantial cost savings if the implementer replaces the generation of paper documents with EDI. However, it is quite common for an EDI user to maintain a hybrid system: one in which data flows electronically and a simultaneous one in which data flows via paper. While this type of system might accommodate trading partner mandates, it offers little in the way of cost savings for the implementer. In order to realize substantial cost savings, the implementer must redesign the way in which information flows within the organization such that paper is no longer necessary. With such a highly visible benefit, the firm may be more willing to plunge into the reengineering process, being fairly certain of the payoff and that it will be immediate.

Since EDI is one of several information technologies that may be used to realize electronic commerce, its second tier benefits are often only fully obtained when it is used in conjunction with other technologies. For example, a firm using EDI to transmit electronically purchase orders to its trading partners may realize greater benefits when it also integrates the purchase order application with Electronic Funds Transfer (EFT) to directly credit the accounts of its trading partners upon receipt of an invoice. In addition to realizing reduced transaction costs, the firm may also benefit from improved cash management. Another example is the retailer who uses EDI in conjunction with an inventory management technology such as point of sale (POS). Not only can the retailer transmit purchase orders to a supplier electronically, the retailer can use POS so that sales are electronically recorded in an inventory database as they occur and purchase orders are automatically sent to suppliers at designated inventory levels. The integration of these two related information technologies offers not only improved information flow between the firm and its suppliers, but better communication and coordination within the firm.
Standards and the Competitive Advantage of EDI

Standards play an important role in the adoption of EDI and firms' ability to realize competitive advantages. As noted, first movers may attempt to use standards to gain a competitive advantage. Early EDI applications such as in retail or insurance tended to operate on proprietary formats. One explanation for the early use of proprietary systems is that first movers found it necessary to design their own systems due to an insufficient selection of EDI software on the market or a lack of standardized data formats applicable to its particular EDI application. A more compelling explanation, however, is that to capture a competitive advantage, first movers attempted to create a captive market through the use of a proprietary system. A trading partner having invested in this system would be reluctant to switch to another system or accommodate an additional trading partner's proprietary system as long as it could still derive benefit from the relationship with the first mover.

Observations of EDI development in the insurance industry illustrate this. In their study of the property and casualty insurance market, Venkatraman and Zaheer (1989) found that while insurance agents seemed favorably disposed to the use of common EDI standards, insurance carriers preferred a proprietary standard. A common standard would allow agents to access and evaluate competing quotes at a much lower cost, making the market for insurance more price competitive. If insurance carriers implemented proprietary standards, the cost to agents, most of whom are small firms, of shopping around for quotes would be prohibitive.

Rotemberg and Saloner's (1989) concept of competitive versus cooperative advantage adds an interesting dimension to this theory. They argue that a competitive advantage arises when a firm pushes a proprietary standard over a common one. Conversely, a cooperative advantage arises when a firm pushes a common standard over a proprietary one. In the early stages of adoption of EDI, it would appear that a first mover may benefit from capturing its trading partners through the use of a proprietary standard, hence creating a competitive advantage. However, as the rate of diffusion of EDI increases and focus turns toward electronic commerce and the "virtual corporation," the ability to hold on to this competitive advantage may decrease. The virtual corporation survives on cooperation. A trend toward electronic commerce must lead to a trend toward non-proprietary standards. The firm maintaining a proprietary standard will find itself unable to integrate its EDI applications into the emerging wider network. At this stage, proprietary standard users may be required to convert to common standards out of competitive necessity as the use of EDI coordinates.
with other information technologies to construct the virtual corporation. It is at this stage that "third
tier" EDI benefits are realized. Third tier EDI benefits are cooperative in nature because they are
realized through the seamless electronic integration of all members of a trading community. Mem-
bers of the trading community benefit from the existence of a single electronic infrastructure not
obstructed by multiple data formats.

For a small firm with limited resources the cost of developing a proprietary EDI system may
be prohibitive. A small firm may possess neither the financial resources nor the technological
knowledge necessary for such an investment. Without the availability of third-party software with
standardized data formats, a small firm with limited resources simply cannot be a first mover in EDI
implementation. If the small firm is a member of the first mover's captive audience it might be unable
to accommodate other trading partners' formats thus limiting its business possibilities and precluding
the full benefits of reengineering and membership in the broader community of electronic commerce.
Not only is the small firm missing out on the first tier benefits of EDI but it is unable to capture fully
the second tier benefits until standardized data formats and a broad selection of EDI software exist.
However, if the small firm can put off its implementation of EDI until this point, it may enjoy the
benefits of an easier transition toward electronic commerce having employed common standards
from the outset of its implementation and recognize substantial third tier benefits.² The rate of EDI
adoption thus will clearly affect firms' ability to gain and sustain a competitive advantage through the
use of EDI. Figure III-1 outlines the various categories of benefits that can be realized tying them
to the rate of adoption of EDI. Obviously other factors will also affect the rate of adoption and the
ability of small firms to realize the benefits of EDI. One such factor is the perception of the costs and
benefits that firms will have regarding the use of EDI.

Cost/Benefit Tradeoffs of EDI

As noted, many small firms regard the decision to adopt EDI as being driven by competitive
forces external to the strategic makeup of the firm, i.e., out of competitive necessity. If this is the
factor driving the decision to adopt EDI, or if the costs are so low that it would be more costly to

²Indeed small firms may gain advantages at this stage relative to first movers since imitation at this point may be easy
and inexpensive. If the rate of adoption is especially rapid, then any competitive advantages (i.e., first tier benefits) may
be rapidly diminished and small firms will not face severe competitive disadvantages from not adopting earlier.
Rate of EDI Adoption vs. Advantages Realizable from EDI

<table>
<thead>
<tr>
<th>Rate of Adoption</th>
<th>First Tier Advantages</th>
<th>Second Tier Advantages</th>
<th>Third Tier Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early</td>
<td>Competitive Advantage</td>
<td>Competitive Necessity</td>
<td>Cooperative Advantages</td>
</tr>
<tr>
<td></td>
<td>First Mover Advantages</td>
<td>Cost Advantages</td>
<td>Cost Savings</td>
</tr>
<tr>
<td></td>
<td>Differentiation Advantages</td>
<td>Workplace Reengineering</td>
<td>Small Firm Accessibility</td>
</tr>
<tr>
<td>Middle (Imitator)</td>
<td>Proprietary Standards</td>
<td></td>
<td>Non-Proprietary Standards</td>
</tr>
<tr>
<td>Late</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure III-1

analyze the decision, firms will not perform a formal cost-benefit analysis. Nevertheless, some firms may engage in more formal analyses of the costs and benefits of implementing EDI at early stages of the technology. It is useful to identify in theory what the particular costs and benefits of EDI may be and then later contrast them with those costs and benefits that appear to have been actually realized to determine whether the technology delivers the benefits that are promised. This may make it easier for firms, especially small ones, to determine whether and when the cost/benefit tradeoffs of EDI can be maximized.

The costs of EDI implementation, though varying widely depending upon the type of installation envisioned, fall into four categories:

1. System costs

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3In our case studies, we found that very few firms invested the time and money involved in performing a formal cost-benefit analysis. Some were able to reflect, after the fact, on the costs required and the benefits derived, but most felt a compelling competitive necessity to adopt EDI.
2. Telecommunications costs
3. Installation costs
4. Staffing costs

System costs include the costs of acquiring whatever additional hardware and software is required in order to exchange documents electronically. For firms pioneering a new application, this category might include software or other systems development, and possibly standards development. Ongoing maintenance for the hardware of the system, and software upgrades expected during the life of the cost-benefit analysis would also be included in this category of costs.

Telecommunications costs are the monthly expenses of operating the EDI system and the transmission charges assessed for EDI. Included in installation costs are the up-front planning time required prior to acquisition of the system, and the costs involved for in-house staff or outside consultants from initial evaluation and selection of a vendor through final installation of a functioning EDI system that operates without any glitches. Staffing costs include the costs of training staff for operating the EDI system, costs associated with workplace reengineering (e.g., redesigning procedures to take best advantage of the new technology) and worker retraining. For a booming business whose volume has increased due to implementation of EDI, these staffing costs might include hiring additional staff.

There are various ways to categorize the benefits of EDI, but in general the benefits are quite similar to the benefits to be derived from any automated technology. There are four generic categories of benefits:

1. Reduced transaction costs
2. Improved cash management
3. Instantaneous management information
4. Competitive advantages
Reduced transaction costs derive from the automation of any repetitive process. There are generally two sources for reduced transaction costs. First, labor costs are reduced, due in part to the elimination of errors as well as elimination of clerical help required to enter, file, and maintain data, including the costs incurred from matching documents and tracking down lost documents. Second, there are reduced paper costs due to elimination of hard copy documents, reports, invoices, etc. Some of our prior studies performed on other automation technologies, such as imaging, indicate that the average business document is copied three to ten times during its life; all of these additional copies need to be filed. Paper savings from use of EDI (or many new technologies) would include reduced supply costs, reduced filing space, elimination of postage, fax, and courier costs, and elimination of photocopying costs.

Improved cash management most often is realized as a result of combining EDI with electronic funds transfer (EFT), but can be realized simply through EDI via electronic invoicing or improved inventory management. When funds are transferred electronically and invoices are transmitted electronically, there is a predictability about when you will receive the money. Some of the benefits that would fall into this category would include accelerated payment of receivables, reduced carrying costs, cash savings from “playing the float,” and improved relationships with banks (that is, since the bank can see this predictability of a business’s cash flow, the bank will be more willing to extend credit).

Instantaneous management information is a general term we have coined to reflect a benefit that we see with EDI. Although this takes many different forms depending on the application and the industry, EDI offers instantaneous (or at least, improved) access to the information that the business needs to operate. For retail, this might mean “Just In Time/Quick Response” strategies for inventory and production management. For healthcare, this means that physicians have direct access to the laboratory results as soon as they are available, and that the pharmacy has immediate access to the physician’s prescription orders.

Several studies have been performed by various businesses which attempt to quantify these benefits. For example, see Canright 1988; Joyce 1989; Kemezis 1987; and Stevens 1988.

One source interviewed stated that some of the most significant labor savings are in matching documents. For example, a paper-based transaction in the retail industry requires that a retailer match the purchase order with the invoice with the shipping notice. In an EDI-based transaction, this matching can be done by computer.
Competitive advantages also vary from industry to industry and application to application. As discussed above, there are various marketplace advantages that can be obtained through EDI. For example, EDI can potentially affect a firm's relations with suppliers and customers, as well as create internal efficiencies. Other areas where EDI can benefit a firm with competitive advantages include:

- **Customer relations:** EDI can improve customer service, reduce order lead time, and enhance the flow of information (pricing, promotion, quality, etc.) about a product to customers. In service-oriented businesses, EDI can enhance customer service by enabling the firm to respond immediately with full information to customer inquiries.

- **Internal efficiencies:** EDI can create a number of internal efficiencies which can reduce costs, improve productivity, and enhance strategic focus. Some of these benefits are described above; in addition, EDI provides timely information regarding demand trends and, for early adopters, provides strategic first mover advantages vis-a-vis competitors.

- **Supplier relations:** Although there are similar benefits here as described for customer relations (i.e., better information faster), EDI can reduce the transaction costs and improve the working relationships with suppliers by allowing the firm to predict what it needs and respond more quickly.

Although there are many ways to implement EDI (and the case studies will elaborate upon the variety in selected industries), we have charted the ranges of EDI installations in Figure III-2. This figure demonstrates the types of EDI benefits that one can expect to derive when implementing various types of EDI. For example, a firm that decides to become EDI-capable to meet the demands of a trading partner by receiving orders from a VAN and then rekeying those order forms into its own internal system will probably not realize many benefits. On the other hand, a firm that adopts EDI systemwide, along with substantial reengineering of the workplace, will derive all of the categories of benefits.
<table>
<thead>
<tr>
<th>Type of Installation</th>
<th>Cost Range</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reduced Transactions Costs</td>
<td>Improved Cash Management</td>
</tr>
<tr>
<td>EDI-capable</td>
<td>$150 startup Usage charges</td>
<td>?</td>
</tr>
<tr>
<td>EDI on PC</td>
<td>$4,000-6,000</td>
<td>X</td>
</tr>
<tr>
<td>EDI on PC Network</td>
<td>$10,000-75,000</td>
<td>X</td>
</tr>
<tr>
<td>EDI Systemwide</td>
<td>&gt;$100,000</td>
<td>X</td>
</tr>
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</table>
Chapter IV
Research Methodology for Performing the Case Studies

Introduction

The case studies provide an empirical basis for understanding the effects of various applications of EDI on small business. The case study approach has also enabled us to compile information on the relative costs and benefits of EDI to small firms and the role of standards in the adoption of EDI, and to develop a detailed bibliography on the use of EDI in various industries. IIC, Inc. has conducted six case studies which captured some of the range of conditions and market settings under which EDI has been implemented. These case studies include: mortgage lending, community health information networks in healthcare services, retailing, the U.S. Customs Service's interface with customs brokers, and the Department of Defense's GATEC pilot program. Finally, we have also performed a case study to explore the innovative use of EDI by small firms to create market niches for information intensive services.

IIC, Inc., in conjunction with the Small Business Administration, selected the case study approach for several reasons. In situations in which a technology is still emerging and developing, surveys, which require considerable time to prepare and return, are not as useful as case studies in generating up-to-date information and data. Also there has been relatively little prior research in this area and therefore there does not exist a large number of hypotheses or theories regarding the effects of EDI that could be empirically tested in a broad-based survey. In addition, existing research on the business implications of EDI indicates that evaluation of EDI from a cost/benefit perspective is difficult due, in part, to idiosyncratic circumstances that vary substantially across organizations within an industry. Therefore it makes more sense at this stage of our analysis to assess EDI investments on a case-by-case basis. A case study approach enables one to identify the major cost/benefit categories and to summarize individual EDI experiences such that more specific cost/benefit estimates can be determined within the targeted industries.

Methodology

The case study methodology included three steps: (1) the selection of the industries for study, (2) identification of data, and (3) collection of the data.
Case Study Selection

The selection process began with the development of certain criteria for selecting potential industries or market areas for the case studies. Table IV-1 lists the criteria that were used to develop an initial listing of industry areas for study. As can be seen, various factors were important. For example, in order to examine the differential impact of EDI technology on small businesses compared to large ones within the same industry, it was necessary for each selected industry to include a mix of both small and large firms. In addition, to determine whether firms that adopt EDI technology in the early stages have a comparative "first mover" advantage over those which adopt EDI technology later, it was important that each industry include ones whose rate of adoption of EDI varied considerably. These first two criteria were also used to determine whether small businesses were over-represented among the firms that are slower to adopt EDI technology.

<table>
<thead>
<tr>
<th>Selection Criteria for Case Studies</th>
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<tbody>
<tr>
<td>Industry Structure:</td>
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<tr>
<td>Rate of Adoption of EDI:</td>
</tr>
<tr>
<td>Diffusion of EDI:</td>
</tr>
<tr>
<td>Standards:</td>
</tr>
<tr>
<td>Role of Government:</td>
</tr>
</tbody>
</table>

To assess whether the diffusion of EDI technology throughout industry in general has had an effect upon the competitive advantage of small businesses, we required at least one industry which had adopted EDI and was a "heavy user" of EDI and another industry where EDI was just
being adopted. Because of the perceived importance of standards to the adoption of EDI, we also
wanted to select industries in which different levels of EDI standardization had been achieved.
Given the interests of the SBA we also wanted to select one or more industry areas in which govern-
ment policy and the role of the government had an impact on the use and adoption of EDI. Lastly,
to facilitate the collection and analysis of data and information, we selected industries within which
we have knowledge, experience and contacts.

Through a quick survey of existing literature and consultation with several individuals working
in the field of EDI we narrowed our focus and selected the final six candidate industry areas for our
study. In consultation with SBA, we made a final selection and began the process of data identifica-
tion and collection for each case study.

Identification of Data

We used the conceptual framework as well as information collected in the preliminary steps
of our analysis, including the SBA's Statement of Work, as a basis for defining the information that
we sought to collect in the case studies. Certain basic elements included:

- types or forms of EDI being used,
- the rate of adoption of EDI,
- the costs and benefits of EDI,
- firm size/distribution and other competitive factors,
- identification of the work flow aspects related to EDI,
- identification of relevant standards,
- effect of government policy regarding EDI.

From these basic data elements more detailed sets of information were identified and general
"guidelines" for collecting information were developed for each case study. These guidelines pro-
vided more detail regarding the information that was to be collected through both the literature review
and interviews. Table IV-2 (located at the end of this chapter) lists the guidelines grouped according
to the general elements of information we sought to collect.

In addition to this information, the conceptual framework led us to believe that we might
observe certain relationships regarding the rate of adoption of EDI, and the role of small firms in that
process. For example, we expected to find that the rate of adoption of EDI technology differs across
industries and according to different applications. Our preliminary research indicated that the early implementers of EDI within an industry may realize competitive advantages stemming from either cost savings or product differentiation and that more often than not it was large firms who gained these first mover advantages. Also, in industries characterized by a high degree of price competition, we expected that diffusion of EDI would be more rapid since it can result in lower costs. Other key factors relating to the rate of adoption of EDI which we sought to investigate were the use of VANs and the level of information technology sophistication within individual organizations.

Collection of Data

We used two methods for obtaining data for the case studies: literature review and interviews. For each case study, we conducted a thorough literature search, examining the economic and technical aspects of EDI as it related to each particular case study. Sources included book-length studies, business and economic periodicals and company directories and reports. Technical sources included books, articles from trade press and technical articles, and books and articles published by standards bodies and various EDI conference materials. The two basic goals of the literature review were to develop the necessary background information about each case study in order to conduct interviews in a timely and intelligent manner as well as to substantiate results obtained from the interviews. We have compiled an annotated bibliography of the sources we have reviewed which is contained in Chapter XI.

We also conducted informal interviews with small and large EDI users, EDI software and service vendors (including VANs), industry trade groups and other key players in each case study. Preliminary contacts were made by phone or in writing and follow-up meetings and phone calls were used to elicit data and information. We used the general guidelines for discussion as the basis for developing information regarding EDI use in the interviews. We appreciated the time and effort taken by those whom we interviewed. On average we contacted between 7 and 15 individuals for each case study. We generally found that the responses we received in the interviews corroborated well with the information we had developed from the literature review. In some cases where conflicting information was provided, especially from different interviews, we attempted to discern and reconcile through additional interviews and review of the literature the apparent conflicting results.

1During the course of our study members of the project team attended several conferences relating to EDI use and the role of small business and EDI.
Each of the case studies is described in the following chapters of this report. Each chapter follows the same general outline, beginning with a description of the industry and background regarding the use(s) of EDI, the rate of adoption, the role of standards and the government, a discussion of the effects of EDI on small business, and a summary of our findings.

Guidelines for Information Collection

Adoption of EDI
- Reasons for using/adopting EDI
- Decision-making process related to adoption of EDI
- Use of pilot program(s)
- Time required to implement EDI
- Rate of adoption of EDI within the industry

Forms of EDI
- Description of EDI application
- Description of EDI hardware, software
- Availability of commercial software for EDI application
- Form of telecommunications (third party service, VAN, direct line, etc.)
- Decision regarding choice of telecommunications

Standards
- Identification of data format being used
- Details regarding format and involvement in standards development process
- Proprietary standard's effect on competitive environment
- Relationship between standards and rate of adoption of EDI
- Role of small firms in standards process
- Role of user groups

Competitive Factors
- Identification of first movers by size
- Integration of EDI with trading partners
- Firm size/distribution of trading partners
- Impact of EDI on ability to compete
- Impact of EDI on ability to compete with large firms
- Response of competition to EDI
- Change in market share or profitability related to use of EDI

Table IV-2
Guidelines for Information Collection (cont.)

Cost/Benefit Analysis
- Identification of barriers to adoption/implementation
- Quantification of EDI usage within the firm
- Degree of complexity of EDI usage
- Identification/quantification of costs of EDI
- Use of related technologies
- Identification of potential benefits realized via EDI
  - reduced paper flow
  - reduced inventories
  - faster turnaround time
  - reduced staff/lower labor costs
  - improved customer service
  - better trading partner control of business processes
  - ability to offer new products/services
  - competitive/strategic benefits
- Any quantification of benefits
- Comparison of costs vs. benefits
- Realization of benefits vs. rate of adoption

Work Flow
- Extent of organizational changes prompted by adoption of EDI
  - modified paper flow, redesigned jobs, decreased staff, etc.
- Use of paper back-up
- Use of EDI to enhance other internal processes
- Extension of EDI to other business processes

Role of Government
- Degree of interaction with government
- Identification of ways the government can assist in the process of EDI adoption
- Role of SBA

Table IV-2
Chapter V
EDI in the Retail Industry

Introduction
The term "distribution chain" refers to all of the firms who participate in bringing finished goods to consumer markets. Manufacturers, importers, distributors, transporters, franchises, and retailers all play key roles in the distribution chain. All of the different players along the distribution chain share the common goal of satisfying consumer demand, which makes communication among these players the chain's lifeline. The more quickly and effectively these players share information, the more likely they will give consumers precisely what they want, when they want it. Given that good communication is so vital, it is not surprising that members of the distribution chain were among EDI's earliest pioneers. EDI was first used by the distribution chain as early as the 1960s, and since then EDI has become a permanent and essential part of it.

In this case study, we focus upon how EDI has affected one component of the distribution chain: the relationship between suppliers and retailers. In particular, we focus upon suppliers and retailers involved in selling "softgoods," i.e., clothing, accessories, household items, electronics, etc.¹

Large softgood retailers were among the first in the distribution chain to take an interest in EDI, and also the first to pressure business partners (namely suppliers) to join them. These large retailers have also led in integrating EDI with other information technologies and in developing and maintaining industry standards. Given the early adoption of EDI in this area and its more mature use, we have focused on this study to provide insights into how small firms deal with EDI as it diffuses and becomes entrenched in an industry. Since large firms in other industries may similarly lead in the development and implementation of EDI, this case study may reveal how small firms in such industries will be affected by EDI in the future.

The Role of Information Technologies in the Retail Industry
To understand how EDI has influenced the retail industry, it is important to first understand the industry trends that have simultaneously created the need for and been fueled by information

¹Retailers of softgoods include mass merchandisers, department stores, specialty stores, office supply stores, etc. They do not include grocers and other food retailers.
technologies such as EDI. The first trend has been toward mass merchandising, i.e., selling a broad assortment of many different types of goods. To take advantage of economies of scale in purchasing, accounting, and other business functions, many mass merchandisers have found it to their advantage to increase the number and size of their outlets. While this trend was particularly prevalent during the 1950s and 1960s, the recent dramatic growth of Wal-Mart indicates that this trend persists today. A second trend has been towards "niche" marketing. The counterpart to mass merchandising, niche retailers cater to the unique needs of particular consumers. Niche retailers include retailers such as the "killer category" stores that offer an extraordinarily broad array of a single category of merchandise (such as office supply and home improvement stores), as well as retailers that emphasize service, market to particular age groups, or target large families.

Several technological advances have facilitated mass merchandising and niche marketing. On the manufacturing side, new production techniques have allowed suppliers to economically produce a far broader assortment of sizes, colors, patterns, and styles than in the past (Pashigian 1988). At the same time, the broadening effect on assortments afforded by these new techniques has been amplified by a proliferation of imports. One small clothing manufacturer, for example, announced in January that it was increasing the number of items in its line by 70 percent (Agins 1994). Retail consultants expect manufacturers to continue to diversify their product assortments. No doubt, offering a broader and more unique assortment of goods allows retailers to better satisfy consumers. Yet controlling the flow of goods through the distribution chain becomes increasingly difficult as the number and variety of items increases.

Lacking innovative means to handle this increased flow of merchandise, business operations such as inventory control, sales monitoring and forecasting, purchasing, and routine business communications became more paper and labor intensive, prone to error, and costly. For example, to determine when stock needs to be replenished, retailers without computer technology had to manually count each item in their stores and warehouses, record the total number of items into an inventory ledger, determine the number of items to be purchased, and order items from suppliers. Retailers infrequently took inventory because it was an extremely labor-intensive and costly process. And with lead times as much as 34 weeks in some segments of the retail industry (Pashigian 1988), retailers made purchasing decisions far in advance of the selling season.\(^2\) Because their operations

\(^2\)"Lead time" refers to the amount of time that lapses from the time an item is ordered to when it is received.
were too slow to respond immediately to consumers, retailers would often sell out of the items in high demand while being overstocked with unwanted items.

Starting in the 1960s, retailers, particularly large mass merchandisers, developed several new retail-oriented technologies in an effort to streamline their internal business operations. Perhaps the most important of these technologies is the Point-of-Sale (POS) inventory management system. A POS system essentially computerizes and integrates inventory ledgers with cash registers. As stock is brought into a store, the volume of each item is recorded into the retailer's computer system. Each time a consumer makes a purchase (the "point of sale"), a scanner at a check-out terminal "reads" the item codes and deducts the volumes sold from the inventory record. The retailer's computer therefore constantly monitors inventory levels, which allows retailers to instantly know how well specific items are selling. The retailer can then readily pinpoint which items need to be repurchased and in what volumes, increasing the likelihood that it can replenish popular stock in time to satisfy consumers (Biby 1992). The retailer can even program its POS system to flag when inventories reach levels that warrant reordering additional stock.

Once retailers acquired the components of POS systems, i.e., a computer, check-out terminal(s), and a scanner, other computer applications followed. For example, a Price-Look-Up (PLU) system allows cashiers to quickly and accurately identify the current selling price of every item. Retailers using PLU maintain a computer database which stores item codes and current selling prices. When cashiers scan an item's code, the check-out terminal instantly retrieves the current selling price associated with that item's code and charges that amount to the consumer's account. Retailers have found that PLU reduces the time consumers spend in check-out lines, reduces the costs associated with cashier error, and eliminates the costs associated with affixing price tags to individual items. Furthermore, since PLU allows retailers to economically change prices more frequently than before, retailers are better able to insure that their prices reflect current market conditions.

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3 Some state and local governments still require that individual price tags be affixed on certain types of items, thus moderating this benefit for some retailers.
The Evolution of EDI in the Retail Industry

As retailers streamlined their internal operations through the use of PLU, POS, and other technologies, itfollowed that they should also streamline their interorganizational operations, i.e., their communications with business partners. Communications between retailers and suppliers, which include purchase orders, invoices, and receipt acknowledgements, were paper and labor intensive and prone to error. If, for example, a supplier misread a purchase order and provided the retailer with the wrong stock, lead times would be extended and costs would increase. In response, large mass merchandisers began to push suppliers, both large and small, to communicate with them using EDI. These retailers developed proprietary systems as early as the 1960s which automated routine correspondence between retailers and suppliers. These "first mover" retailers recognized "first tier" benefits of EDI: shorter lead times, reduced inventory levels, improved data accuracy, and streamlined merchandise handling. EDI gave the first movers a competitive advantage over other retailers who could not communicate with suppliers as quickly, efficiently, and accurately.

After retailers began to use EDI, some realized how EDI complemented the new information technologies developed for internal purposes. For example, if a retailer integrates EDI and POS, the retailer's computer system determines when inventories are critically low and then uses EDI to simultaneously and automatically send a purchase order to the supplier (Thierauf 1990, 31). If EDI and EFT (Electronic Funds Transfer) are integrated, the retailer automatically transfers payment at a specified time. By integrating EDI with other computer technologies, retailers achieve benefits greater than the sum of benefits afforded by these technologies individually. Retailers saw these integrated systems as a means to dramatically simplify and improve their operations. Suppliers similarly saw opportunities to integrate EDI with their own computer technologies.

The advantages to the distribution chain afforded by integrating EDI with internal computer systems are the "second tier" benefits of EDI. These integrated systems are the backbone of what retailers call Quick Response or Rapid Replenishment programs. A Quick Response program completely restructures how retailers control their inventory. Rather than purchase large quantities of items on a seasonal basis, a retailer using Quick Response purchases small quantities of items on an as-needed basis. And because the retailer knows which of its stores need inventory, the supplier sends the needed inventories to the retailer's warehouse with labels identifying to which stores the items need to be forwarded. This saves the retailer from having to determine the

V-4
quantities that each of its stores needs. With some retailers, suppliers send the needed inventories directly to the stores in need, thus circumventing the warehouse altogether. With Quick Response, the retailer reduces warehousing and distribution costs, lead times, and operating costs.

Suppliers' functional equivalent and complement to Quick Response is a Just-In-Time (JIT) manufacturing program. A supplier using a JIT program receives not only routine correspondence such as purchase orders from its retail business partners, but it also receives detailed sales data using EDI. Suppliers then use these data to develop sales forecasts and plan production schedules. The supplier's goal is to manufacture precisely what is demanded just as the retailers need it. Prior to EDI, the supplier had to manufacture goods far in advance of purchase order receipts and keep high inventory levels in anticipation of the large and infrequent orders that retailers would place. Just-In-Time manufacturing allows suppliers to greatly reduce warehousing and distribution costs and minimize the likelihood of shortages and overruns (Dysart 1992).

A current trend in the retail industry, VMI (Vendor Managed Inventory), allows suppliers to directly participate in retailers' Quick Response programs. With VMI, the retailer shifts to the supplier the burden of deciding when and how much merchandise to order. The retailer provides its supplier with sales data from each of its stores, and the supplier uses these data as well as its own judgment to determine how much merchandise each of the retailer's stores needs. The supplier then provides the needed merchandise without the retailer ever placing a purchase order. To prevent the supplier from overstocking the retailer's stores, the retailer often imposes volume limits or other guidelines and/or withholds payment to the supplier until the merchandise is sold to consumers. VMI capitalizes on the experience and knowledge of both the retailer and supplier, further reducing inventory and operating costs. VMI is now being used by only the few largest retailers and suppliers, but its popularity will likely grow in the future.

Currently, most retailers and suppliers using EDI are in various stages of transition from paper to computerized operations. Even sophisticated EDI users still use paper correspondence with those business partners who are not EDI-capable or maintain paper back-up files of routine communications. Because they perform their routine business functions using both traditional paper

4 Distribution and delivery costs are reduced because suppliers are less likely to produce and ship items that prove to be undesirable to consumers. Even if the per-unit shipping cost is unchanged, the supplier ships fewer items and thus spends less in total shipping costs.
methods as well as new electronic technologies, their operations can be thought of as hybrid systems. The more a firm shifts from paper to electronic systems, the benefits of Quick Response and Just-In-Time programs are magnified.

When all members of the distribution chain are trading information electronically and the hybrid systems in the entire distribution chain are replaced with electronic ones, the benefits of EDI will be fully exploited. If this can be accomplished, all routine paperwork will be eliminated from the distribution chain. Information recorded by retailers’ POS systems will instantly flow to suppliers, transporters, and even those involved in the production of raw materials so that each can perfect its schedule. There will be virtually no need for warehouses and distribution centers because goods will be manufactured just in time to supply retailers. Lead times will be eliminated completely. There will be no costly shortages of highly demanded goods nor surpluses of undesirable stock. These ultimate goals of EDI, which benefit individual members of the distribution chain as well as the distribution chain as a whole, have yet to be achieved and can be thought of as the “third tier” benefits of EDI in retailing.

Standards in the Retail Industry
To attain the benefits of Quick Response and Just-in-Time programs, retailers and suppliers realized the need to standardize product codes and to standardize EDI protocols. Prior to EDI, suppliers and retailers had often assigned their own product codes or numbers to the same item and used these codes only for internal purposes. As suppliers began to receive POS data from retailers, it was clear that all members in the distribution chain needed to identify items using the same numbers. Starting with the grocery industry and following with other retailers and suppliers, members of the distribution chain began to identify items using UPC (uniform product code) bar codes, a system that has proven to be successful and widely accepted. Using the UPC standard, manufacturers assign a unique number to each item and register the number with the Uniform Code Council (UCC). These numbers, which are represented with a series of bars that can be “read” using a bar code scanner, are printed on an item’s label or tag. All members in the distribution chain, including manufacturers, transporters, and even competing retailers, identify a given item using the same number. Bar codes are also used for uniquely identifying boxes of items, as well as cartons, pallets, and containers.
The need to develop EDI protocol standards increased as more retailers developed proprietary EDI systems. As illustrated in Figure V-1, in this environment of proprietary systems, the large retailers acted as "hubs" and the suppliers to each of the retailers acted as their "spokes." As large retailers each developed their own proprietary EDI systems, suppliers, who often did business with many retailers, were forced to contend with an increasing number of unique and conflicting systems. Suppliers found that being the spoke to more than one hub was difficult in the absence of industry standards and neither suppliers nor retailers could maximize cost savings if EDI proved tedious for either. In July 1986, the Voluntary Interindustry Communications Standards (VICS) was established by members of the retail, vendor, and textile manufacturing firms (Thierauf 1990, 31). VICS, which has been aligned with ANSI from its inception, is the standard for the retail industry, excluding food manufacturers and grocers which have their own standard.
The Uniform Code Council, which administers VICS, initially adopted standards that were taken largely from the proprietary systems developed by the large firms. Additions and modifications to the VICS standards are decided by the Standards Maintenance Committee, which is composed of eight manufacturers, eight retailers, one motor carrier, and one representative each from Canada and Mexico. Anyone, including non-members of the UCC, can submit suggestions to this committee. Hearings are held three times a year, and while everyone can participate in discussions, final decisions are made by the Committee. In recent years, most firms that had developed proprietary systems have replaced them with the VICS standards, and most first time EDI users choose VICS.

VANs are also helping the standardization process. While some retailers originally maintained direct connections with suppliers, VANs can provide retailers and suppliers with the flexibility to communicate with many different business partners through a single VAN. In fact, many of the previously proprietary systems of large retailers have evolved into or contributed to third party networks. For example, Sears' proprietary EDI network has merged with IBM to become the Advantis network which offers value-added services in the retail and other industries.

Interview Focus and Hypotheses
To assess how small firms in the retail industry are being impacted by EDI, we interviewed suppliers and retailers (both large and small), industry specialists, academics, VANs, and a representative of the Uniform Code Council. Our first goal was to analyze why EDI technology was developed and first implemented by large mass merchandisers. Virtually none of the early implementers in the retail industry were small, and our goal was to understand why small firms did not take the lead. We focused upon small suppliers who do business with large retailers so that we could identify the characteristics of small firms that best respond to pressure from large business partners to implement EDI. We also focused upon small retailers, to assess whether and why they felt they were at a competitive disadvantage relative to the large retailers who lead in implementing EDI.

Our second goal was to understand the ways in which EDI is being implemented by small suppliers and retailers. Our research showed that EDI is now so diffused in the retail industry, there are many different software packages, VANs, and other services available to small businesses.
interested in implementing EDI. Our objective was to identify how small retailers and suppliers learn about EDI and evaluate all of these innumerable options, given that they may lack the time and resources to do so. We also strove to identify the different ways in which EDI can be implemented by small firms in the retail industry and the conditions that make each of these options economical for small firms.

A third goal was to identify the benefits and costs of EDI to small businesses. Since small firms lagged larger ones in implementing EDI, small firms did not capture first mover advantages. Our objective was to identify the benefits that small firms were able to realize and to learn how small firms change their strategies to maximize these benefits. We also attempted to identify the hardware, software, and network costs associated with not being first movers. An a priori hypothesis was that the VICS standards, because they were based heavily upon the proprietary standards developed by large retailers, better suit large firms than small ones. We explored in our interviews whether small firms felt that there was a bias and we investigated how this bias was perpetuated.

A final goal was to identify the long-term impact of EDI on small suppliers and retailers. Since EDI perfects the flow of information across the different parties in the distribution chain, we hypothesized that firms whose primary business is in capitalizing on imperfect information flow may be in jeopardy. For example, middlemen, such as importers or distributors whose businesses are based on an ability to do business with suppliers and retailers better than they can with each other, might suffer if EDI allows suppliers and retailers to communicate directly with one another. On the other hand, we hypothesized that the dramatic changes in the distribution chain caused by EDI and related technologies would likely create needs for new services. Since small firms are typically most able to fill newly created needs, we attempted to identify specific examples of small firms that are successfully responding to the changing needs of the distribution chain.

Findings: The Use of EDI in the Retail Industry

Characteristics of the First Movers

The earliest, most sophisticated users of EDI in the retail industry are mass merchandisers, such as Sears and Wal-Mart, and to a lesser extent, large manufacturers such as Levi's. There are several reasons why large retailers, as opposed to small ones, have proven to be on the forefront
of EDI use (Radosevich 1993b). First, they have large MIS departments and extensive knowledge of computer technology. These departments developed and implemented other computer technologies such as POS and were therefore well prepared to develop EDI systems. Second, the mass merchandising market is extremely competitive and profit margins are narrow. There are many mass merchandisers selling virtually identical products, so all are under considerable pressure to reduce costs and keep prices low. Third, these retailers were in the best position to profit from the first tier benefits of EDI. Because of the large number and size of their outlets, these retailers were required to closely monitor inventory and repurchase large quantities of merchandise. Moreover, they stock many different types of products, requiring that they deal with a large number of suppliers. On the other hand, small retailers neither had the resources needed to develop EDI systems nor as strong a need to streamline since their smaller operations were simpler and less burdensome.

Response by Small Suppliers

The diffusion of EDI among small suppliers is primarily dependent on pressure from retailers. Most small suppliers adopt EDI at the urging of their retailer trading partners. The large retailers who developed EDI began encouraging their suppliers to join in the use of EDI as early as the 1960s, and the largest mass merchandisers are just now converting the last of their suppliers to EDI. 5 Retailers have taken several different approaches over the years to convince their suppliers to join them. Subtle encouragement by retailers has in many cases evolved into more extreme levels of coercion as they attempt to get their remaining suppliers on-line. The most extreme position taken by retailers has been the "letter bomb," in which the retailer informs the supplier that it must use EDI or their business relationship will be terminated. Other retailers have issued financial ultimatums. For example, one small manufacturer that we interviewed said that it was told by a large retailer that if it did not implement EDI, the retailer would charge $50 for each paper invoice it received. While letter bombs are used, they are usually retailers' last resort. Retailers typically send letter bombs after less oppressive techniques have successfully convinced most of their suppliers to use EDI. These techniques include providing free or discounted software, training and technical support, and other forms of assistance regarding the implementation and use of EDI.

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5In 1993, an industry consultant reported that 95 percent of the trading partners of the fifteen largest retailers were using EDI (Radosevich 1993b).
While most suppliers wait to implement EDI at their trading partners' initiative, the level of successful EDI implementation among small suppliers appears to be dependent on the level of information technology already in use within the firm, the initiative within the firm to investigate EDI before it becomes a trading partner mandate, and the degree of cooperation by trading partners in adhering to standards. We found that those that were best prepared to implement EDI tend to share the following characteristics. With uncanny frequency, we found that successful adopters tend to be those firms which have an EDI leader: a single employee who is computer literate, innovative, and responsible for pushing her/his firm and trading partners into using EDI and other related technologies to their fullest potentials. Enabled by a certain level of computer literacy among the business decision-makers, these firms did not wait until a letter bomb arrived before they took an interest in EDI. They heeded the earliest warnings from retailers and learned as much about EDI as they could before they tried to implement it. Such firms had already successfully computerized many of their internal operations and saw EDI as being one component of their Just-in-Time strategy rather than as a means to automate their routine correspondence with retailers. Due to this experience in implementing and using information technology, these firms were able, when determining hardware, software and network service needs, to take a proactive role in finding what was optimal from their own perspectives. They did not rely upon the retailer trading partners to make the decision for them and, thus, were able to adopt EDI earlier and more successfully than other competitors. Interestingly, the size of the firm did not seem to be significant in determining which firms most successfully use EDI. The two most innovative suppliers that we have learned about in this study had fewer than 25 employees when they first successfully implemented EDI. In general, the more proactive a supplier was in trying to implement and integrate EDI technology, the more satisfied it was with EDI.

On the other hand, we found that some small suppliers have had far less success in implementing EDI. The overriding characteristic of the small suppliers that are struggling with EDI is that they waited until they received a letter bomb before they even learned about EDI. Lacking an EDI leader within the firm, they relied too heavily upon the retailer for guidance in choosing an EDI system and often blindly accepted the software the retailer provided. As a result, they neither fully understand their EDI system nor have a system that suits their needs. Third, these firms tend to have had little or no prior experience with computer technology and also have not computerized their internal business operations. Fourth, these firms typically do only the bare minimum to satisfy their exchange partners. Due to a lack of knowledge of the benefits of integrating EDI with other
internal applications, they use EDI to send and receive routine correspondence but they do not view EDI as part of Just-In-Time manufacturing or other integrated information-intensive processes. These firms tend to use EDI only with those retailers that insist upon it and continue to use paper correspondence with others.

An interview with a small supplier revealed another reason why adopting EDI may be challenging for small firms. This supplier, an importer with only four employees, explained that she implemented EDI hoping to impress one of her large retail accounts. She had purchased the software recommended by the retailer, and relied exclusively upon the retailer for training. She explained that she followed the retailer's advice because the retailer still used a proprietary system and did not adhere to industry standards. While she had hoped that EDI would give her a competitive edge over other suppliers, she felt that she had not realized any competitive advantages. The retailer's proprietary system was the stumbling block. The importer explained that the retailer's computer was often down, and the retailer changed the protocols too frequently for her to keep track. The retailer provided only a half day training, and no outside source could help her because only the retailer knew its proprietary protocols. For a supplier as small as this importer, adherence to industry standards by retailers will be necessary before she can economically use EDI. While proprietary systems are now rare in the retail industry, this case illustrates why some suppliers struggled with EDI in the era prior to industry standards and why widespread use of EDI did not occur until after firms abandoned proprietary systems for industry standards (Radosevich 1993b).

Response by Small Retailers

Small retailers do not receive the same pressure from large suppliers that small suppliers receive from large retailers. One EDI specialist that we interviewed suggests that the reason for this difference may be because of the nature of the relationship between supplier and retailer. She explained that the old adage applies, "he who has the gold makes the rules." Those small retailers who do implement EDI do so in order to compete with large retailers who have successfully implemented EDI and enjoy first mover cost advantages. The first small retailers who used EDI were those that most directly competed with large retailers. It is still generally true that the small retailers who have implemented EDI are those that most directly compete with large retailers — both in terms

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6In all of our interviews, we learned of only two cases in which retailers insisted upon using proprietary systems. It is generally believed in the industry that these retailers are not realizing any benefit by maintaining proprietary systems.
of their product mix and geographical proximity to large retailers. Unlike small suppliers, small retailers for the most part never faced the difficulties of dealing with proprietary systems, since most adopted EDI after industry standards were developed. These small retailers are not without challenges, however. Retailers need to determine whether EDI implementation has become a competitive necessity, and if so, determine which system best suits their needs.⁷

There are now many different hardware, software, and network services available for retailers, and choosing the right system is especially challenging for small firms. One small clothing retailer that we interviewed first implemented EDI seven years ago. She explained that she competes directly with several large chain stores in a downtown shopping area, all of which had implemented EDI. She believed EDI, as well as other technologies such as POS, PLU, and EFT, were now necessities for her to compete. She explained that her greatest challenge was in finding the EDI system that most suited her needs. Neither her business partners nor software vendors could make sound recommendations to her. The first software package that she bought seven years ago was a complete failure, for what is seemingly an esoteric reason. The software defaulted to placing the current date on purchase orders, and restricted her from changing this date. As she explained, she wanted the date to correspond with when she wanted to receive delivery, not with when she completed the purchase order. She scrapped the software and has since replaced it twice. She likened the experience to shopping for a car. She had done considerable research prior to making the purchase, and had identified the features that she felt she needed. Yet after she made the purchase, she discovered it did not have certain features that she realized only later that she needed.

There are many small retailers that choose not to use EDI. The primary reason is that they did not feel that EDI would offer significant cost savings over their existing practices because they did not exchange with trading partners the type or magnitude of information that would lend itself to an interorganizational technology such as EDI. These small retailers who do not use EDI tend to fall into one of three general categories: their information exchange with trading partners may be low in volume, infrequent, or non-routine.

⁷Suppliers are also faced with the challenge of determining how to implement EDI most effectively.
First, some are extremely small. They do not need POS systems because the cost of controlling the flow of inventory is manageable without computer assistance. Likewise, communication with suppliers is not burdensome because they can easily place orders over the phone or via fax. One large manufacturer has developed an 800 phone service designed specifically for the smallest retailers that sell its products. We interviewed a small retailer which was supplied by this manufacturer. She reported that she had been using EDI but switched to this 800 service because it was cheaper and just as easy to use. Alternatively, she can call or fax orders to a local sales representative of the manufacturer. She explained that she could not justify the user fees charged by her VAN. Her conclusion was repeated by a service bureau which said that EDI is not beneficial for the extremely small retailer which makes purchases on such an infrequent basis that the fixed costs of EDI cannot be favorably amortized.

A second type of retailer that has found it unnecessary to use EDI are retailers of one-of-a-kind or extremely expensive items that are not routinely reordered. Examples of such retailers include art galleries or exclusive clothing stores. The merchandise that these retailers sell is not available in large retail establishments, thus these firms do not feel as much competitive pressure from large retailers as others selling more mundane merchandise do. One such retailer that we interviewed had never heard of EDI. He explained that he purchased inventory in small quantities; when he sold out, he had no interest in repurchasing the same items. His competition were similar stores who likewise did not need EDI. A third type of retailer not using EDI are those selling close-outs. These retailers do not regularly stock any particular type of merchandise and are not loyal to a specific set of suppliers. They do not engage in routine business correspondence with suppliers and therefore do not yet need EDI.

Many of these retailers believed that they would be quite capable of implementing EDI if they chose; one retailer which has an extremely sophisticated POS system for internal purposes indicated to us that he felt no need to use EDI. Another had used EDI but found it cheaper and easier to send purchase orders via fax or through phone conversations with suppliers. Unlike the small suppliers that we interviewed, we came across a fair number of small retailers who had never heard of EDI.
Costs and Benefits

The hardware, software, and network services have become affordable to most small firms in the distribution chain. Most small firms interested in starting EDI need only a personal computer and modem (which they probably already own) and software that generally sells for between $500 to $1,000 (Stack 1991), and a VAN, whose initiation fees range from $50 to $300. They then must pay network charges to the VAN, and in some cases yearly software upgrades. Network charges vary depending upon the type of service the business receives, but most of the small businesses we interviewed reported monthly fees that did not exceed $100. The cost of the VICS standards manual is $600. In general, EDI costs have significantly decreased since the last decade. Prior to the advent of commercially developed software and third-party networks, firms were compelled to use the proprietary systems developed by the large retailers. Now there are numerous software vendors and VANs, many of which specialize in developing products and services for small companies. And with translation software and inter-VAN connections, small businesses no longer need to have systems identical to those of their trading partners. The possible combinations of hardware, software, and network services are as diverse as the retail industry itself.

Perhaps the greatest cost to small firms interested in implementing EDI is the cost of evaluating the innumerable options available to them. This cost is highest to firms with little experience using computer technologies. Because EDI technology is so new, small businesses tend to lack the technological expertise that large firms have in their MIS departments. Getting sound, unbiased advice is difficult. Business partners may be able to tell the small business what software and network service will work best for their partnership, but the business partner may not know what is best for the small business overall. For example, a business partner may provide software free of charge, but the software may not be able to perform functions that the small business needs for its other trading partners. Sometimes a business partner will recommend a more rigid system than is necessary. A business partner may suggest that a small business use the VAN that it uses itself, even though the small business might be able to communicate with the partner using any VAN. Yet when EDI is a foreign concept, and when business partners are applying pressure to implement EDI immediately, small businesses seem prone to short-sighted, inoptimal decisions.
User groups help small suppliers and retailers in deciding whether and how to implement EDI. For suppliers and retailers, the Uniform Code Council organizes annual user group meetings, and many of their sessions are well suited for small firms. The UCC user group meeting scheduled for October 1994, for example, included over forty workshops, some of which were designed specifically for non-EDI users, for small firms, for firms with limited financial resources, etc. These user group meetings provide an opportunity for small firms to meet with adept EDI users in their industry as well as with their own business partners. Attending the UCC meeting costs from $525 to $725, depending upon whether the firm is a member of the UCC. The National Retail Federation (NRF) similarly organizes workshops for retailers and suppliers which cater to the needs of small firms. An industry consultant with whom we spoke said that attending user groups is vital for small firms who lack the expertise to independently decide whether and how to implement EDI.

Most suppliers interviewed for this study felt that once they decided which system was right for them, the hardware, software, and transmission costs were easily justified in light of their cost savings. For example, one small shoe manufacturer interviewed stated that their costs of implementing EDI totaled $10,000 but that these costs were readily justified by the fact that the time needed to process orders fell from one week to 20 minutes. There are many alternatives available to suppliers who need to satisfy business partners' demands but are not yet ready to make significant investments. The shoe manufacturer that we interviewed explained that for six months after they implemented EDI, they continued to convert EDI invoices back to paper. This allowed them time to reengineer workflow from within their organization by integrating their EDI applications with existing and compatible internal applications without preventing them from satisfying their retailers. Once this integration was achieved, they were able to realize increased benefits from faster order processing and lower transactions costs due to decreased paper flow and a smoother flow of information within the organization.

Like the shoe manufacturer, others in the retail industry have found many ways to immediately become EDI-capable without reengineering or making significant investments until they are prepared. Some receive and transmit communications via fax (Sprinkle and Hooper 1990) and exchange data via diskette or tape. Others use service bureaus which act as intermediaries between the retailer and supplier. With one type of service bureau, Firm A communicates with the service bureau using EDI; the service bureau converts these communications to paper and sends them via mail or fax to Firm B. Firm B responds via mail or fax to the service bureau, who in turn
sends the correspondence via EDI to Firm A. Thus Firm B achieves EDI capability without investing in an in-house EDI system. Other service bureaus operate by leasing equipment and software and providing on-site technical assistance. Service bureaus set their fees to be affordable for small firms who are just starting with EDI. In general, service bureaus prove to be a viable alternative for small suppliers who lack the technical expertise and financial resources to implement EDI themselves (EDI News 1994). But as one director of a service bureau explained to us, service bureaus are cheaper—but not better—than implementing EDI in-house. This service bureau sees itself as an interim service, that is, a service for a small business to use to satisfy business partners' EDI mandates until it has the ability to economically do so itself.

There are many benefits to EDI for small firms. First, especially for small suppliers, it allows the small supplier to satisfy the large retailers who are clamoring for them to use EDI. Second, EDI streamlines their business functions, reduces operating costs, and allows them to continue to compete with larger firms who may have already implemented EDI. If the small firm implementing EDI has already implemented other information technologies, EDI enhances the benefits of those systems. Many firms are quick to quantify the benefits. One small supplier reported that EDI reduced the time to process a retailer's purchase orders from two weeks to one day (EDI News 1994). Retailers and suppliers report the cost of sending purchase orders and invoices has dropped by 75 to 95 percent (Canright 1988; Joyce 1989; Morgan 1992; Robins 1993a). While first movers were better able to capitalize on these advantages than followers, most recent adopters of EDI have also reported significant cost savings.

Small suppliers and retailers achieve "second tier" benefits of EDI when they integrate EDI with other systems, such as POS, PLU, and EFT. The most successful users of EDI that we interviewed described EDI as one component of their Just-In-Time manufacturing and Quick Response inventory control programs. These firms tended not to isolate the benefits of EDI, but rather spoke about the benefits of their entire systems, of which EDI was an integral part. Such small suppliers reported that they are better able to plan production schedules and more likely to provide retailers with products that are in demand. Small retailers reported that they are better able to quickly identify and replenish popular items, and thus are reporting improved customer satisfaction. While none reported that they had yet eliminated the need for warehouses, they did report significantly reduced distribution and related labor costs.
To realize these "second tier" benefits, suppliers and retailers needed to restructure their business relationships. The relationship between retailers and suppliers had traditionally been adversarial, but Just-In-Time and Quick Response programs require they establish more trusting and open relationships (Dysart 1992). For example, in order for the supplier to provide inventory to the retailer just as it is needed, a retailer needs to provide the supplier with frequent (often daily) data showing the rate at which the supplier's items are selling in each of the retailer's stores. Retailers had considered such information to be proprietary, and had not been in the practice of sharing such detailed information with anyone outside their organizations. Small firms that we interviewed reported that they were initially concerned that their business partners would share their proprietary data with competitors or use EDI as an opportunity to encroach on their businesses. These firms reported that to truly benefit from EDI, they needed to establish "partnerships" with their business partners. In these partnerships, suppliers and retailers freely share information for their mutual benefit, and they tacitly agree to not use this information for any other purpose. These partnerships are perhaps precursors to the establishment of the virtual corporation.

The Impact of VICS Standards and the UCC on Small Firms

There are no small firms on the UCC's Standards Maintenance Committee, the governing body of the VICS standards. As discussed earlier, the VICS standards were based heavily upon the proprietary systems developed by large retailers. As a result, small firms have not had significant, direct impact upon the development of the VICS standards. Given this fact, we hypothesized that VICS standards are biased against small firms. In our investigation, we sought to determine if large firms generate this bias against small firms intentionally in an effort to drive small firms out of business or to maintain first mover competitive advantages.

We have found no evidence of intentional malice on part of large firms in the standards process. We have, however, found that the lack of participation by small businesses in the standards process has worked to their competitive disadvantage. The director of a service bureau provided a useful illustration to us. She explained that at a UCC hearing organized to discuss proposed standards changes, large retailers proposed that firms be forbidden from using dot matrix printers to print bar codes, a standard that was ultimately not adopted. The retailers were assuredly concerned with print quality of the bar code, since bar code scanners fail if the bar code image is unclear. Had this standard been adopted, however, it would have had the unintentional effect of
placing undue burden on small businesses who only own dot matrix printers. The service bureau
director stated that she persuaded the large retailers that their proposal was unfair to small firms.
She added that this responsibility fell on her because there was a dearth of small businesses in
attendance at the hearing. An EDI technical specialist with the UCC told us that "mom and pop"
businesses simply do not attend the hearings at which standards are discussed. The cost for a
small firm to designate and send a person to the standards maintenance meetings can be
prohibitive.

Another concern regarding EDI standards in the retail industry is the lack of adherence to
standards. Most firms state that they adhere to the VICS standards, yet we learned of two large
retailers that still use proprietary ones. Use of proprietary systems is especially burdensome for
small firms. We interviewed one small supplier who had successfully implemented EDI with eight
large retailers using industry standards. Another of its large retailers recently told this supplier that
it wanted all of its suppliers to use a newly developed proprietary system in conjunction with a
specific VAN (different from the one the supplier used). The added burden of dealing with this
retailer seems unjustified in light of the widespread use of VICS standards. Yet the small supplier
probably has little alternative but to work with the retailer on its terms or lose that retailer's business.

An EDI technical specialist with the UCC provided another example of a firm not following
VICS standards to the detriment of small firms. She explained that one large, powerful retailer
requires that suppliers initiate the communication link to retrieve purchase orders from the retailers.
The retailer's incentive for this practice is that it shifts the communication charge from the retailer
to its suppliers, many of whom are small firms. The EDI specialist explained that this is a clear
violation of a VICS procedure, which requires that the firm which originates the communication must
initiate the communication link. While the UCC has indicated to this large retailer that it is not
adhering to the VICS standards, the UCC lacks authority to enforce the voluntary standards. And
the retailers' suppliers, especially the smallest ones, are probably too intimidated to complain to this
large supplier.

A far more widespread problem is that many suppliers and retailers who state that they
adhere to VICS standards do not strictly adhere to them. Many businesses, particularly the large
retailers, tend to "customize" the standards. That is, these firms adhere to the protocols for the most
part, but they implement their own unique rules and modifications on how and when certain protocols
should be used. In addition, each year when the UCC announces the new standards, some firms stay with the old protocols or instead choose to mix some of the old protocols with the new ones. The UCC refers to this problem as "static migration." Both customization and static migration complicate the use of EDI. This is especially problematic for small firms, similar to when they were faced with multiple proprietary systems in the era prior to VICS.

Long Term Impact of EDI upon Small Firms

In the long term, there will be many permanent changes to the distribution chain. Because EDI facilitates the sharing of information and streamlines the flow of goods, the distribution chain may become leaner and more efficient than before the use of EDI. One potential change may be that large suppliers may circumvent the retailers with which they traditionally do business and vertically integrate to become retailers themselves. The data that retailers provide suppliers give suppliers a wealth of information that they never had before EDI. For example, prior to EDI, a supplier could not pinpoint which of a retailer's locations was performing best or on which days of the week were items most likely to sell. Such information is critical for choosing site locations and planning retail promotions. Now that suppliers have this information, they can use it to become retailers themselves. In support of this notion is the fact that many large suppliers have opened factory outlets as well as full service stores in recent years. This may pose a competitive threat to small retailers, or even foreclose them from business. Middlemen, such as importers and distributors, also seem vulnerable since EDI makes it easier for retailers to communicate directly with suppliers and manufacturers.

We asked several people about these potential effects of EDI. We spoke to a small retailer whose principal supplier had opened an outlet store nearby and we spoke to a small importer in business with a powerful retailer. Both seemed vulnerable to the potential effects of EDI but neither credited EDI alone with changing its competitive advantage. The retailer felt that the supplier would have opened the outlet store regardless of EDI; the importer felt that if the retailer could bypass it, the retailer would have already. Perhaps the reason why no one is confident that EDI causes change to the distribution chain is because EDI has become widespread concurrently with so many other advances in the industry. It is perhaps more accurate to conclude that EDI, in conjunction with many other new information technologies, has led to structural changes in the distribution chain.
These changes are inevitable, and small businesses will need to face increased competition and/or the need to alter their strategic outlook.

Similarly, we have found no evidence of any firm being driven out of business because it failed to implement EDI. The director of a service bureau told us that she recalled many occasions of retailers pressuring suppliers to use EDI. Of these cases, she knew of only two that resulted in a retailer terminating its relationship with a supplier allegedly because the supplier was unwilling to implement EDI. Moreover, she added that it was her belief that these retailers had actually terminated their relationships for reasons unrelated to EDI but had used EDI as an alibi. Even if these firms had been driven out of business, the reason would not be because of a failure to implement EDI as much as because they failed to be responsive to their customers' needs.

The changes to the structure of the distribution chain will also present new opportunities for innovative firms and entrepreneurs. Since small businesses are often the most nimble and therefore the most capable of responding to a changing environment, they stand to benefit from EDI in the long run. One new opportunity is the service bureau, which provides EDI services to small firms on an outsourcing basis. One service bureau that we interviewed started as a small furniture supplier to large retail stores. A large supplier pressured them to use EDI in 1989, at a time when none of their 20 employees had ever heard of EDI. Those employees successfully implemented EDI and soon thereafter began to help other small businesses struggling with EDI. The firm now provides EDI services on an outsourcing basis to over 300 clients; it employs 70 people and revenues have increased 800 percent since 1989.

Another new opportunity proving beneficial to small firms is in sales data analysis. POS systems generate an enormous amount of sales data that if properly analyzed can be used to learn more about consumer demand. Such data, known as "scanner data" (because the data are collected by bar code scanners), are the sales information that suppliers receive via EDI from retailers. When properly analyzed, scanner data help suppliers plan production schedules, forecast demand, and even design better products. Scanner data help retailers plan promotions, determine price sensitivities, and customize services for consumers. The industry leader in scanner data analysis is a software company started in recent years by an entrepreneur. The market for scanner data analysis is growing at an extremely rapid pace, providing new opportunities for innovative small firms.
Implications for Other Industries

The retail industry was a leader in the development of EDI technology out of necessity. The first movers, large mass merchandisers, were under considerable pressure to reduce the costs associated with handling broad and deep assortments of merchandise. EDI allowed these retailers a means to automate their communications with suppliers, and ultimately to streamline and simplify the distribution chain, realizing substantial cost advantages. Small firms lagged these large first movers in part because their smaller operations were more manageable than those of the large firms and in part because they lacked the financial resources and expertise needed to develop proprietary systems. In other industries, small firms will most likely lag large firms but will follow their lead more quickly. We expect this to be the case because although small firms may be like small retailers in not needing to automate processes as much as their large competitors, the use of EDI has diffused enough in general that software vendors and VANs exist that can quickly develop EDI-related products and services for these firms once such a need exists. Such vendors and VANs did not exist when large retailers first developed proprietary systems in the 1960s.

Small firms in the retail industry that successfully implemented EDI shared several characteristics. They learned about EDI long before it became a competitive necessity, they viewed EDI as a business tool rather than a technology, and they took a proactive role in determining when and how to implement it. They found ways to implement EDI as soon as they felt it was necessary, and used interim means, such as exchanging diskettes and service bureaus, as they learned how to use "truer" forms of EDI themselves. Most importantly, they worked with their business partners in reinventing the ways in which they do business. They abandoned adversarial relationships for new partnerships, and worked together to streamline operations. Put simply, these firms saw EDI as a way to improve their businesses and have aggressively and consistently attempted to get the most out of EDI. We are confident that the small firms that successfully implement EDI in any industry will share these characteristics.

We found that standards play an important role in the diffusion of EDI. EDI became widely used in the retail industry only after the establishment of VICS standards. While proprietary systems work at first, they become burdensome as individual firms are forced to contend with an increasing number of systems. In the retail industry, this burden fell disproportionately on small firms whose large business partners had each developed different and conflicting proprietary standards. The
standards were developed out of prevailing systems at the time, which were the proprietary systems
developed by the large firms. As a result, large firms had disproportionate influence over these
standards. These standards may be subtly, but unintentionally, biased against small firms. In other
industries in which large firms lead in the implementation of EDI, we would expect that the standards
that emerge will be heavily influenced by the large firms' systems. The only antidote is for small
firms to actively participate in the standards process. Standards will better represent small firms
when small firms participate in the development and maintenance of standards.

Recommendations to the SBA

Both small suppliers and small retailers benefit the most from EDI when they understand the
efficiencies that can be gained from integration of EDI with internal processes and other information
technologies. We have identified how small firms may more quickly and accurately learn about EDI.

First, EDI needs to be demystified. Many small businesses in the retail distribution chain,
when they first learn about EDI, have unfounded concerns. One industry consultant told us that
many small suppliers to large retailers are concerned that if they implement EDI, the large retailer
will be able to peruse the supplier's computer and collect proprietary information against the
supplier's will. Too often, academics and consultants explain EDI in technical terms to potential
users who do not need to be concerned with those technical aspects. Software vendors explain EDI
in the context of their own products, giving potential users a distorted view of EDI. The SBA could
provide a publication to potential EDI users that would present a simple, non-technical, and unbiased
introduction to EDI.

Second, small businesses need to get involved in user groups and trade organizations.
These groups can provide small firms with unbiased advice specific to the retail industry, such as
information regarding software vendors, VANs, and industry standards. The SBA could provide
small businesses with information regarding established user groups and lobby that these user
groups address the needs of small firms. Further, the SBA could identify those industries which lack
user groups and facilitate their formation.

Third, small businesses need to participate in the development and maintenance of the VICS
standards. The standards in the retail industry are disproportionately influenced by large firms and
small firms have no voting rights in the approval of new and modified standards. The SBA could encourage small firms, through user groups, to get involved in the formation of standards and lobby for direct influence over standards maintenance.
Introduction

Electronic data interchange has been used in the healthcare industry since the mid-1980s when large medical and pharmaceutical suppliers (such as Johnson & Johnson, Baxter Healthcare, and McKesson) established purchasing networks between themselves and large healthcare providers. In much the same way that EDI provided benefits to the retail industry, so EDI afforded large providers, such as hospitals, the ability to better control their inventory and to receive new supplies just as quickly as they exhausted existing inventory. As in retail, these first systems were proprietary and available to only the largest providers from the largest suppliers. By the late 1980s, however, many of those with purchasing systems in place had begun to adopt industrywide standards for EDI, and their use had become more widespread.

Electronic claims processing followed in the early 1990s; spurred by large payers, such as Blue Cross-Blue Shield and the Health Care Financing Administration (responsible for payment of Medicare claims for the federal government), providers could file claims for payment electronically and receive payment much more quickly. With Medicare, the carrot of quick payment was followed by the stick of mandated electronic claims submission or else payment would be delayed. Large clearinghouses sprang up to bring the benefits of electronic claims submission (i.e., improved cash flow and error-free data entry) not only to the large hospitals, but also to physician groups and local pharmacies.

Despite these relatively mature uses of EDI in the healthcare industry, we have chosen to focus this case study on a somewhat new application for EDI, that of the Community Health Information Network (CHIN). A complex set of transactions is involved in the Community Health Information Networks, which allow for the collecting and sharing of patient, administrative, financial, and demographic data among providers, payers, suppliers, and those who pay for health care (e.g., government, employers, and individuals). The evolution of CHINs offered us an opportunity to explore the emergence of a new application of EDI in an area where larger players are already well versed in EDI and can provide leadership, and to examine EDI benefits in a cooperative, rather than competi-
tive, environment. We also believed that there were a variety of smaller players in this environment; EDI could give them opportunities to have access to the same information that was available to only the largest players otherwise. Whereas purchasing and electronic claims submission have more importance to the large providers, the CHIN application was equally accessible and important for small and large entities within the healthcare industry.

Background on Community Health Information Networks

As the costs of healthcare continue to escalate, and as the healthcare industry anticipates more intervention from the federal government following some type of healthcare reform legislation, two key points emerge: the public requires more information about who is providing what quality of care to whom, and the employers, payers, and policymakers need to know how much this care costs. Providers and payers alike have grappled with how to answer these questions, and one solution that has emerged is the formation of Community Health Information Networks (CHINs) that can electronically transmit, store, and use data about not only claims, but also eligibility and clinical conditions. Additionally, the system can provide management tools to point to the community's needs for additional types of clinical services, improved health care delivery, and need for wellness programs. CHINs represent a complex set of transactions, and demonstrate a new evolution of EDI in two areas. First, the transactions involved are complex and thus the standards and confidentiality issues are difficult to surmount. Second, the CHIN represents true electronic commerce, the practice of conducting business electronically within a trading community through the use of EDI and other related technologies.

National attention has focused on the costs of providing healthcare. Many professionals feel that escalating costs could be curbed by eliminating the administrative waste in the healthcare industry and by ensuring that unnecessary duplication is eliminated. The Workgroup for Electronic Data Interchange (WEDI), organized by the U.S. Department of Health and Human Services, issued its report in November 1993 and stated that $42 billion could be saved over the next six years if EDI were expanded to eleven types of healthcare transactions (Barrett 1994). The fragmentation of the $800 billion healthcare industry leads to inefficiencies and higher costs. For example, often tests and evaluations are repeated when a patient is referred to a hospital or another physician, rather than providing the medical records along with the referral. According to Moynihan and Norman (1994),
Physicians... are unable to access medical records for 30 percent of patient visits; 70 percent of hospital paper based medical records are incomplete; 11 percent of laboratory tests must be reordered due to lack of results availability; 50 percent of nurses' time is spent recording patient charts; and the average hospital medical record weighs 1.5 pounds.

Many hospitals and other large providers (nursing homes, HMOs, physician groups) established electronic linkages for either purchasing in the late 1980s or for electronic claims submission in the early 1990s. As the industry prepared for more comprehensive requirements from the federal government as part of some type of healthcare reform package, this expertise with electronic linkages was evaluated as a means to increase the overall efficiency of the healthcare industry within given communities. Furthermore, it was believed that such a network could collect information about the healthcare needs and delivery systems within a specific geographic area, then distribute this information to the community and to those who pay for healthcare within a community. Such information could include how healthcare dollars are spent, the cost-effectiveness of specific treatments, and the quality of care provided, segregated by numerous factors on request (e.g., by income group, by narrow geographic area, by employer, by lifestyle characteristics, etc.).

In 1992, the John A. Hartford Foundation provided $2 million to initiate pilot projects for CHINs at three sites: the states of Washington and Iowa, and the city of Memphis. Working with business and healthcare coalitions already established at the three sites, the Hartford Foundation also tapped the consulting services of Benton International, who had expertise in electronic funds transfer and financial networks, to develop functional specifications for a community health management information system. These functions are portrayed in Figure VI-1.
Functions of the CHINs:

- Make the healthcare claims process and financial settlement transactions more efficient.
- Provide the community with information on the cost, appropriateness, and effectiveness of healthcare providers.
- Provide employers with capacity for benefit plan and workplace health analysis.
- Provide the community with capacity for special wellness/health studies.
- Provide researchers and physicians with the capacity for medical effectiveness studies.

Requirements of the Integrated Systems of CHINs:

- Integrate hardware and software systems of the participants.
- Provide for extensive eligibility and claims processing support.
- Deliver remittances from payers to providers.
- Accommodate credit and debit card billing for non-covered balances.
- Create reports for providers, purchasers, and patients.
- Monitor and periodically report to the community on its wellness and healthcare delivery.

Source: Benton International, as used in Gardner (1992)

Working with these guidelines, numerous CHINs are beginning to be formed. Approximately 70 CHINs are in some stage of implementation throughout the country (Mitchell 1994). Besides the Hartford Foundation, other groups spearheading the formation of CHINs include telecommunications companies (such as Ameritech, which was instrumental in the forming of the Wisconsin Health Information Network), groups of managed care plans in a specific location (such as the collaboration that produced the California Health Information Network), and vendors (such as Integrated Medical Systems, Inc., which was instrumental in the formation of the Illinois Medical Information Network). The latest trend is for groups of hospitals to form their own working groups to begin planning CHINs; examples include groups in Chicago and Cincinnati.

The evolution of Community Health Information Networks is important not only for their immediate application but also for the longer term. As both the technology and the structure for how to share information among a geographically related group of providers, payers, employers, etc., are developed, the door is opened for networking more isolated areas. For example, rural and otherwise remote clinics can have access to the clinical expertise of the best physicians and hospitals in the
world via electronic linkages; this shared information could ultimately include diagnoses, clinical evaluations, prescriptions, treatment regimens, as well as x-ray images. Small hospitals or sole practitioners could have access to the same consultations and services that are currently only available to the largest hospitals with their staffs and technology. This concept of networking healthcare services could lead to a national network of healthcare information envisioned by former secretary of the U.S. Department of Health and Human Services, Louis Sullivan, when he discussed “smart cards.” Using a smart card (a credit card with a magnetic strip of encoded information, similar to a bank ATM card), a patient could access health care throughout the country from any available provider, who could access previous medical records, eligibility, and insurance information.

Applications for EDI and Other Technologies within a CHIN

In establishing linkages among the providers and payers in a community, many CHINs begin with systems that are already in place and the types of transactions they already know. The starting point for many CHINs is to use EDI to submit claims for payment to payers and to receive payment via electronic funds transfer. Another common use is to verify eligibility for benefits. EDI is also being used by human resources departments of employers to enter benefits coverage for new employees (or those whose status has changed, e.g., for dependents due to marriage or birth of a child) and to convey that information from personnel records to the insurance company or health maintenance organization (HMO) who provides the coverage.

Continuing on the administrative side, those who plan for CHINs envision that the data collected will be used by review organizations such as preferred provider organizations (PPOs), utilization reviewer, and case management companies. Figure VI-2 illustrates some of these administrative types of transactions.
But CHINs will do more than merely improve the administrative aspect of healthcare; they will allow providers to access clinical information from other providers to improve the quality of care provided to the patient and to make healthcare delivery more efficient and cost-effective. The referral of a patient from a primary-care physician to a specialist, the transfer of a patient from a hospital to a nursing home or to home for follow-up with a home health care provider, the reporting of lab results to a physician, and sending a prescription to a pharmacy are all examples of the types of transactions that a CHIN will allow where financial, clinical, and demographic data need to be transmitted and ultimately stored for later review. Examples of financial data include eligibility, claims submission, claims status, and pre-certification coverage. Examples of clinical data include lab results, radiology exams, consultations, history and physical information, operative summary, drug administration, referrals, discharge summary, EKG strips, admissions summary, physical
therapy, and respiratory therapy. Examples of demographic information collected might include name, address, phone, employer, occupation, family, race, religion, sex, education, consent forms, lifestyle or behavior information (i.e., family history, evidence of occupation-related illness or of substance abuse). Figure VI-3 summarizes the provider-to-provider types of data exchanges that a CHIN might facilitate.

Transmittion of clinical data especially lends itself to other technologies. For example, voice technologies might be used to automate the transcription of medical records, or to communicate directly the physician's evaluation to another physician. Imaging technologies might be used in combination with EDI to transmit x-ray films or EKG strips to a consulting physician or from a hospital to a primary physician. Bar coding, which has been used in inventory control in the healthcare industry, is being discussed for clinical management; for example, bar codes could be used for drug administration and management, in laboratories to track orders, specimens, and results, and dialysis cells to provide the identification necessary for reuse in the same patient (Chapin-Strike and Vogios 1994).
Standards as an Impediment to CHIN Development

The first EDI systems used in the healthcare industry were proprietary systems given to large providers by large suppliers for purchasing and inventory control. These systems were replaced in the late 1980s with EDI systems that used ANSI X12 standards. Similarly, the first electronic claims submission systems that evolved used proprietary linkages between providers and specific payers. Clearinghouses, such as the National Electronic Information Corporation, started up as a way to ease the way for a provider to submit claims to many payers without needing to use multiple proprietary systems. A clearinghouse such as NEIC served 60 private carriers and processed more than 12 million claims in 1991 with payers such as Aetna, CIGNA, CNA, General American, John Hancock, Mutual of Omaha, New York Life, Prudential and Travelers. The development of CHINs, with the types of transactions that need to be transmitted, has required a large technological advancement into new areas and the development of many new standards. CHINs will require connectivity across many systems and will necessitate using industry standards rather than proprietary standards.

There are numerous standards competing for adoption in the health care industry. Those best suited for financial and administrative transactions are ANSI X12 standards; those that developed to allow the sharing of information between hospital departments about patient care are HL7 standards; and those that were designed to facilitate laboratory and other clinical reporting use ASTM standards.

Initial EDI applications in health care used ANSI X12; these standards for purchasing, electronic claims submission, electronic funds transfer, eligibility verification, benefits enrollment, etc., are reasonably well developed at this time. Health Level 7 (HL7) is another standards group which is currently the standard for clinical transactions but is less robust and not as widely accepted; HL7 is more suitable for communication between different systems within the hospital environment, as opposed to communication between external business partners. The American Society for Testing and Materials (ASTM) has also worked with HL7 to expand their standard E 1238, initially developed for reporting laboratory results, to include many other components of patient care. Because hospitals have so much experience and software available for the ANSI X12 exchanges, they have resisted trying to expand the use of HL7. Smaller players, without software or experience with either EDI standard, are more willing to give the HL7 standards a chance and to see their advantages.
Healthcare professionals are all concerned that one set of standards be developed. To this end, on February 10, 1994, ANSI X12 and HL7 reached agreement on a joint working plan that will lead to a Memorandum of Agreement between the two standards organizations. More importantly, the Health Information Standards Planning Panel (HISPP) is the ANSI subcommittee responsible for coordinating the six groups involved with developing standards for health information. The activities of these groups include developing EDI standards for administrative and financial transactions to internal standards for transmitting hospital information. The six groups include ASC X12, Health Level 7 (HL7), National Council for Prescription Drug Programs (NCPDP), American Society of Testing and Materials (ASTM), American College of Radiology/National Electronics Manufacturing Association (ACR/NEMA), and the Institute of Electrical and Electronics Engineers (IEEE). This last group, the IEEE, is responsible for designing the overall data model, which will integrate the activities of the other five groups (DeBow 1994). Other groups that are discussing (but not developing) standards include the Workgroup on Electronic Data Interchange (WEDI), which grew from an effort organized by the U.S. Health and Human Services Department several years ago to study the uses of EDI in healthcare, the Healthcare Financial Management Association (HFMA), and the Computer-Based Patient Record Institute.

A report by the U.S. General Accounting Office (1993b) described the progress that had been made thus far by voluntary standards-making organizations in advancing the automated patient record. However, the GAO concluded that although the federal government prefers to let private voluntary standards groups lead the way in standards formation, the lack of adequate progress toward the healthcare patient record standards would probably require some leadership from the federal government. The GAO believed that the computerized patient record was vitally important to evaluating the effectiveness and benefits of the health care for which the government pays $808 billion annually. Suggestions made for Congressional approval included providing resources to HISPP to provide leadership and giving standards development a more prominent role in the federal government. Also suggested are providing incentives for timely completion of standards, including tying the use of standardized medical records to Medicare reimbursement, and funding pilot projects demonstrating the technology required to implement standards and share information in the complex healthcare setting.

The Computer-Based Patient Record Institute was a response to that report. The CPRI is currently proposing a public/private project over four years to accelerate the development of stan-
standards for the computer-based patient record, a key ingredient for the CHINs' plans to transfer clinical information among providers, payers, and the community (Bergman 1994). The project, which is seeking approximately $30 million in funding to accelerate the rate of standards development over current voluntary models, proposes to develop standards, test them in selected health care organizations, review and refine the standards, and put them to a vote through the American National Standards Institute. The project's steering committee is comprised of representatives from CPRI and HISPP, and expects to subcontract with the standards groups for the drafting of standards.

Other Impediments to the Development of CHINs

CHINs face several other hurdles before full implementation will be possible. There is a great deal of concern about how to maintain the confidentiality of patient records. Although there are many benefits to be gained from compiling information about an entire community in one database, privacy advocates are concerned about how to establish a unique patient identifier, which would be necessary for such exchanges as envisioned in the CHIN, and how to ensure that confidential information is kept safe from unauthorized access.

The unique patient identifier is a necessary ingredient for exchanges of clinical information as envisioned by the fully developed CHIN. Proponents of the computerized patient record recommend the issuance of a unique identifier at birth which would remain permanently with the person throughout their lifetime. Various ideas for such an identifier have been proposed, which might combine parts of the Social Security number with segments of the patient's name, date of birth, or even the latitude/longitude coordinates of the place of birth (U.S. Congress OTA 1993). Others recommend the use of the Social Security number itself; this concept is vehemently opposed by privacy advocates since the use of the Social Security number to unlock all varieties of information about a person and its attendant abuses are well-documented.

The other issue relating to privacy is how to protect the databases that contain the patient information. As envisioned, the information that a CHIN would collect about patients would contain not only clinical data (which requires a great deal of privacy) but also financial information as well. The first CHIN concepts used a central depository for patient records. Many communities were opposed to the idea of all of this information being stored in one place. People expressed concern about the lone hacker who could tap into the system and gain unauthorized access to all varieties of confidential information. Others pointed out that it was far easier to safeguard a computer system...
than a paper-based system (Wright 1994). For example, a system could be set up that would evaluate the requests for information to determine whether this individual or institution should have access to this particular type of information, and an audit trail would track who had requested which information and for what purpose.

Many of the newer CHINs emerging have decided against a central depository and instead are using distributed databases; information about one patient would be stored in a number of different databases, so a security breach would result only in partial information rather than complete information about a patient. According to some of the interviews that we conducted, this has created an additional problem in that the communications protocols are not yet fully developed to allow for both the storing and retrieval of information from all of these multiple databases.

The final hurdle for the full implementation of the CHINs is for individual providers and payers to stop viewing the information that they have as providing each individually with a competitive advantage, and rather to view the networking of this information as providing a cooperative advantage to all by promoting information as a community resource. The advantages of automating need to be distributed equitably so that all participants benefit equally (Gardner 1992). As in the banking and airline industries, healthcare must rethink the advantages of cooperative, rather than competitive, information.

**Small Player Focus in the CHIN**

The small players that we have chosen to focus on in the development of Community Health Information Networks are the individual physicians or small physician groups, small hospitals (perhaps a satellite facility), the small firms who might be involved in providing medical goods, individual pharmacies, and small laboratories or other testing facilities (such as an MRI, ultrasound, or radiology facility). The cooperative nature of the CHIN means that the implementation of the CHIN should benefit everyone. Although we attempted to gather information on this point in our interviews, there are an insufficient number of small players available to judge this at the present time.

**Findings**

The Community Health Information Network (CHIN) strives to link all of the providers, payers, and related healthcare entities in a given community into an electronic network that can provide...
better quality service to its community and can provide data to those who pay for the healthcare and those who create healthcare policy on the needs of that particular community. By their nature, these networks are complex, transmitting a wide range of varying information to a large number of entities for very different purposes.

In most communities, the hospitals, who have had the most extensive experience with computer systems and with electronic data interchange, have been able to provide the leadership. Although the effort is sometimes spearheaded by outside sources (e.g., telecommunications or software vendors, or external funding sources, as is the case with the Hartford Foundation grantees), the impetus and leadership frequently come from the hospitals. Although there is some evidence that hospitals might have initially offered resistance about the standards issues, the consensus seems to be that the hospitals are playing the role of being the "experienced trading partner" which we have observed frequently needs to go along with successful EDI implementations.

As efforts to establish CHINs get under way in various communities, most have used a committee approach to develop the package for vendors to bid on, and to outline how to proceed in setting up the CHIN. Smaller players (e.g., laboratories, physicians, small hospitals, nursing homes, durable medical goods suppliers, pharmacies) have been represented on these committees, and have participated in making decisions. One hospital representative suggested that there is some inequity from a hospital's standpoint in this strategy, since a single person from a hospital might represent numerous sites and thousands of employees, whereas a single person from a physician group or from a small laboratory might represent only a handful of individual perspectives. Nevertheless, this strategy seems to have prevailed.

Small players seem to benefit from the formation of the CHINs. Prior to implementation of such networks, small players succeeded either by virtue of their own competitive strengths (pricing, reputation, or "old boy networks"). With a CHIN in place, the small players take on the reputation of the whole entity, and gain stature because of that affiliation. Improved information can level the playing field and allow newer firms and laboratories to compete for business that was always given to one firm who knew the right people, or because "we've always done business with them." With a network in place making it equally available to do business with many other people, everyone is able to evaluate objectively who has the best prices, quickest turnaround, most consistent results, etc.
A small 19-bed hospital that we interviewed indicated that they received benefits from being involved in a network that would not be affordable to them any other way. For example, through use of EDI they were able to receive administrative functions through a partnership with a large hospital that would not have been available to them in any other way.

Although several CHIN participants we interviewed indicated that during the time the CHIN had been meeting and planning that some small participants had dropped out or even been bought up by larger competitors, they all felt that this was due to other market pressures, and not related to the formation of the CHIN.

Costs and Benefits

The cost to wire a single community ranges from $1 to $10 million, depending on the geographic size of the area and how many functions the network will handle (Gardner 1992). Some of the costs have been borne by telecommunications, software, and hardware vendors, while others have been shared by providers and payers. Additional costs are incurred by providers and payers who may have to upgrade their systems in order to be networked into the CHIN. State governments, business coalitions, and private foundations have all contributed money to the formation of CHINs.

For example, many of the networks established by Integrated Medical Systems, Inc., are owned by IMS, but sometimes IMS invites hospitals to become equity partners in the networks (National Report on Computers & Health No date). For those networks where IMS continues to own the network, doctors pay no fees, but labs, HMOs, pharmacies, and hospitals pay fees. IMS charges flat fees to hospitals; a 300-bed hospital with 250 participating physicians would pay about $190,000 a year (National Report on Computers & Health No date). Hospitals are willing to absorb the costs and allow physicians to participate free of charge, since hospitals and laboratories are currently incurring the costs to convey lab results to physicians (e.g., via postage, telephone, or courier charges). In many instances, staff size can be cut since someone does not have to perform the time-consuming task of calling doctors' offices to convey results.

Other benefits from the CHIN for the physicians include instantaneous transmission of results; by eliminating the middlemen on the process, the physicians receive the correct results for the correct patient in a timely manner. Electronic claims payment is available for physician groups.
that might have lacked the hardware, software, and technical expertise in EDI to embark upon such ventures previously.

In healthcare, the hospitals that first adopted EDI for purchasing/inventory received first mover advantages. The providers that entered into electronic claims submission frequently reorganized their work processes on the administrative side to receive second tier benefits from EDI. CHINs represent a good example of the third tier or cooperative benefits of EDI: everyone in the community benefits only if everyone is linked together and electronically sharing information. Unfortunately, neither the standards nor the technology is quite able to meet this expectation at this stage, but both are moving in that direction.

The community where the CHIN is located benefits from its formation by receiving information about the quality and cost effectiveness of care. Employers who have contracts with providers can evaluate how well those providers are doing compared with other providers in the area; future contracts may depend upon information gathered by the CHIN. Policymakers, both in the public and healthcare sectors, can use information collected by the CHIN, to plan for health needs in the future: what equipment is being underused? what equipment and facilities are lacking in the area?

Recommendations

The healthcare industry is fortunate in that many support organizations already seem to exist within the industry. Standards groups and others that discuss standards (e.g., WEDI, CPRI) are actively moving the industry toward the standards required for full CHIN implementation. Other user groups are available. The Healthcare EDI Corporation (HEDIC), based in Little Rock, Arkansas, has formed a number of Healthcare Users’ Groups (HUGs) around the country. A special trade organization has been formed for CHINs, the Community Medical Network Society (COMNET Society).

Standards and technology need further advancement before full CHIN implementation is possible. The proposal put forth by the Computer-Based Patient Record Institute for a public/private coalition to raise funds to accelerate standards development in this area by making the standards process paid rather than voluntary is worthy of consideration. The Small Business Administration might consider participation in this effort to ensure that the voices of the small firms in the healthcare industry are adequately represented.
Chapter VII
EDI in Mortgage Lending

Introduction

Mortgage lending is an extremely information and paper-intensive service business involving numerous different parties for each loan. To further complicate matters, a mortgage loan exists for a relatively long period of time (usually 15 to 30 years), and the entire paper documentation must be collected from many sources, transferred at different times, appended, retrieved, and stored away again. One author estimates that the typical mortgage loan package today requires a two-inch-thick stack of paper, which is the end result of 500 different tasks by 19 people; it takes 900 minutes spread out over four or five weeks to process the stack of paper (Barmore 1990). The parties involved in each loan are numerous, including borrower, mortgage broker, lending institution, credit bureaus, employers, banking institutions, mortgage insurers, appraisers, title insurers, hazard insurers, and various agencies of the federal government. Electronic data interchange could play a vital role in all of these interactions, but its status at present is that it is used only among participants in the secondary market1: namely, federal government agencies and the larger lending institutions. Even here EDI is just beginning to be implemented and many issues relating to standards development remain to be resolved. This chapter will explore the mortgage banking industry and the life cycle of a loan, and describe our findings regarding how EDI is being used in this industry.

Background on the Mortgage Lending Industry

Life Cycle of a Typical Loan

A mortgage loan has three distinct phases to its life cycle. The origination phase is the starting point for the mortgage beginning with the borrower's first contact with the mortgage broker or banker through the collection of all the various pieces of information which will make up the loan

1In general terms, the primary mortgage lending market is where mortgage loans are originated and funds extended directly to the borrower. Examples of primary market players include mortgage companies, commercial banks, savings and loan institutions, and mutual savings banks. The secondary mortgage market exists when these primary lenders sell existing mortgages to permanent investors, creating additional capital with which more loans are funded. The role of the secondary market is detailed later in this chapter.
package. In the marketing phase, the loan package is shown to a potential lender for underwriting, the loan is closed, and the loan is oftentimes marketed again on the "secondary market." The loan spends the remainder of its life in the servicing phase; in this phase, monthly payments are collected from the borrower for interest and principal, taxes, and possibly hazard insurance, and payments are paid out to the holder of the loan, to the town for property tax, and to the insurer for hazard insurance. The entire process is paper-intensive and involves collecting and transferring numerous pieces of information among a multitude of parties.

The loan originates with a borrower entering the office of a mortgage banker or a mortgage broker, who might represent many banks or lenders. At this initial meeting, the borrower provides some preliminary information and often a credit check is performed based on this primary information to "prequalify" the borrower. The prequalification process ensures that the borrower is a suitable candidate for proceeding further: that the borrower's income is sufficient to afford a property in a certain price range and that the borrower appears to be creditworthy.

Assuming that the borrower is deemed creditworthy, the borrower then completes an application for the loan, which includes a variety of information about the borrower(s). This information includes employment history and salary, bank accounts, other real estate owned or mortgaged, credit history, and summary of monthly expenses. The borrower must attach statements for bank accounts and other supporting documentation. Once this package of information (all in paper form) is received by the mortgage broker, the information must all be verified. In the case of employment and bank account history, the mortgage broker must send out appropriate forms to the employer and the bank for each account. In turn, the recipient of these forms must complete them and mail them back. While waiting for these verifications, the broker/banker must conduct a credit check. The broker contacts two credit agencies (such as Equifax, TRW, Transunion) and requests credit reports. Paper copies of the credit reports are sent to the broker, who either checks the information or sends it to a third-party credit agency to verify information contained in the credit report. This involves contacting those credit card issuers or other lending institutions which have reported default or problems with timely payment. In addition, this third-party credit agency searches the public record for any outstanding liens against the borrower, bankruptcy proceedings, or defaults.

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This first credit check is called a "soft credit report" and it is distinguished from the more intensive check done at a later stage of the mortgage application process. This first credit check is "soft" because it is frequently done by using a dial-up connection to the credit bureau. This technology is discussed in greater detail below.
At the same time that the borrower’s creditworthiness is being assessed, the property being purchased needs to be evaluated. Many of these tasks are things that the potential homeowner participates in, such as the house inspection and radon testing. An appraiser needs to evaluate the property, and determine whether the market price that the borrower has negotiated is suitable for the property, and whether the price is consistent with that being paid for comparable properties in the surrounding community.

The assembling of all the pieces of the loan application package is extraordinarily paper and time intensive. Brokers interviewed suggested that the typical loan package takes nearly three weeks to assemble. Much time is spent waiting for verifications and for pieces of paper to be mailed or delivered to the broker. Time is crucial to all parties involved. For the borrower, there is a signed purchase and sale agreement which will expire within a set period of time, whether financing has been secured or not. Perhaps the borrower is selling an existing home and timing needs to be coordinated between the two transactions. For the broker or banker, time is crucial since the broker or lending institution has “locked in” an interest rate; if the interest rate creeps up in the interval between when the rate has been locked in and the closing, the broker or lending institution will lose money.

Once the loan package is completed, the marketing phase of the loan begins. Although this process varies from loan to loan, and depends upon where the borrower initially begins the loan, for purposes of illustration we will describe the marketing phase as if a mortgage broker were involved in the process. The broker would typically work with a number of lending institutions or wholesalers (say, two dozen), and would select perhaps five that might be appropriate for this particular borrower on this particular property. The loan package would be sent out to the institution most likely to provide the loan; again, time would elapse. Brokers indicated that the fastest response came the day the lender received the package, but other lenders might take as long as seven to ten days for approval. Should the first lender reject the package, the procedure would be repeated with the next likely lender; of course, more time would elapse. Once the package is approved, the mortgage broker or its designated attorney would prepare closing documents, detailing the terms of the loan and its repayment. Proof of hazard insurance must be obtained. Private mortgage insurance is required for conventional loans where the loan-to-value ratio exceeds 80 percent, since these loans where the consumer has made a smaller downpayment have a higher risk of default. Title insurance is usually required by lenders and secondary-market investors to protect the lender against risks.
such as a hostile claim of ownership against the borrower. All of these must be requested and documented prior to closing.

After the closing, the lending institution that financed the loan has several options. It might choose to keep the loan and service it (i.e., send out monthly notices of payments due for interest, principal, taxes, and insurance, and collect these payments). Or it might choose to sell the loan to the secondary market. The loan can be sold to the secondary market with or without servicing. The loan is transferred perhaps, and the servicing phase begins.

In the servicing phase of the loan, the mortgage lender holds the loan and receives monthly payments for interest and principal, taxes and insurance. The servicer of the loan is responsible for making payments for taxes and insurance, and to the primary holder of the loan if it is not. Finally, the servicer must ensure that the borrower does not default on the loan, and must report to the U.S. Department of Housing and Urban Development on the number of loans that are in default, and the source of those loans (e.g., mortgage broker, bank, thrift, etc.).

**Structure of the Mortgage Lending Industry**

The mortgage lending industry is a complex and highly diverse group of entities. The types of information exchanges are depicted in Figure VII-1. The primary market structure is composed of those institutions involved with the origination of loans. Typically, these entities deal directly with the borrower and include large commercial banks, savings and loans, thrifts, mortgage banks, and wholesalers. Mortgage brokers are a special niche of the primary market; typically, they work with a set of lenders or wholesalers and serve as an intermediary between these large institutions and the borrowers. Some wholesalers, such as Countrywide, work with branch offices that function much as brokerage firms; the exception here is that these branch offices only work with one wholesaler, whereas brokers can represent several dozen lending institutions and work with the borrower to match up the borrower with the lender most likely to approve this particular loan package.
The secondary market is primarily composed of several federal government agencies (or outgrowths of federal agencies) that interact with the mortgage banking industry throughout the life cycle of a mortgage loan. The Federal Housing Administration (FHA) was established in 1934 and is now under the aegis of the more recently established U.S. Department of Housing and Urban Development (HUD) to encourage lenders to loan money for residential mortgages by providing mortgage insurance. FHA has several mortgage insurance programs, all of which require both the preapproval of the lender (verifying staff, facilities, net worth of the institution) and prescribed limitations for the borrower (i.e., loans cannot exceed dollar limitations imposed by HUD and minimum down payments must be met). The Department of Veterans Affairs (VA) guarantees loans made to

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3 Much of the discussion in this section relies on Axelson and Smuckler (1993).
veterans of the armed forces; the VA does not offer mortgage insurance, but rather guarantees that it will pay a certain percentage of the mortgage loan should there be a default by the borrower.

The Federal National Mortgage Association (Fannie Mae) was created by Congress in 1934 to provide a secondary market for FHA/VA loans. Currently Fannie Mae purchases single-family and multifamily conventional loans as well as the FHA-insured and VA-guaranteed loans; these loans are pooled and sold to Wall Street investors as Mortgage-Backed Securities (MSBs). Although Fannie Mae was first part of the federal government, it is now a privately owned corporation which trades its stock on the New York Stock Exchange. By purchasing loans from mortgage lenders, Fannie Mae sends money back to the lenders to extend additional loans. Fannie Mae has established underwriting requirements for the loans that it purchases. Since most mortgage lenders now anticipate that the mortgages they underwrite will be sold to Fannie Mae, these requirements prevail throughout the mortgage origination process for residential loans. These underwriting guidelines require that the borrower be able and willing to repay the loan, and that the property is sufficient security for the loan; the mortgage lender must include credit reports, bank statements, employment and deposit verifications, and verifications of income as part of the loan package, and must confirm that the borrower has adequate cash to cover closing costs.

The Federal Home Loan Mortgage Corporation (Freddie Mac), begun in 1970 by Congress, provides a secondary market for mortgage loans originated by federally insured thrift institutions. Although it was set up to purchase FHA/VA loans, Freddie Mac has concentrated only on conventional loans since 1981. Freddie Mac has many similarities to Fannie Mae. Freddie Mac pools its mortgages and sells them as securities to investors. Freddie Mac purchases mortgages only from approved lenders, which must demonstrate prudent lending practices and acceptable net worth. There are also underwriting guidelines to ensure that the loan is of "investment quality" such that the loan will be repaid in a timely manner and that the property is of sufficient value to recover the lender's investment should the borrower default.

The Government National Mortgage Association (Ginnie Mae), which was created by Congress in 1968 as a part of HUD, finances mortgages for those who cannot obtain housing under other mortgage programs. Ginnie Mae guarantees mortgage-backed securities issued by Ginnie-Mae approved mortgage lenders and backed by FHA-insured and VA-guaranteed loans.
There are numerous federal laws that regulate the mortgage banking industry and thus require the industry to report to various federal agencies. The most important one to discuss here, however, is the Home Mortgage Disclosure Act (HMDA), enacted in 1975, which provides information about whether financial institutions are providing credit to the neighborhoods which they serve, and targets those areas that are most in need of additional private-sector investments. The data reporting and compilation requirements are extensive. Mortgage bankers are required to disclose information about loan applicants and on numbers of loan defaults/foreclosures segregated by origination source, neighborhood, etc.

Applications for EDI and Other Technologies

Because of the paper-intensive nature of mortgage banking, there are numerous ways in which EDI and related technologies might be used. The incentive is strong within the mortgage lending industry to save time and costs, and to be able to deliver a loan to the consumer as quickly as possible. The industry has faced with an enormous downsizing in 1994; after doing $1 trillion in loan business in 1993 (mostly due to refinancings as a result of reduced interest rates), the industry expects to have about $600 billion in 1994 loans (Carroll 1994). Technology is being investigated thoroughly as a means to gain efficiencies. As will be discussed in greater detail below, the major stumbling block that has hindered active development and use of many of these technologies has been the inability of the mortgage banking industry to agree upon standardized ways to track and present the numerous pieces of information that it requires. Some progress has been made toward this end in the last several years with the formation of the Mortgage Bankers Association of America's Interagency Technology Task Force (IAT) which is a collaborative effort among MBA, Fannie Mae, Freddie Mac, and Ginnie Mae. With the IAT offering leadership on standards development, technology is emerging as a solution to many of the industry's problems.

Although the banking industry was one of the first to adopt automation for business processes, including EDI, the computerization of the mortgage banking industry has progressed backward through the loan cycle. The servicing end of the mortgage banking business is heavily computerized and has been so for a long time. Only gradually has the automation shifted back to the marketing phase of the loan cycle, and finally to the origination phase of the loan cycle.

On the servicing end of the loan cycle, EDI can be used between customer and bank for electronic funds transfer for loan and escrow payments. Similarly, EDI can be used to facilitate the
transfer of interest and principal payments between the servicer and the primary holder of the loan, and to pay hazard insurance premiums and taxes to the insurer and the local taxing authority. EDI can be used to report default rates and other routine reporting requirements to HUD as required by the Home Mortgage Disclosure Act. HUD is encouraging the electronic transmission of default rates and borrower disclosure data by providing a software checking program to lenders who wish to use the program (DeZube 1991).

In the marketing phase, EDI could be used to transfer the loan package between brokers/banks and the secondary market. The IAT has taken many steps to move along use of technology in this area. The IAT has developed a proposal for a Whole Loan Book Entry concept to be applied to the mortgage banking industry. Under this proposal, modeled after a similar concept used in the stock brokerage business, a clearinghouse would be established to track mortgage ownership immediately after loan closing. This would eliminate the need to prepare and record assignments, or papers documenting the transfers of ownership, for subsequent transactions. The industry estimates that over its life cycle, the average loan requires four unrecorded and two recorded assignment documents. With EDI, such transfers could be done electronically, eliminating the need to process such transfers on paper, and would save an estimated $164 million per year in assignment processing costs, document movement and certification costs, and mailing and notification costs during lien release (Mortgage Bankers Association et al. 1993).

EDI has also been used in the secondary marketing of a loan between the primary loan provider and Fannie Mae, Freddie Mac, or Ginnie Mae. Fannie Mae has developed an EDI network called MORNET-EDI, which is a value-added network (VAN) using ANSI X12 EDI standards "to shorten the mortgage loan origination process. It provides lenders with a single dial-up source for an array of origination and closing services" (Fannie Mae 1994). Fannie Mae's schedule for MORNET-EDI is that the first phase will offer credit reports and mortgage insurance (and begin operating in fall 1994); the second phase will offer appraisals and title insurance and begin in the fourth quarter of 1994; and the third phase, offering hazard insurance and fraud detection services, will begin operation in the first quarter of 1995. Fannie Mae's plans include eventual connections among originators, lenders, appraisers, credit bureaus, mortgage insurers, service bureaus, and the secondary market. Freddie Mac has similar EDI capabilities becoming available late this year, which
will provide an electronic evaluation of a loan package; furthermore, Freddie Mac has promised to honor an approval from the system as a commitment to purchase based upon the information submitted.

Freddie Mac's system will also use another technology which will be used in the future in the mortgage banking industry, artificial intelligence. The system envisioned by Freddie Mac will evaluate a loan package using "rules-based" artificial intelligence. It is expected that other forms of artificial intelligence can be combined with EDI in the near future in the mortgage banking industry. Combined with EDI, loan approval using artificial intelligence can enhance productivity and speed the approval process. The automated system compares the electronically gathered information to the applicant's file, alerting the underwriter of missing, unconventional, or discrepant information. The software is designed to either approve a loan immediately, or refer questionable decisions to the underwriter. In this way, the underwriting staff can focus attention on problem loans, and put more effort into matching up an applicant's requirements with the lending market, rather than filling out forms and rekeying information into a computer. Current applications for such rules-based AI allow for on-line credit scoring; this process merges information from three credit sources to determine the creditworthiness of the borrower.

Other technologies that are expected to be used in the near future in combination with EDI in the mortgage banking industry include voice and imaging technologies. Voice technologies have been used extensively in the servicing end of the mortgage industry to provide general information about loans, servicing transfers, explanations of interest rate adjustments, and requests for payoff information (Cisney 1993). In the secondary market, Fannie Mae began using its Pooltalk system in 1989 to allow investors to retrieve information about Fannie Mae pools of mortgages; Freddie Mac introduced a similar system in 1991 called "Freddie Answers." It is anticipated that voice technology could be used in the future to request information from consumers and input information into remote computers as part of the loan origination process.

Imaging technology allows paper documents to be converted into digital images to be stored and retrieved on computers. Imaging studies estimate that less than 10 percent of business operating information resides on computers, while the remaining 90 percent comes into the business from outside the organization, through the mailroom where it is sorted, routed, processed, filed, retrieved, and refiled in paper form (Mikel 1993). Imaging technology is currently used in the servicing phase
of the loan, and can be particularly helpful for on-line answers to customers' questions. Combined with EDI, whole files of information, including signed documents, annotations, etc., can be transferred electronically.

Yet another technology being investigated for use in the mortgage banking industry is bar coding. Applications currently planned for bar coding of documents include application processing (for example, to track a verification of employment form, when it is sent out, when received back), tracking post closing documents, shipping of documents, pool processing, and loan folder storage and retrieval (Mortgage Bankers Association 1994). Bar coding of an application identifier could facilitate an EDI transfer of the loan package by pointing from the existing loan number to the new number assigned by the firm who has purchased the loan.

Standards

As in many other industries, the first electronic connections in the mortgage banking industry took place between established trading partners using proprietary linkages. In mortgage banking, these first electronic links were frequently between brokers or other loan originators and credit bureaus, or between large wholesalers of mortgage loans and the secondary market agencies. Because of the infeasibility of having a proprietary terminal for each link with a trading partner, these proprietary standards have begun to give way to the development of industry-wide standards. These standards, as they are approved and come into use, are expected to diffuse the technology and make EDI available to more sectors of the mortgage industry.

Much of the push for standardization in mortgage lending took root in the late 1980s when a group of volunteers from mortgage companies, credit companies, mortgage insurers, and others organized the Mortgage Data Standards Task Force. Their main goal was to identify the kinds of data items collected in loan processing that, if standardized under the ANSI Accredited Standards Committee X12, could efficiently and effectively streamline the transmission of information among all players in the lending process. In 1989, the Lending Task Group was set up under ANSI's Finance Subcommittee to work with ANSI X12 in defining and approving standards for the mortgage lending industry. In recent years, the secondary mortgage market agencies have made a serious commitment to EDI standards development and implementation. The Lending Task Group under ANSI's Finance Subcommittee has worked diligently to define transaction sets for standardization. Traditionally, the servicing side of mortgage lending has been more apt to automate functions and
in this sector far more ANSI X12 standards have been approved. Standards approved by ANSI X12 include Application for Mortgage Insurance Benefits, Residential Mortgage Insurance Application, Mortgage Credit Report, and Mortgage Record Change. Standards development to enhance origination processes has been slower, although two standards currently in ballot include Residential Loan Application and Residential Appraisal Report. Additional standards in development which could enhance the way loan information is collected and processed are Residential Appraisal Request, Loan Verification Information, Real Estate Title Evidence, and Mortgage Settlement Information.

Fannie Mae, Freddie Mac, and Ginnie Mae have also teamed up with the Mortgage Bankers Association under the aegis of the Interagency Technology Task Force (IAT). The main goal of IAT has been to coordinate the activities of the agencies, lenders and other market participants as the industry moves toward standardization. Two major projects that the IAT has tackled are the standardization of secondary market functions such as loan delivery and investor reporting, and organization of a Whole Loan Book Entry (WLBE) system for the mortgage lending market.

The standard for the Secondary Mortgage Market Investor Report is currently in ballot while Secondary Mortgage Market Loan Delivery is still under development. A Fall 1992 White Paper by the Interagency Technology Task Force outlines how these standards can enhance market functions. Delivery data standards would enable lenders to electronically transmit the information they collect from loan applications, mortgage notes, and mortgage insurance documents, etc., to the secondary agencies in one format. The standard would eliminate the inefficiencies created when lenders must deliver loans in three different formats to three different agencies. Similarly, investor reporting standards would encourage the effective transfer of loan level investor data from lenders to agencies.

**Small Firm Focus**

We have focused our research in the mortgage banking industry on small mortgage brokers, and have investigated in what ways the mortgage brokers are using EDI technology, and what effect EDI use is having on these brokers. The National Association of Mortgage Brokers had 440 members in 1988; that number had tripled by 1993 (Schneider 1993), probably due to interest fluctuations and the large number of refinancing transactions that arise from that. Mortgage brokers make their money by originating loans for consumers and selling these loans to the secondary market or to wholesalers for servicing. Unlike mortgage lenders, who earn their money through interest payments
over the life of the loan, mortgage brokers receive a fee for each loan that they sell to secondary market investors or to lenders who will service the loan. Good mortgage brokers offer their customers a service by counseling customers on how to improve their chances of credit approval. For customers who shun the impersonal nature of dealing with a large financial institution, brokers can offer a personal touch and assist their customers through the loan application stage.

Some brokers specialize in specific areas. For example, The Herndon Company, Westlake Village, California, works mainly with self-employed borrowers. Typical loans for these customers require loan packages that contain both personal tax returns and business cash flow statements. In working with these borrowers, the broker consults about changes that might be needed in a borrower's business finances to improve how an investor might view the loan portfolio. The broker might suggest that the business owner obtain a line of credit for the business to pay for inventory, and then draw more cash for a personal savings account (Schneider 1993). Brokers believe that this service is valuable to customers, and develop such niches for themselves.

Mortgage brokers attract customers through such unique services, and by processing loans at less per loan than lenders. Brokers have typically shunned overhead expenses, and many have been reluctant to invest in technology. One industry estimates that less than two-thirds of all mortgage brokerage firms use technology to speed loan processing or credit report ordering, and our interviews with brokers support this estimate. Brokers who have invested in technology are using computers for credit reporting and for loan tracking internally. Several PC-based products are available that permit the broker to generate information in a format required by Fannie Mae, track the sending/receipt of verifications, and produce closing documents.

Successful mortgage brokers usually develop working relationships with two dozen wholesaler or lenders who have confidence in the broker’s ability to market its services to attractive borrowers, and to check on the borrower’s ability to pay in a satisfactory way.

Findings: Effect on Small Firms

Implementation of EDI in the mortgage banking industry has been driven by the federal government agencies (especially HUD), and by participants in the secondary market (Fannie Mae, Freddie Mac, Ginnie Mae). These entities have provided an enormous push to standards develop-
ment and pilot projects that will use standards as they are approved by ANSI. Mortgage brokerage firms, however, have been very slow to adopt EDI, largely because they do not interact directly with the EDI first movers in the industry. This may result in a bias in the way that standards are being developed such that small firm needs and concerns may not be adequately incorporated into the process. However, these early efforts at implementation and standardization should ease the way for small firms once the technology reaches them and they begin to adopt EDI.

The U.S. Department of Housing and Urban Development, for example, has initiated a pilot program to use EDI to eliminate the paper associated with more than 13,000 mortgage insurance claims filed annually with that department. In conjunction with the Mortgage Bankers Association, HUD has piloted a project with ANSI for the development of an electronic claims process. But because 96 percent of the business volume is done between HUD and 274 companies, the pilot targeted these large volume companies first, leaving the remaining 4 percent of the business, done with 900 other companies, to await the results of the pilot.

Fannie Mae's MORNET-EDI system has begun implementation and includes some services related to loan origination. More are planned for introduction in the last quarter of 1994 as more standards are agreed upon for use, including appraisals, flood certifications, and title reports. According to our interviews with its personnel, Fannie Mae is working to decrease the amount of time it takes to originate a loan from eight weeks to one week, and ultimately to three days. Through MORNET-EDI, Fannie Mae is hoping to push the entire mortgage industry toward EDI by providing exposure to all. Fannie Mae is committed to promoting EDI because it believes that EDI can increase efficiency in the lending system, and reduce errors created by multiple entry of data (they estimate that some loan information is input an average of 27 times!).

Freddie Mac has established a value-added network (VAN) called MIDENET, used for servicing and loan delivery. Available on PCs, MIDENET is free for small and medium-size customers, again as a way to encourage the use of EDI throughout the mortgage industry. Customers are not charged for software.

However, since mortgage brokers seldom deal directly with the secondary market, rather selling their loans first to a wholesaler or larger lender, they are not as likely to come into contact with the use of EDI. Most brokers that we interviewed felt that EDI would inevitably come to the
mortgage broker business, but only after the technology was first pushed by the large institutions and the secondary market, and then is adopted by the wholesalers and lenders with whom the mortgage brokers come into contact. There is currently neither competitive advantage nor competitive necessity for brokers to adopt EDI, since the regulatory requirements still require paper documents and "wet" signatures (i.e., signatures made with pen and ink as opposed to electronic signatures). Only as the regulatory agencies and secondary market become accepting of electronic documents can the mortgage brokers begin to move away from paper documents, and begin to achieve some benefits from the substantial costs that EDI may necessitate for them.

Interviews with mortgage brokers indicate that the brokers who will be the first to adopt EDI once it has diffused more widely for loan origination are the brokers that have already invested in information technology. Those brokers who are already using computers for loan tracking and document production have invested in PC networks and trained their personnel to use computers. Because of the computer experience of these firms, they will be more likely to have a "technology leader" who will facilitate the adoption of EDI. The additional costs of adding EDI capabilities for these brokers will be relatively small, whereas the training and implementation costs for brokers without trained staff and hardware already in-house will be substantially larger.

Many of the brokers whom we interviewed thought that the first EDI implementation would come to brokers via the "laptop origination," which was discussed at the most recent meeting of the Mortgage Brokers Association (Carroll 1994). The concept is that, armed with a laptop computer, a broker or representative from a lender can meet with a consumer at his/her home or office, gather information from the customer through an interview, enter the information into the computer, then evaluate the information and give an answer to the prospective borrower almost instantly. Programs can also perform credit checks from this remote location.

Laptop origination has already become popular with some of the large wholesalers, whose branch offices compete directly with the mortgage brokers. As this concept of laptop origination takes hold, brokers will likely feel more competitive pressure to evaluate loans as quickly as possible. It does not appear that EDI will penetrate the brokerage business until the banks and wholesalers with whom the brokers typically exchange information begin to use EDI more fully. Until this happens, there will be little benefit for brokers from the implementation.
There are companies operating EDI networks that can order credit reports. Examples include Chase Credit Research and Financial Databank, Inc., both of whom have functioning EDI links to many clients. Stewart Title has a system, called Stepnet, which allows mortgage companies to order reports on credit, title, appraisal, survey and home inspection (Cooley, no date). Apart from the VANs operated by Fannie Mae and Freddie Mac (MORNET-EDI and MIDENET), we have not been able to document any other VANs operating generally in the mortgage banking industry. It seems likely that growth in the use of EDI will spur some VANs to venture into this area.

Costs and Benefits

The costs of implementing EDI in the mortgage industry are mostly estimates at this stage, due to the early stage of implementation. One vendor who specializes in mortgage industry EDI add-ons to its software estimates that EDI translation software costs approximately between $1,300 and $2,000; for $4,000-6,000, a small lender can become EDI-capable using a modem, translation software, and a VAN. Software add-ons are emerging that will allow loan origination programs to request and receive various reports that are available through the ANSI X12 standards: credit reports, appraisals, mortgage insurance, title insurance, hazard insurance renewals, and mortgage insurance claims. The cost of implementing these is usually limited to the cost of the software, modem, and translation software, and should include very minimal cost for training staff since they work with programs that are already being used to track loans and generate closing documents. The cost of laptop origination systems, according to one source, is approximately $10,000 for the computer, networking, and software (National Mortgage News, no date). One source whom we interviewed estimated one-time conversion cost at $16,667 (for capital and application expenses) for companies with annual loan production volumes of less than $500 million.

The benefits of EDI technology for loan origination are the vastly decreased time to process a loan, thus providing the consumer with an answer as quickly as possible, and assuring the lender that the interest rate offered is accurate for the date of approval, rather than being locked in for as many as four weeks before the loan is processed. Lenders estimate the national average cost of closing a loan to be between $2,500 and $2,700; industry experts believe that EDI can cut that cost to $1,500. Though most lenders would prefer to keep the savings for themselves, competition in the industry will probably necessitate passing that cost savings on to borrowers, which will result in more affordable transactions for borrowers.
Other EDI applications have different costs and benefits. For example, the Whole Loan Book Entry proposal advanced by the IAT does not include a cost of implementing the WLBE proposal. The white paper (Mortgage Bankers Association 1993) notes that the industry currently spends $260.5 million per year on the transfers of title involved with originations, servicing transfers, and payoffs, or $80.90 per loan during its entire loan cycle. The WLBE concept would reduce annual industry spending to $96.5 million, or $15.75 per loan during the entire loan cycle. Slesinger (1993) estimates the cost to implement WLBE for an individual mortgage company as the cost of a personal computer, a modem, and translation software.

EDI brings many qualitative benefits to the mortgage industry. It replaces a paper-intensive process that is encumbered by complex manual processes with an electronic, streamlined process that simplifies interfaces with multiple trading partners. EDI offers an automated tracking, auditing and reporting system that reduces delays associated with missing or late items. EDI reduces errors by eliminating the need to rekey information. EDI can reduce risks by moving the commitment process more quickly, thus avoiding interest rate exposure. Finally, once a common standard is used, the training process is simplified, since staff need only to learn one interface rather than multiple formats for multiple lenders or other parties.

Conclusion

Mortgage brokers need to know more about EDI and to understand how EDI can benefit them and their customers. The push that the secondary market has given the standards development process has greatly influenced the rate of adoption of EDI, and it is expected that many more EDI applications will become available as standards are approved. The secondary market will be able to influence EDI use among the mortgage banks and other lenders from whom it purchases mortgages, but the mortgage brokers will only begin to use EDI when it becomes a competitive necessity because other brokerage-related firms, tied to wholesalers or large lenders, begin to use EDI. SBA or trade associations (such as the Mortgage Bankers Association or the National Association of Mortgage Brokers) could consider offering EDI seminars to educate those in the industry about what EDI is, its costs, and benefits. If brokers were aware of the benefits to be derived, they might be more interested in implementing EDI (once underwriting requirements allow for wet signatures and electronic verifications) before it becomes a competitive necessity so that they might offer customers improved service or offer a unique type of service.
The EDI technology might be diffused through an increased interest in VANs. The secondary market or a collaborative body such as the Interagency Technology Task Force might consider encouraging third-party VANs to begin offering more services to those in mortgage lending services. As is detailed in a later case study, VANs could become "authorized" to deal with the mortgage banking business; this might have the effect of making EDI more available to smaller firms in the mortgage business.

Another way in which the secondary market can influence and speed the adoption of EDI is to be involved not only in ANSI X12 standards, but also to ensure that its own requirements for underwriting encourage electronic transmission. This means that Fannie Mae and Freddie Mac move quickly to provide for electronic transmission by allowing electronic verifications of employment and credit, as well as to ultimately allow for electronic signatures so that the entire industry can move away from a paper-based system and thus begin to benefit from this technology.
Chapter VIII
EDI and the Federal Government

Introduction

The U.S. government is widely implementing EDI in its operations. Several government agencies report one or more EDI applications in operation or in the planning stages. Examples include the General Services Administration's use of EDI to electronically place orders for goods and services; the Environmental Protection Agency's use of EDI to electronically receive toxic waste reports and submissions of other regulatory information; the Department of Defense's use of EDI in its procurement process to electronically solicit and accept bids; and the U.S. Customs Service's use of EDI to clear goods for entry in to the United States. It has been forecasted that by the end of 1999, the federal government will be the largest user of EDI in the world (Corbin 1992). In October 1993, President Clinton signed an executive order calling for government-wide reform of the procurement process through implementation of electronic commerce, a paperless trading environment reliant on the widespread implementation of EDI and other information technologies among all trading partners. The order mandates complete government-wide implementation of electronic commerce by January 1997 (Clinton 1993). This action shows the importance of EDI for the federal government, and is yet another step in the expansion of this technology.

We have examined the current use of EDI by the federal government through studies of some of the efforts of two government entities, the Department of Defense's (DoD) Government Acquisition Through Electronic Commerce (GATEC) pilot program and the U.S. Customs Service's Automated Broker Interface (ABI) system. Preliminary research indicates that these two government programs, the former targeted at small procurements at Wright Patterson Air Force Base in Dayton, Ohio, and the latter encompassing the automation of all import documentation, show two distinctly different approaches to the adoption and use of EDI. Both programs originated out of a need to accomplish increasing volumes of work more accurately and more efficiently but the methods of implementation differ greatly.

At DoD, officials developed an accessible system offering flexible communications options and standardized formats. The developers of the system were concerned with making their EDI
system attainable to small suppliers, upon whom Wright Patterson depends for many of its procure-
ment contracts. The idea of this system was to create a "single face" for government, which would
eventually allow any business desiring to do business with the federal government to do so using
the same hardware, formatting, and registration system.

In contrast, at Customs, the EDI system which was developed was a closed, proprietary
system. Customs' EDI system, which was developed earlier than the DoD system, was designed
using proprietary U.S. Customs data formats which were only standardized between Customs and
the customs brokers with which it trades information.¹ Users of this system may find it difficult to
utilize their investment to implement EDI with others who do not use that system. The Customs
system was developed during a time when standard formats were not well developed, and the
system's adaptability suffers as a result.

Our examination of both of these systems focuses on the effects that the use of EDI has on
the small business community. An open, standardized system affords the opportunity for small
businesses to use the investment they make in interacting with the federal government through EDI
with other trading partners. In this way, adoption of open systems allows the federal government
to push the diffusion of EDI technology within the broad trading community, which may eventually
result in higher productivity levels for U.S. companies nationwide.

EDI and the Department of Defense

Background

The DoD, which has approximately 350,000 trading partners (Gerson 1993, 42), has commit-
ted itself to widespread use of EDI. With several pilot programs in progress, the department hopes
that its use of EDI will break the ground for widespread adoption of electronic commerce. EDI
applications in the DoD range across several national and international industries, and involve
related technologies such as EFT and E-Mail, differing standards, and varying firm sizes. One third
of all of the federal government's existing or projected EDI applications are DoD projects (Corbin

¹Customs is currently switching over to EDIFACT standards; this is addressed later in the report.
Examination of the use of EDI by the DoD would obviously be a large undertaking, transcending a number of different industries and applications. Therefore, we have focused our case study of EDI at DoD on the GATEC program, which was instituted at Wright Patterson Air Force Base in Dayton, Ohio. GATEC automates, via EDI, Wright Patterson’s Requests for Quotes (RFQs) that are less than or equal to $25,000.

The GATEC project grew out of a desire by personnel at Wright Patterson to increase the efficiency of the procurement process in the wake of manpower cuts. They saw EDI as a way to handle a steady workload under the pressures of diminishing human resources. Initially, officials at Wright Patterson looked at EDI systems already in place within other parts of DoD, but found that the available options were not suitable. They therefore teamed with Lawrence-Livermore Laboratory, which agreed to act as DoD's technical arm and develop a system which would meet Wright Patterson's needs. The GATEC system was intended as a pilot program which would eventually be implemented throughout DoD.

In addition to creating an electronic procurement system that considered the needs of small bidders, another goal of the GATEC program was to create a more competitive bidding system by increasing the number of bids on each RFQ issued by the base. It was thought that disseminating information to more vendors would drive down procurement costs and save money for the government. Another goal was to reduce the lead time required to procure goods for the base. By shortening the amount of time it takes for end users at the base to request and obtain an item they need, the government hoped to decrease inventory carrying costs and reduce the number of work stoppages.

Under GATEC, companies interested in selling their goods to Wright Patterson must subscribe to one of several participating value-added networks (VANs) that are connected through a hub at Lawrence-Livermore Laboratory in California. Wright Patterson transmits all RFQs (request for quote) to Lawrence-Livermore’s hub site via the Internet. Lawrence-Livermore then transmits the data to the participating VANs via the Internet. Small businesses can connect through the VANs or the Internet to “bulletin boards” to obtain detailed information on RFQs. With this information,

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2VANs originally selected for the GATEC program included AT&T Easylink, Bell Atlantic Information Services, Datamatix, EDI*Able, Harbinger*EDI Services and Simplix. As of this writing, Bell Atlantic has dropped out as a participating VAN and Softshare and General Electric Information Services have been added to the list.

VIII-3
businesses can prepare a bid, and using EDI submit the bid through the VAN or the Internet to Wright Patterson. According to one Lawrence-Livermore official, this architecture was designed to offer a flexible communications format that allows the user the option of connecting through either a VAN or the Internet (EDI News 1994d).

Standards. GATEC vendors communicate with their VANs in standard ANSI X12 formats. However, the software they use usually provides very simplified forms of the purchase orders and other documents vendors use. VANs then translate the information provided by the vendor, filling in additional fields that are not relevant to the vendor with blanks, into the standard business form format before sending it to Lawrence-Livermore. Vendors are also insulated from the standards setting process, and while some vendors are vaguely aware that the committees exist, they do not monitor those committees and are surprisingly ignorant of standards in general. One VAN, Simplix, insulates its users from standards changes almost completely. Whenever a new version of ANSI X12 is adopted, they simply send each user a copy of the updated software, and the user continues business as usual.

Costs and Benefits of GATEC to DoD. Wright Patterson personnel estimate that they have spent approximately $3 million to develop the GATEC system. The figures so far indicate that Wright Patterson has benefitted tremendously from this investment. To the extent that DoD has been able to derive cost savings and other benefits from an EDI system designed with the needs and concerns of small business in mind, this pilot program can be used as an example for future government EDI systems.

One important area of savings has been reduced procurement costs, which was one of the stated goals of the system. Wright Patterson's analysis indicates that the base pays an average of 8-10 percent less for its small procurements than it did prior to GATEC. Since the program's implementation in 1992, savings on bids from GATEC on the $17 million of goods and services purchased by Wright Patterson total $1.2 million.

One Lawrence-Livermore official indicated that EDIFACT formats will be incorporated in the future (EDI News 1994d).
Prior to GATEC, purchases of less than $2,500 required a buyer to call one vendor for a quote, while contracts under $25,000 required three quotes. Now the buyer inputs the RFQ into the system and waits for vendors to bid. With EDI, buyers are able to process four times as many contracts as they could previously. This productivity increase represents a substantial saving of manpower for Wright Patterson.

As a third benefit, Wright Patterson has significantly reduced the lead time required for small procurements. Prior to GATEC, the time between the end user issuing a request for an item until the base received delivery was an average of 22 to 23 days. With GATEC, the base has reduced that time to about 9 days. This reduction in lead time translates to lower inventory carrying costs and fewer work stoppages for the base. The magnitude of the benefits accrued to Wright Patterson indicates that it is possible for the government to employ an EDI system with the interests of small business in mind and still reap benefits from it.

Small Firm Focus. In designing the GATEC program, Wright Patterson had to consider the needs of the small business community, on which the base (and other DoD entities) relies for many procurements. DoD officials felt that an electronic procurement system presented the risk of squeezing small business out of the process if implementation costs, on-going systems operation costs, or training costs were high. To this end, they developed a system which they believed would allow small business to participate in GATEC without significant obstacles. As a result, the system's developers at Lawrence-Livermore set out to develop a system which would provide a "single face" externally. In other words, they wanted to design a system such that when it was expanded to include all of DoD, a small business interested in doing business with the federal government (as well as state and local governments, if possible) could use the same guidelines, forms, and formats with all government agencies. The system they developed uses an open architecture and ANSI X12 standardized formats, and is not costly to implement.

According to a source at one VAN which caters to the needs of small businesses that want to trade with government, such firms have three primary concerns. First, small firms are unaware of government's procurement needs and are therefore often unable to bid on all of the contracts in which they are interested. They must wait for a government buyer to contact them. Second, when small firms bid on contracts and lose, they are often unaware of who won and on what terms. This makes small firms suspicious of government procurements generally, and also fails to provide them...
with information about whether they can provide competitive bids. Third, small firms complain that they do not get paid in a timely manner, which puts strain on their typically already tenuous cash flow. The GATEC system addresses the first two of these concerns, and was originally intended to address the third.

Findings: Effect on Small Firms

Since the implementation of the GATEC program in October 1992, the number of procurement contracts awarded to small business has increased from just over 60 percent to 97 percent. This measurement indicates that GATEC has had a positive impact on the ability of small business to compete for contracts at Wright Patterson.

One reason for the dramatic increase in small firm participation in the GATEC program, according to an official at Wright Patterson, has been the inability of some large businesses to implement EDI. Because of the bureaucratic nature of many large companies, they have not been able to gain approval to automate their contracting function as quickly as small firms. It is interesting that DoD did not anticipate this effect; they thought that large firms would adopt EDI more easily than small business because of their greater access to financial resources.

Another advantage for small firms results from the fact that prior to GATEC, some Wright Patterson buyers did not try hard to use small business. They often cited big business as the only known supplier of certain goods. With GATEC, small business knows what Wright Patterson is buying, and buyers know what small business can supply.

In our discussions with GATEC vendors, we found that their implementation of EDI has been driven by Wright Patterson's implementation of GATEC. For the majority of the vendors, Wright Patterson is often the only trading partner with whom the vendors use EDI. Furthermore, many vendors cite their previous business with Wright Patterson, and their desire to continue that business, as the reason they implemented EDI. The fact that implementation is DoD-driven indicates the effect that the federal government can have by being a first mover.

We also found that it is not necessary that purchases by Wright Patterson generate a significant percentage of a vendor's revenues in order to justify investment in EDI. This is a further indication that the cost of EDI is often not an obstacle for small business. Several vendors we spoke
with implemented EDI even though only 1-2 percent of their revenues are generated from sales to Wright Patterson. However, one negative impact on the competitive nature of Wright Patterson's procurements is that as the number of vendors bidding increases, the margins on each contract narrow. Many small vendors say that they are now obtaining more contracts with Wright Patterson, but that the profit they make on individual contracts is smaller than it was prior to GATEC. However, to the extent that vendors are better able to bid on and obtain an increased number of contracts, the GATEC program can increase vendors' total profits while reducing overall cost to Wright Patterson.

Wright Patterson officials feel that they have done a lot to address the needs of small business in GATEC implementation, and vendors generally agree. Initially, the base sponsored several vendor conferences in which they invited all of their vendors to participate. At these conferences, GATEC organizers explained the benefits of EDI and included the VANs, who demonstrated their software. The base also opened an "opportunity center" which vendors could visit. At this center, vendors could see the system up and running, get practice using the applications, obtain VAN information, and even bid on contracts without having to invest in any equipment. The opportunity center was open for two years until it became clear that vendors no longer needed it.

It is clear that most vendors are generally happy with the GATEC system. They do, however, see room for improvement. The most common complaint we heard from vendors is that they would like to see GATEC integrate EFT in order to speed up payment. They would also like to see the system develop the capability to consolidate RFQs for similar items that are being fulfilled separately. Currently, each line item is one Wright Patterson contract. Therefore, if a vendor supplies Wright Patterson with eight different items, those items require eight purchase orders, eight invoices and eight checks. This is more expensive for the government and the vendor than if these similar RFQs could be consolidated into one.

Costs and Benefits

From the suppliers' side, vendors do not consider the costs of GATEC implementation to be high. While many of them implemented EDI because they had to if they wanted to continue doing business with Wright Patterson, they have not found it prohibitively expensive. Most vendors did not conduct cost/benefit analyses prior to EDI implementation for one of three reasons: (1) they felt that the benefits were obvious, (2) they needed to do it to continue to do business with Wright Patterson,
or (3) they already had most of the requisite equipment in place and the cost of implementation was very low. Also many vendors stressed the low exit costs due to the lack of dedicated assets.

Implementation costs do vary, but are never very high and do not appear to be a barrier to adoption of this application of EDI. Assuming a vendor already owns a PC, which most do, they can implement GATEC for as low as $600 or $700. In addition to initial startup costs, they may also have to pay a monthly usage fee, which could be $50 to $150 per month, and telecommunications charges for the phone calls they make.

Of course, vendors interested in receiving more services have to pay more for their system. At the high end, software can cost a vendor as much as $3,000, and the monthly VAN fees are dependent upon the services the vendor requires. It appears that smaller VANs that obtain a large percentage of their business from GATEC vendors are more likely to supply software free or for a nominal fee. It is clear from these figures that implementation costs are not precluding small business from participation in GATEC. Comments from vendors confirm this observation; most feel that the benefits of the system greatly outweigh the costs.

Vendors cite the increase in the amount of information available regarding potential procurements through EDI as the most important benefit. As discussed above, prior to GATEC, vendors were dependent on telephone calls from Wright Patterson buyers to gain awareness of the base's procurement needs. With GATEC they are aware of all of the base's procurement needs under $25,000, and are free to bid on all of those contracts.

In addition to increased information about what Wright Patterson purchases, vendors also benefit from information on bids they did not win. With GATEC, vendors can obtain information about the winning bid for any RFQ on which they bid. They know the winning bid, by whom it was submitted, and whether it is cost effective for them to continue bidding on similar contracts.

It appears that small firms using the GATEC system are in a position to realize the first tier benefits of EDI, because they are often first movers in their industry. Many vendors indicated that they have been able to maintain or increase the level of business they do with Wright Patterson by implementing GATEC. Wright Patterson is often the only trading partner with whom they use EDI, because no one in their industry uses it yet. In this sense, GATEC is a pilot project for these ven-
dors because presumably their industries will eventually begin using EDI. They will then be in a position to expand their use of the technology and capitalize on their experience, perhaps realizing additional first-mover benefits.⁴

Through our discussions we also found that small firms are typically not realizing the full benefits of EDI because they have not integrated EDI with their internal computer applications. That is, they are not yet realizing the second-tier benefits of EDI. Most small GATEC vendors maintain paper back-up for all of their EDI transactions and re-key all EDI documents to input them into their accounting, inventory, or other internal software applications. Since these firms do not typically use EDI with their other trading partners (e.g., suppliers) they need to have hard copies of all of their documents. Possible reasons offered why vendors are not integrating EDI with their internal computer capabilities are as follows: (1) they do not own or are not aware that they own the mapping capabilities within their translation software to create the interface; and (2) the internal systems used by small and medium-sized businesses do not anticipate incorporating EDI, and vendors would therefore have to purchase new internal software applications. There are a handful of software companies and VANs working to solve this difficulty by developing software that will provide an interface between internal applications software and EDI transmission software.

Implications/Recommendations

The fact that Wright Patterson has been the first trading partner with whom most GATEC vendors have used EDI indicates the potential impact that DoD and the federal government can have on the diffusion of this very important technology. In the case of GATEC, the small business focus of this pilot program motivated the government to design a system with an open architecture which has allowed small business to participate widely in EDI without incurring large implementation costs. The importance of this open architecture to the success of GATEC cannot be overemphasized. Since much of private industry has developed proprietary EDI systems and is slow to move to more open systems, it is important for the federal government to take the lead in demonstrating the advantages of systems which employ open architecture and standard formats.

⁴It is important, however, that these firms use some foresight to make educated choices when selecting their VANs. A VAN that caters to a firm's current EDI needs and has the capabilities to accommodate its future EDI needs is the best choice. A firm that may expand its EDI applications to more than one industry may want to choose a VAN that serves several industries. On the other hand, a firm that deals exclusively with the federal government may want to select a VAN with a concentration in this area.
Another important factor contributing to the rapid diffusion of the GATEC EDI program among small firms is that the DoD is an experienced user of EDI. Research has shown that EDI is more easily implemented with an experienced trading partner. The DoD has implemented several projects prior to and concurrent with their implementation of the GATEC program. Examples of previous DoD EDI programs include the Electronic Commerce Operating Net (ECON) pilot program, which was established in 1991 as a precursor to the GATEC program and involved the use of electronic mail with approximately 30 vendors, and the Defense Logistic Agency's SPEDE program, which electronically solicited, received, evaluated, and awarded bids to 42 pre-qualified vendors of medical products. These prior experiences with EDI have allowed the DoD to better evaluate the best way to implement an EDI program that is responsive to the needs of small firms.

Also contributing to the rapid diffusion of EDI among DoD vendors is the DoD's selection of participating VANs. The DoD selected participating VANs in an attempt to offer a varied range of cost and service alternatives while at the same time ensuring standardized data formats. In the words of one DoD official, the DoD's selection of participating VANs offers "Volkswagen to Cadillac service." By selecting a limited number of participating VANs, the DoD made it easier for the vendors, most of which were implementing EDI for the first time, to evaluate the network options available providing a wide range of service options. In addition, the use of VANs better enables those vendors who wish to extend their EDI implementation outside of the DoD to add trading partners. Some of the VANs selected allow interconnects to other VANs, thus increasing the network options of users. In addition, because VANs often cater to several differing data formats, the potential problem of adding trading partners who support differing standards is minimized. Some VANs will identify those RFQs of interest to a given vendor.

Through the use of VANs, vendors can avoid the additional training costs associated with incorporating revised versions of standards into their existing systems. However, the insulation from differing standards that the VANs provide may also be detrimental to small firms. As mentioned above, some vendors are vaguely aware of the ANSI X12 standards setting process but do not participate and therefore do not provide input into the development of the standard transaction sets which they use.

According to one VAN, currently there are approximately 35,000 businesses in the United States that use EDI, and 50,000 total worldwide. However, 350,000 businesses trade with DoD
(Gerson 1993, 42), the vast majority of which are small firms. Given these figures, one can easily see the potential impact that the government can have in the diffusion of EDI.

However, despite its high visibility and high level support, expansion of the GATEC pilot program throughout the DoD was officially halted in March 1994. Much controversy surrounds this decision. Since the termination of the GATEC pilot, the DoD has begun the operation of a new EDI Test Facility with the goal of transacting business electronically with 300,000 trading partners. Using a file format known as the SEF (Standard Exchange Format) and a software that allows users to customize EDI standards, the DoD is attempting to comply with the federal government initiative of presenting “a single face to industry” such that through a single electronic registration, a trading partner can use a common set of procedures to conduct business with any branch of the federal government in exactly the same way (Whitcomb 1994, 21-22). DoD officials state that the best parts of GATEC will be carried over into the new electronic procurement system. If the federal government can help to influence the migration from closed, proprietary systems to open, standardized systems, the efficiency of American industry can be increased more quickly. If, on the other hand, the federal government does not use the lessons of GATEC’s open system in its further EDI ventures, the adoption of open systems will be slower, and potential efficiencies will be lost by American industry.

In terms of the interests of small business, we have developed several strategies that SBA can pursue to ensure that as EDI technology becomes more widespread, small business is in a position to take advantage of its benefits. First, SBA should encourage small firms who want to implement EDI, as well as small firms already using EDI to form users groups which are specifically concerned with small business issues. Small firms could help each other through discussions of issues such as VAN selection, hardware and software options, and technical difficulties.

In addition, SBA has information on-line about small businesses throughout the country, which other government agencies, including DoD, as well as other firms interested in adding more trading partners to their EDI networks, could use to target small businesses for EDI implementation. This information should at the very least be made available to government entities implementing EDI.

5Also see Clinton (1993) and Chisa (1994).
In addition, this information could be used by value-added networks to inform small businesses of the communications options available and their cost.

SBA should also act to disseminate information to the small business community regarding EDI. Since small firms are typically not first movers in the implementation of new technologies, and since their resources are usually more limited than those of larger firms, small firms will always have special concerns. A lack of information about available EDI options may present an obstacle to implementation, and SBA is in a position to facilitate the formation of an EDI information depository, which could serve as a resource for small firms.

Another area in which the SBA could help small firms benefit from EDI is to make them aware of the ANSI X12 standards setting process. Because vendors are insulated by their VANs from issues related to standards development and because for many the DoD is their sole electronic trading partner, most of them have little, if any, familiarity with the standards setting process. If vendors are to eventually expand their EDI programs to other non-DoD trading partners, they will benefit from knowledge of and participation in the standards setting process and will have input into the development of the standards that will affect them.

Finally, SBA could provide small business loans to firms interested in implementing EDI. While the designers of the GATEC system succeeded in developing a system which can be implemented at very low cost, not all EDI systems are as accessible. As will be shown in the case study of the U.S. Customs Service’s EDI system, many EDI users must make fairly substantial capital investments in order to become EDI literate. The SBA could work to fill the gap between the resources that small businesses have, and those required to implement EDI.

**EDI and the Customs Service**

**Background**

The U.S. Customs Service provides one of the primary revenue sources for the federal government. Customs collects approximately $20 billion in duties, taxes, and other fees annually while also enforcing over 400 laws and regulations pertaining to 40 different government agencies.
In the last two decades, the volume of imported goods has increased astronomically, and Customs' resources have been stretched to the breaking point. From 1981 to 1991, the annual total dollar value of imported goods has increased over 100 percent, and Customs has turned to automation, and specifically EDI, as a resource for handling the transaction volume.

The U.S. Customs Service initially became involved with EDI in the mid- to late-1970s. EDI represented an opportunity to process import paperwork more accurately and more quickly. Customs' initial electronic pilot program involved five ports and the simple automation of customs forms. The program did not save money because the cost of entering data from a manual system exceeded the productivity benefits resulting from automation. According to one Automated Commercial Systems official at Customs, when Customs wanted to expand the service, the Office of Management and Budget shut the project down due to its high cost.

In the late 1970s, Customs tried again. At that time, most brokers already had computers and were keying in their customs information. They printed out their import paperwork, and sent it to Customs via courier or mail. Customs then had to re-key the information. As an alternative, Customs worked with the National Customs Brokers and Forwarders Association of America (NCBFAA) to implement a pilot program using nine brokers in Philadelphia and Baltimore which allowed brokers to submit import documents electronically through a system called Automated Broker Interface (ABI). Customs' computers could evaluate the information and send the forms back if they contained incorrect or incomplete information. The pilot was successful, and ABI was implemented nationwide in April 1984. In 1986, Customs expanded its use of EDI with the automation of bill of lading information provided by freight and air carriers with a system called Automated Manifest System (AMS). Currently, the entire EDI system at Customs, generally referred to as the Automated Commercial Systems (ACS), includes use of the National Automated Clearinghouse Association's ACH system, which allows users to pay customs duties and other charges electronically, and a line release system to facilitate clearance of trucks entering the United States from Canada and Mexico, among other features.

Brokers can access the ABI system by dialing a 1-800 telephone number provided by Customs that connects to the ABI network hub. Transmissions are sent from the hub to Customs and to brokers in batches. For faster, real-time transmission to Customs, some larger brokers install and maintain, at their own cost, dedicated links to Customs.
Standards. In contrast to the DoD's GATEC system, the Customs ABI system was developed using proprietary software and standards. Before developing ABI, Customs conducted a series of surveys on the industry's use of computer technology. Customs found that the most popular system was a DEC mainframe with an IBM mainframe running a close second. They developed proprietary software for use on an IBM system, but made available conversion software which enables brokers to operate ABI using a non-IBM system. The development of high-powered, low-cost PCs in the last few years has triggered a trend toward running ABI on a PC. Over the past several years, third-party software vendors have made ABI-compatible software commercially available for several levels of computers. There are currently at least 50 vendors that sell ABI system software and hardware. Users are free to implement any software package that meets their own needs and the requirements of ABI. Customs also supports Transportation Data Coordinating Committee (TDCC) standards for ocean and air manifests.6

Since the development of ABI, standards have become a more important and pressing issue for EDI communications. The import trade industry by its nature involves many international players, and in order to facilitate the flow of information used by the Customs Service and other members of the U.S. trade community, the Customs Service has decided to migrate from its proprietary ABI standard to EDIFACT. The service already supports the EDIFACT standard in addition to ABI, but will at some time in the future support only EDIFACT.7 EDIFACT will enable the U.S. Customs Service to share information more readily with customs services in other countries. In addition, migration to EDIFACT will make it easier for members of the import trade community to communicate with other trade partners via EDI. Since the import trade crosses many different industries, firms that want to use EDI with all of their trading partners, in addition to Customs, must currently support the ABI standard in addition to their industry standard. According to some customs brokers, the Customs Service currently updates ABI so often that most larger brokerages employ a full time software maintenance person to implement the changes. Since many industries are migrating to EDIFACT, firms will be able to use one standard to conduct all of their EDI transactions.

6The TDCC standards were aligned with ANSI X12 standards in the early 1990s.

7The details of this switchover are still being determined. According to one Customs official, it will happen within the next two to four years.
Costs and Benefits to the U.S. Customs Service. We have not been able to ascertain the costs of development of the ABI system or even the ACS system more generally, but one Customs official estimated that the Service has invested roughly $1 billion on the entire ACS operation since 1984, of which roughly 40 percent can be attributed to ABI.8

On the benefits side, Customs has performed an extensive evaluation of EDI. In terms of paper, EDI saves each employee 40,000 sheets of paper annually, which is equivalent to a stack of paper 14 feet high. EDI has increased accuracy in import documentation. Prior to ABI, Customs used to reject 17 percent of entry filings; now they reject less than 1 percent (U.S. Department of the Treasury 1994b). They estimate that increased accuracy in filings has saved the import industry $50 million. In terms of cost avoidance, ABI has allowed Customs to reduce employment requirements by approximately 6,900 positions, based on productivity rates for 1983, the last year prior to ABI implementation. This equates to productivity increases of 9 percent per year, and cost avoidance of $276 million annually (U.S. Department of the Treasury 1994b). With ABI, Customs has introduced predictability and uniformity into the system, which has eliminated the need for port shopping and ensured fairness in treatment of shipments.

The most significant benefit of ACS for Customs is the increased selectivity of their inspections. With ACS, Customs now selects targets for inspections by computer, using criteria and other types of data, variable random formulae, and novel occurrences. Those shipments that are deemed to be low-risk are automatically cleared by the computer with no human intervention (U.S. GAO 1992a). With the increased import volume in the 1970s, inspectors worked hard simply to clear shipments through customs, and were unable to analyze shipments carefully. As a result, they were not able to properly prioritize inspections. With ACS, they can select those shipments most likely to have violated trade laws for inspection. In the last year, for example, the rate of inspections per inspector has decreased 1.7 percent while releases per inspector have increased by 14.6 percent. During the same period, total value of narcotics seized per inspector increased 53 percent and non-narcotics seized per inspector increased 51 percent (U.S. Department of the Treasury 1994b).

8 Because certain components of the ABI system are so intertwined with the ACS system, Customs has not been able to perform a cost analysis focusing only on the ABI system.
Small Firm Focus. While the ABI system can be used by both customs brokers and importers, we have chosen to focus on brokerage firms because of the large percentage of small firms in this segment. One study finds that 80 percent of customs brokers have fewer than 50 employees and over one half of customs brokers have only one office (U.S. Congress 1990, 53-54). The mix of firm size as well as the maturity of the EDI technology in this industry allow us to examine the potential impact of EDI on small firms over a longer horizon. Customs aided in the implementation of one of the early EDI systems, and more concrete conclusions can be made from its lessons than from those of GATEC, which has only been in operation for a short time.

The primary value that a broker adds to a transaction is its relationship with the various players in the market, such as steamship lines, customs officials, freight forwarders, etc. As a result, many brokerage houses have remained small, concentrating on building strong local ties. Traditionally, many importers who use one primary port of entry have used an independent broker with an office there. If they needed to import a shipment into another port, their regular broker would call a non-related local broker in the destination city and have that broker handle the transaction. The two brokers would arrange the fee split between them.

Findings: Effect on Small Firms

Currently, 96 percent of entry documents are submitted electronically to Customs. Nearly one-third of all entry release transactions through ACS are transmitted without submission of any paper documents (U.S. Department of the Treasury 1994b). However, many entry documents still require paper backup because they may require approval from other government agencies which have not fully implemented EDI. For example, the Food and Drug Administration (FDA) is concerned with approximately 20 percent of imports, and they have only recently been integrated into ABI. Until all of the relevant agencies are on-line with ABI, brokers cannot fully realize all of the potential benefits of EDI because they cannot limit the paperflow.

When ABI was first implemented in 1984, PCs were not powerful enough to operate the system. As a result only large brokers, who already had mainframe capability or could afford to invest in such technology, adopted ABI at that time. As PCs have become more powerful, ABI capability has become more accessible to small firms that have limited resources available for investment in technology. In the 1986-1989 period, medium-sized brokerages began to implement EDI. By the 1990s, ABI has become a competitive necessity. Brokerages that do not perform EDI
in-house must either utilize a service bureau or face losing all of their customers. Today, over 1,200 customs brokers use ABI.

Some brokers have indicated that they would like Customs to provide alternatives to the 1-800 access. Large brokers can afford to install dedicated links to Customs in order to perform faster data transmission. However, for smaller brokers that cannot justify this investment, Customs does not provide an alternative. Some of the small brokers we interviewed felt that because the majority of brokers run their ABI transmissions from a PC-based system, the Customs service could afford to provide an on-line, real-time transmission alternative to the 1-800 access, perhaps for a slight additional charge to brokers. This alternative would provide small brokers with constant immediate access to Customs and eliminate the current system of batch transfers.

In recent years there has been a trend toward acquisition of small brokerages by larger brokerages as the larger players try to gain market share. By acquiring a smaller brokerage instead of opening a new office, some large brokers entering new geographical areas or expanding into additional modes of delivery (i.e., land, sea, air) feel that they can capitalize on existing relationships. Many large brokers feel that they can better serve the needs of large importers by entering into all segments of the market. This trend was particularly strong in the early 1990s, when EDI technology became affordable for mid-sized and small brokers. In the rush to automate, many brokers felt that increasing their volume of business would help to justify their ABI implementation costs (Delia-Loyle 1991). As the role of technology has increased in the industry, some brokers have felt that the importance of a presence at several ports has grown. By purchasing already established brokerages, large firms feel they can obtain an established customer base in new markets as well as provide a local presence for their larger customers. The integration of these branch offices is enabled by the use of EDI. Small, technologically unsophisticated brokers that specialize in one area and have limited resources make good acquisition targets.

While most brokers are aware of the acquisition trend in their industry, many see no advantage in maintaining a presence in a number of ports. In fact, one small broker we spoke with in Boston says that with a large brokerage firm, an importer must measure the service it receives from a large broker by the weakest office in the big broker’s operation. By selecting a more national broker, importers often relinquish the right to use another broker in a particular city if they feel they are not receiving high quality service. Further, some think that the brokerage business is most
profitable as an owner-operated business, and that large brokerage firms have a hard time motivating employees at multiple offices.

Most small brokers view EDI as a technology which helps to level the playing field by allowing them to process transactions as efficiently and provide the same level of service as their larger competitors. At present, shipments must clear customs at the port of entry, although duties can be paid at any port. Customs has promised that shipments will soon be allowed clearance through any port, which many feel will eliminate the advantage of multiple offices altogether. While a local office allows better relationship building, which is an integral element of the brokerage business, there is no reason to think that a large brokerage can build better relationships within a given community than can a small broker. While there are differences of opinion about the advantages of large brokerage firms, it is clear that there are still many profitable, thriving small customs brokerages at all major ports in the United States. Given that EDI has been pervasive in this industry for over ten years, we believe that the small broker will not be pushed out of this market, and that ABI has generally had the effect of leveling the playing field.

However, it appears that large brokers have realized some differential advantages from the increased reliance on computer technology in the import industry. When Customs first implemented the ABI system, its design was geared toward mainframe computers because PCs were not as powerful as they are today. Large brokers with more trading partners and financial resources were better able to justify this expense. However, with the advent of more powerful, low-cost PCs and the subsequent design of ABI software to run on PCs, small brokers have been somewhat able to eliminate this differential advantage between small and large firms.

In addition, since large brokers are more likely to service the largest importers, they are also more likely to be integrated electronically with their customers. The large importers are generally some of the most sophisticated firms in the world, and they use EDI in their own businesses. By integrating with their customs brokers, these importers can avoid re-keying customs information and thereby operate more efficiently. Large brokers can realize some efficiencies from this integration such as electronic invoicing. In addition, some large brokers that are integrated with their customers have placed modems in their customers' computer which allows the importer to dial into the brokers' computer to check the status of their own cargo. This saves the broker time and effort in answering calls from customers.
Another trend in the import industry, due to the efficiencies of EDI, is toward self-filing by importers. Instead of using a broker to submit their customs documents, some large importers have elected to bring the customs filing in-house, and they electronically transmit their documentation directly to Customs. One Fortune 500 company tells Customs officials that they have saved $300,000 annually by filing directly. These savings result from reduced brokerage cost, reduced paper volume, reduced use of messengers between themselves and the customs house, and decreased staff. With ABI, the import departments of large importers are able to perform more functions with fewer employees. About 75 percent of these savings stem from reduced broker fees.

Most brokers we spoke with do not see this trend toward self-filing as a threat to the brokerage community because they feel that only the largest importers process enough transactions to justify self-filing. In addition, they feel that customs clearance is just one of the functions performed by customs brokers. They anticipate that as more importers begin to file directly they will realize the value added by brokers in terms of working through problems. We learned of one large retailer that apparently tried self-filing, but had difficulty resolving the inevitable difficulties that arose in dealing with several different trading partners, and decided to return to use of a broker. Many brokers agree that it does make sense for large importers who tend to import the same goods repeatedly to file directly because they are not receiving many value added services from their broker. It is more economical for them to bring this function in-house. From the perspective of small brokers, the large import accounts are usually handled by the large brokers anyway, and the trend toward self-filing has not affected them.

However, a few of the brokers we talked to expressed concern about the trend toward self-filing because they believed that Customs is pushing large importers to do so. They say that Customs has negotiated concessions with large importers who agree to file directly with Customs, and they resent the government's infringement on their business. It is unclear whether such concessions have actually been made, but it seems that importers who are benefitting from the value-added services provided by brokers would soon realize that they are not gaining much from self-filing.

**Costs and Benefits**

For the trading community, the most significant cost of ABI is the cost of implementing this technology. While many large brokerage firms such as John V. Carr & Son, Fritz Companies, and Radix Group, have literally spent millions of dollars developing their computer systems (Delia-Loyle
1991), this level of investment is not required to perform EDI with Customs. There are over 50 vendors which have developed ABI systems, including hardware and software, and the products they supply represent every range of service. PCs are by far the most popular hardware for performing EDI with Customs. At the low end, a small broker that already has a PC can probably spend less than $5,000 on software, and another $1,500 for hardware and have an ABI system in place. One vendor we spoke with, who caters to the needs of small and medium-sized brokers, says the "average" system costs a brokerage house $15,000 to implement. This cost usually includes PC terminals and accounting software, which allows the broker to realize the benefits of integrating EDI communications with internal software applications. Some vendors we spoke with quoted prices in the $40,000 to $50,000 range. Unlike the GATEC system, ABI requires very few on-going costs since Customs provides 800 numbers to ABI users to enable them to communicate with Customs free of charge.

Thus, while implementation costs vary widely, from a low of $6,000-$7,000 to a high of over $50,000, it seems that even the high range is probably not acting as a barrier for small brokerages. The Customs Service provides a list of software vendors and service bureaus to brokers interested in implementing EDI. In addition, Customs Service representatives are available to help with implementation and maintenance, providing training and technical troubleshooting. The general consensus among brokers is that the representatives are very helpful and their only wish is that there were more representatives available. Most brokers who want to implement ABI or who want to start a small brokerage business and needed to purchase an ABI system would probably be able to borrow enough money to do so without much difficulty. This conclusion is borne out in the marketplace, where there are many, many small brokerages using ABI.

An additional future cost will be the switch to EDIFACT. Firms will have to purchase new software to use EDIFACT, as well as train their staff to use the new standard. Although Customs currently supports both ABI and EDIFACT data formats, most brokers use the ABI standard at present because, until recently, it was the only standard supported by Customs. While it is currently unclear when the ABI migration to EDIFACT will occur and the costs are difficult to quantify, it is apparent that customs brokers will incur some switching costs in the form of software and training.

ABI provides many benefits to the brokerage community. The primary benefit brokers cite is the increase in productivity allowed by the system. Customs estimates that brokers can process
approximately four times as many trades per hour with ABI as they can without it. This translates to more business for brokers, and also allows them to spend less time obtaining customs clearance and more time providing other value added services to their customers. Brokers say that the decrease in lead time provided by ABI saves their customers money. Prior to ABI, customs clearance usually took two to three days; now clearance can usually be granted before the broker logs off the system. For importers, this means lower storage costs, shorter lead times, and more predictability.

Another benefit of the ABI system is the inclusion of electronic duties payment through ACH. Some importers are linked electronically with Customs, and therefore can pay their duties directly, precluding the need for the broker to float the payment for the importer. Even when importers are not linked directly with Customs, brokers still save check writing costs associated with duties payment. Most duties payments are due within 10 days of entry. Prior to ACH, it was often difficult for brokers to invoice importers via mail and receive a check for payment within that 10 day period. With ACH, there is no extension of the payment due date, but the payer’s account is debited usually no sooner than two business days after Customs accepts the initial ACH payment authorization (U.S. Department of the Treasury 1994a). Several brokers we spoke with mentioned the benefit of two additional days to obtain payment from importers, indicating that ACH reduces their losses from floating their customers. The predictability of payment has allowed brokers to restructure their letters of credit, and Customs has estimated this saves them $1.5 million per year in interest costs alone.

With respect to benefits, it is clear that ABI has provided more benefits to large brokers than to small brokers. The proprietary nature of the ABI system, with its high cost, initially allowed large brokerage firms to capture the first tier benefits of EDI by developing a competitive advantage over smaller firms. In the mid-1980s, brokerages with high volumes and significant financial resources could afford to implement the technology, and most likely captured the business of the largest importers. Small firms were not able to realize any of the first tier benefits of ABI, and have only managed to follow the lead of the large firms as the price of the technology has fallen. ABI is now a competitive necessity, and in order to realize any true benefit from their investment, firms must integrate ABI with their internal software applications.

It is clear that many small brokerages, like small firms in other industries, have found it difficult to accomplish such integration with internal applications. This lack of integration probably results from the fact that these brokers already had accounting and invoicing software in place.
before they implemented EDI, and would have to invest additional funds into new ABI-compatible systems, as well as train their staffs, in order to achieve integration. Given that ABI is already fairly expensive to implement, they may find the additional investment necessary for integration difficult to justify. In addition, because the ABI data formats and software are Customs-specific, brokers can not extend this investment to conduct EDI with other non-Customs trading partners. Therefore, an additional investment in software, training and the integration of another data format may be prohibitive to small brokers, hindering them from extending their EDI program to multiple trading partners. Migration to EDIFACT might somewhat mitigate this problem. For these reasons, many small brokerages may not have realized the second tier benefits of EDI.

The competitive advantage accrued to large brokerages in the import industry illustrates the limitations and difficulties posed by proprietary EDI systems. The expense of the system put it out of reach of small firms for several years, putting them at a competitive disadvantage. While this advantage will most likely disappear in the long run, it may have in the short run put some small brokers out of business or made them easy take-over targets by larger firms looking to gain additional market share.

Recommendations

The most important aspect of Customs' EDI implementation is its choice to pursue a proprietary system. While this decision was probably largely driven by the time at which Customs pursued EDI rather than a deliberate decision not to adopt a standardized format, the limitations of such a system cannot be avoided. Many of the brokers we spoke with are unaware of Customs' intention to migrate to EDIFACT, and that is the most important recommendation we can make. Customs needs to prepare brokers for the migration, explain to them the advantages of the new system, and facilitate their implementation of the new system. Use of EDIFACT will no doubt open the import community to more widespread uses of EDI, since many companies that trade their goods and services internationally are already using standard EDI formats. Without conversion to EDIFACT, the Customs Service and its trading partners will not be able to move to the seamless trading environment required to capture the third tier benefits of EDI.

One complaint that small brokers had with the ABI system is the lack of flexibility in transmitting data to Customs. For firms that cannot afford a dedicated link to Customs, the only Customs-provided option is access through a 1-800 telephone number. While this is a low-cost way to trans-
mit data, it does not provide the speed or real-time transmission features desired by some smaller brokers. One way in which Customs could introduce more flexibility into the ABI system is to mimic the DoD's use of selected VANs in its GATEC pilot program. Selected VANs could provide interface between brokers and Customs, offering varied transmission speeds, data translation services between standardized formats and the ABI format, connections to multiple non-Customs trading partners, and offering a generally broader range of services at varying costs for small brokers that prefer a greater range of data transmission alternatives or may not wish to make an investment in a strictly proprietary system.

The ACS system provides an excellent example of the difficulties associated with proprietary systems because the closed nature of this system precludes its users from communicating via EDI with trading partners who use standardized formats. Although the selection of a proprietary system may have initially helped spread the diffusion of EDI among brokers, the government has limited its impact on long term EDI diffusion with this system by forcing its users to invest in additional technology to change over to ANSI X12 or EDIFACT. This effect is particularly lamentable because the import trade crosses so many other industries that an open system would provide a great opportunity for EDI spillover.
Chapter IX
Innovative Use of EDI by Small Firms

Introduction

Small firms have historically played a key role as drivers of innovation in the U.S. economy. Because the work flows at small firms are often less complex than at large firms, centering around one core business rather than several, small firms have greater flexibility to integrate technology into their internal operations. Small firms also have a greater ability to employ technology innovatively in products and services, which allows them to expand the scope of their business.

EDI, as an information-intensive technology, enables small firms to control and manipulate vast amounts of information without the large staffs or substantial financial resources of larger firms. Through innovative applications of EDI and other information technologies, small firms can realize competitive advantages, gain access to markets previously dominated by large firms, or create niche markets for unique services. Investigation of specific innovative uses of EDI by small firms can indicate factors for successful small firm implementation of this technology across industries. This chapter presents three interesting applications of EDI, two by small firms and one by a non-profit organization. Each of these three applications of EDI are presented below, followed by a discussion of the competitive effects of each and some common components of successful implementation.

Coyne Leasing

Coyne Leasing acts as a middleman between office equipment vendors and their clients, servicing the leases of office equipment ranging from $500 to $5,000 per month. To service 70 percent of its leases, Coyne uses financial EDI. Coyne electronically invoices lessees and collects lease payments through electronic direct debit via the National Automated Clearinghouse Association (NACHA). Coyne also pays its dealers through direct deposit into their accounts at one of two banks using the Fedwire. In addition, Coyne performs credit checks of lessees and their guarantors in approximately 10 minutes through electronic access to two credit bureaus. Coyne transfers approximately $4 million per month electronically via financial EDI. Coyne currently employs 110

1The names of these organizations have been changed in order to maintain anonymity.
full-time workers. Before its implementation of financial EDI, Coyne had less than 50 full-time employees.

The market for servicing small leases is truly a niche market virtually dominated by small firms. Coyne implemented its electronic invoicing and debit program in 1991 in an attempt to gain a competitive advantage in this market. It expanded its financial EDI applications to include direct deposit into its dealers' bank accounts in 1994. Due to the paper-intensive nature of its business and the lengthy turnaround time of invoice issuance and payment, the use of financial EDI enables Coyne to service many more leases than allowed through traditional paper methods. Coyne has realized a huge increase in business which it attributes to the implementation of EDI, with revenues doubling every year since EDI implementation and the number of leases serviced increasing from the 200 to 300 range to 65,000 to 70,000. To Coyne's knowledge, none of its competitors are using integrated financial EDI although they may be electronically invoicing their clients. In fact, Coyne's competitors are now serving as brokers to Coyne, selling portfolios of leases to it which they cannot service without financial EDI.

Coyne uses a mainframe to maintain its transaction database and run its core applications. Invoicing and direct debit applications are run directly off the mainframe. At the banks' request, a PC server is used for electronic direct deposit applications. Coyne upgrades its mainframe approximately every 18 months to accommodate increased business and a need for additional processing speed. Lessees and dealers can access Coyne via switched dialup links. Coyne gives them the option of connecting directly or through a VAN.

Coyne underwent substantial reorganization to accommodate the transition to EDI. Coyne's EDI system was progressively developed with integration starting in the back office and advancing through the rest of the business in order to achieve integration with internal applications. In order to further ensure a seamless interface between its EDI system and its internal applications, Coyne developed its software in-house. It is constantly revising both its EDI and its applications software to accommodate its rapidly expanding business and assure that it maintains the seamless interface between the two. For this purpose, Coyne employs three full-time software developers.

For approximately one and one-half years after its implementation of financial EDI, Coyne maintained a hybrid system of complete electronic and paper back-up for each transaction. Coyne
currently maintains a brief summary paper back-up for each transaction. In addition, Coyne performs periodic back-ups of its electronic database which it stores offsite at a third-party repository.

Coyne has realized substantial cost savings due to its implementation of financial EDI. Prior to the implementation of EDI, Coyne spent approximately $2.00 per transaction to process paper billing and payment collection. Through electronic invoicing and direct debit Coyne’s cost is approximately $0.18 per transaction. Even more impressive are their cost savings realized through electronic direct deposit. Prior to the implementation of EDI on the deposit side, the cost to Coyne of transferring funds to their dealers was $8.00 per transaction. The cost of electronic deposit is approximately $0.45 per transaction.

Additional benefits realized by Coyne, which are harder to quantify, include the elimination of late payments on leases that are electronically serviced, as well as a decrease in lease defaults. In addition, Coyne has noticed a vast improvement in its banking relationships. Due to the increased control that Coyne has over its funds, banks are more willing to extend credit. This is an important benefit since the firm is highly leveraged due to the nature of its business.

Coyne has encountered some resistance among its trading partners. In signing on electronic trading partners, Coyne has found that smaller customers are more willing than larger customers to allow direct debit. Their explanation for this is that smaller customers have less complex accounting systems and thus can accommodate electronic invoicing and direct debit more easily. Larger accounts have more rigid accounting practices and thus offer more resistance to electronic invoicing and debiting. In addition, there exist several security issues when dealing with EFT. Coyne is extremely careful to avoid security breaches and is audited periodically by a Big Six accounting firm to ensure that its security precautions are sufficient. However, security and confidentiality concerns on the part of large customers may contribute to their resistance to doing EFT with Coyne.

Coyne has also run into problems with standards. They use NACHA’s ACH standard for their direct debit EDI. However, they have found that, in reality, this is not a common standard but is instead implemented in various ways by different banks with each bank picking only certain features from the standard or adapting the standard to fit its own internal applications. The same problem has proved to be true for its direct deposit application. This lack of complete standardization has
somewhat hindered Coyne's expansion because it must be certain that their data formats comply with the varied formats of the banks with which it is dealing.²

Coyne does not consider the cost of implementing financial EDI to be prohibitive for small firms given the level of benefits to be realized. However, Coyne is not only realizing substantial cost savings, it is also realizing a huge increase in business due to first mover advantages which it has been able to sustain for several years. There does not seem to be an explanation for why competitors have not followed in Coyne's footsteps. Perhaps due to the huge growth in its client base it is perceived among Coyne's competitors that Coyne has effectively eaten up the first mover advantage of increased business. It may be that competitors are electronically invoicing their clients but feel that the additional cost saving of EFT does not justify an expansion. Competitors do not seem sufficiently threatened by Coyne's increase in market share that they feel compelled to implement financial EDI out of competitive necessity. Perhaps they are benefitting sufficiently from their expanded role as brokers of lease portfolios to Coyne such that they do not feel the need to expand their EDI programs.

Coyne recognizes its status as a first mover has contributed to the high payoff of its EDI investment. However, it also credits its progressive implementation and the ongoing upgrading of its hardware and software as a key factor in the success of its EDI program. Although Coyne did not conduct a formal pilot program or cost benefit analysis, a progressive implementation allowed the company more time to evaluate the effects of EDI on its day-to-day operations and ensure the full integration of its EDI system with its core applications. Continuous evaluations of and modifications to the software and hardware ensure that the EDI system never becomes outdated and that it never loses the seamless interface between the EDI system and core applications.

Anderson Graphics

Anderson Graphics is a desktop publishing firm which acts as a service bureau, interfacing between the publishing industry and advertising firms, design firms and other clients. Anderson

²As an interesting sidenote: Coyne mentioned that one bank with which it conducts EDI re-keys into its applications all of its electronically received remittance data from all trading partners to account for potential errors caused by transposed digits. Presumably there should be a way to detect and correct for these errors without human intervention. Not only does this suggest an inefficiency at this bank, it also suggests that some of the bank's electronic trading partners are rekeying data from their core applications into their EDI systems.
provides page layout, color correction and other services necessary to convert text and graphics to a publisher ready format. Anderson Graphics uses EDI technology to electronically exchange graphical and textual data with clients. Seventy-five percent of Anderson's client base is composed of small firms. Anderson has 120 full-time employees.

Anderson electronically exchanges data with clients over an ISDN network: a switched telecommunications network which can transmit both voice and data signals over the same cable. Because data transmissions over ISDN do not need to be translated, it offers a faster transmission rate than transmission via modem. Although Anderson's internal applications are Macintosh-based, the firm uses a UNIX environment for EDI transmissions. Clients can use PCs to transmit data to Anderson. Anderson uses third-party software for its EDI applications. Anderson scans and digitally images the received data in order to provide desktop publishing services. Anderson maintains an interactive relationship with its clients, editing, sending and receiving the work product several times before it is sent back to the client the final time in a publisher ready format. ISDN offers the speed required for this interactive relationship.

Anderson believes that its use of EDI has allowed the firm to substantially broaden the range of services it offers. When Anderson started business in 1989 it was a three person firm providing simple desktop publishing resources and hourly computer rental services. Prior to its implementation of EDI, Anderson typically received data from desktop publishing clients via courier. Although only one-half of one percent of Anderson's clients use ISDN to transfer data, Anderson has grown by fifty percent every year since it implemented EDI technology. Anderson believes this growth is due entirely to its use of EDI because the clients that do use it are large, high-volume customers who rely on the interactive relationship Anderson provides. However, Anderson does strive to offer flexible service to clients with varying degrees of technological capability through the use of modem pools, the Internet and courier service in addition to EDI via ISDN.

EDI technology has allowed Anderson to service larger clients that, due to their high volume of work, previously relied upon larger desktop publishing firms. The firm is targeting increased work with large clients as a strategic key goal of its expansion. Anderson believes that it needs to work with larger clients in order to expand its use of EDI. Anderson is willing to pay for the ISDN connec-
tion to its larger clients, relying on the increased business volume to cover the investment. However, Anderson will not pay for small firms to conduct EDI via ISDN believing that the periodic transmissions of small firms do not justify the investment and that the benefits realized by performing this type of EDI with small clients are fewer than with large clients. It feels that its smaller client base suffers from a lack of knowledge about the technology and a lack of financial and technical resources. Anderson is considering an incentive package to aid small firms in installing ISDN networks, however, because EDI via ISDN is in its early stages, it is unlikely that a small firm would use this form of EDI with other trading partners.

For smaller volume clients who cannot justify an investment in ISDN, Anderson also accepts data transferred via modem over an analog network or data posted to an electronic bulletin board via the Internet. Although these methods of data transfer are significantly less expensive, they are much slower, requiring approximately 45 minutes per transfer for large files, and thus do not allow for a rapid interactive relationship. Therefore, small firms which are unable to cover the ISDN investment themselves, are unable to perform high speed, interactive EDI with Anderson.

Although some of Anderson's competitors are currently using similar technologies, Anderson believes through its use of ISDN it is a forerunner in its field and that ISDN will become the preferred method of electronically transferring data in the desktop publishing industry. Its use of EDI via ISDN has allowed Anderson to offer large clients an interactive relationship and high speed, personal service. Anderson is planning to expand its implementation of EDI from three existing sites to seven sites nationwide to service clients outside of its local region. According to Anderson, such an expansion would not be possible if it were still relying on the courier method to receive their work from clients.

Currently, Anderson does not have an electronic connection directly to publishers. It electronically relays publisher-ready work product to clients who then transfer this to publishers via mail or courier. However, Anderson is planning to establish electronic links with its large publishers. In addition, Anderson is planning to expand into the publishing business, establishing their own off-site printing press to which they would electronically transmit data in publisher-ready format. Because they are a forerunner in this particular application of EDI, Anderson feels that it has been necessary

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3The total cost of installing ISDN with a single client is approximately $4,000.
to become its own expert. Anderson does not have the benefit of learning from the experiences of previous implementers and feels that a trial and error approach is the price it pays for gaining a competitive advantage. For this reason, it finds that membership in several user groups has been vital to their successful implementation. Membership in industry and vendor user groups allows Anderson to keep abreast of technological developments and discuss relevant issues with competitors and members of the trading community. According to Anderson, the user group is where hardware, software and telecommunications concerns align. Participation has allowed the firm to survey the technological offerings available before implementation in order to make informed decisions when designing their system. This is especially important concerning desktop publishing applications of EDI because, according to Anderson, there exists a seemingly endless array of implementation options available on the market. In addition to participation in industry user groups, Anderson serves as a beta (or testing) site for several third-party software vendors, allowing it not only to preview future software packages but also contribute to the development process.

In many ways, Anderson is still in the pilot stage of its implementation because its ISDN-based EDI program only serves one-half of one percent of their customer base. Anderson did not perform a formal cost/benefit analysis prior to investing in ISDN technology, but was relatively aware of the costs and benefits due to participation in the industry user groups. Although its competitors are using EDI, Anderson feels that its particular type of implementation allows it tremendous room for growth into new markets and that it will continue to be able to offer its clients a unique service.

Massachusetts Library Network

The Massachusetts Library Network (MLN) is a consortium of 10 regional non-profit library networks in Massachusetts. Each regional network provides electronic searches of local member library holdings as well as limited access to other research databases outside of the local region. The MLN was established in 1980. The participating library networks range in membership from twelve to seventy libraries, averaging approximately twenty-five member libraries. The majority of the members are public town or academic libraries with the remaining being private academic

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4Although the MLN is a non-profit organization, it provides an interesting example of an application of EDI that is well suited for small firms. Because EDI allows small firms to control and manipulate large information databases, many industries contain small information bureaus which search remote databases. For example, one small firm provides electronic searches of a major car manufacturer's dealerships to locate specific automobiles for customers. Another small firm provides an online credit checking service for retailers.
libraries. Approximately 80 percent of the networks' funding is derived from membership library fees with the remaining 20 percent covered by ongoing state funding and periodic federal grants from the Department of Education under the Library Services Construction Act. Each network employs, on average, five to fifteen full-time employees.

Each library network maintains a mainframe database of member library holdings. Hardware is updated periodically to accommodate additional ports for new members and to allow for increased speed and memory. Member libraries, when they join the network, convert their card catalogs to electronic catalogs which contain bibliographic information and current loan status for each library holding. Member libraries are connected to the network via modem over digital dedicated lines. Networks typically use third-party software of which there exists a broad selection. Software is upgraded periodically. Patrons and library staff members can conduct searches of network holdings by accessing the central database on either dumb terminals or PC-Lan systems. Currently five of the MLN networks are interconnected via the Internet such that they can search each other's member library holdings. It is forecasted that eight of the networks will be interconnected by the end of fiscal year 1994. Member libraries can also use the Internet to access remote research databases and Library of Congress holdings.

Member libraries pay approximately $15,000 to $20,000 per year in membership fees which include EDI software, telecommunications equipment and installation, and monthly telecommunications costs. The network also provides staff training for new members and maintains the telecommunications network. Libraries must provide their own hardware, which most already possess, and spend staff time converting their card catalogs to electronic catalogs. Disadvantaged libraries may be able to obtain government grants to subsidize the initial start-up costs. Networks mandate that their member libraries participate in consortium meetings.

Data formats are dictated by the choice of software. Networks within the MLN consortium use differing third-party software. As the consortium strives to interconnect its networks, this lack of common standards has proven to be a problem. However, software vendors are fueling the drive toward increased standardization and will typically provide translation capabilities to enable interconnects. More of a concern regarding interconnects are the varying levels of telecommunications sophistication between different networks.
Typically, the networks did not perform formal pilot programs or cost/benefit studies when implementing their systems. However, early implementers in the consortium usually employed outside consultants to aid in the choice of hardware, software, and telecommunications configurations. Later implementers credit consortium membership as a valuable asset when evaluating third-party software choices or hardware upgrade options. The consortium functions as a user group, keeping members abreast of technological developments and serving as a forum for common issues and concerns. In addition, to qualify for federal and state funding, the networks must provide fairly elaborate proposals outlining short-term and long-term goals. This induces the networks to conduct a periodic if somewhat informal cost/benefit analysis.

Before the advent of the consortium, large academic libraries tended to be the first movers in this area, implementing their own networks of stand-alone systems. Consortiums such as the MLN, however, have allowed smaller libraries to realize economies of scale, grouping together to share the costs of implementation and maintenance and benefitting from the experiences of other members. In addition, the more open environment of the consortium enables the individual networks to interconnect more easily than the stand-alone systems of the first movers.

The MLN networks have found that there is generally a high level of awareness of information technology within the federal government. This may be due to the fact that the Library Services Construction Act makes library networks a high priority. Another explanation offered by one network is that recent discussion of the "information superhighway" has increased government awareness of information technology in general.

The library networks indicated that if they were forced to operate on membership fees alone, the networks would either be forced to increase membership fees or offer varying levels of service to membership libraries at varying rates. The biggest problem would be possible prohibitive start-up costs affecting not only the networks but the member libraries as well as the state and federal governments who subsidize the implementation for small and disadvantaged libraries. In addition, the networks would not be able to upgrade their hardware as often, thus slowing the growth in membership. The networks are currently investigating the possibility of offering varying levels of
service such as full text retrieval and increased access to remote databases at additional membership cost in order to accommodate the variance in the financial resources of the membership libraries. One network indicated that libraries that do not belong to an electronic network will become obsolete.

Conclusions

The competitive effects of small firm implementation of EDI can be observed by comparing these three applications of EDI. While both Anderson Graphics and Coyne Leasing were able to gain a competitive advantage from their applications of EDI, the type of benefits realized are different. Coyne's application of EDI is one of transaction processing. Through the use of financial EDI, Coyne is able to substantially reduce the transaction costs associated with invoicing and funds transfer such that it has been able to increase its customer base, thus dominating the niche market for small lease servicing. Anderson, on the other hand, uses EDI to offer its clients a unique service, thus gaining competitive advantage through product differentiation.\(^5\)

While both firms have been able to substantially increase revenues in their own markets and improve their competitive positions, the two firms are utilizing their competitive positions in different ways. Anderson is using its competitive position to expand its services into the related publishing market, where it previously served only as a middleman. In addition to allowing Anderson to achieve the operating efficiencies only previously realized by large firms, EDI offers Anderson a global reach such that it can expand its desktop publishing services out of its local region.

Alternatively, Coyne has changed the structure of the market it operates in, such that competitors are now servicing Coyne, selling to it portfolios of originated leases. This market shares some interesting similarities with the mortgage lending market in that the smaller players resemble mortgage brokers, originating portfolios which they sell to the larger players for servicing. However, in contrast to the mortgage lending market, the adoption of EDI was pioneered by a small firm rather than a large firm or government entity.

\(^5\)The use of EDI via ISDN has allowed Anderson, as a small firm, to offer a unique service through which it can compete with the larger firms in the desktop publishing industry. However, its attempts to expand its business and develop a large firm client base seem to have caused it to turn its focus away from its small clients such that small firms which are unable to afford the investment in ISDN technology are denied the unique service that Anderson offers.
All three applications of EDI suggest some important factors for the use of this technology as a competitive tool. Each application indicates that the process of workplace reengineering is a continuous one. The success of each application depends not only on the initial integration of EDI with the internal applications, but a constant process of evaluation and periodic revisions and upgrades to both the EDI system and its interface with internal applications in order to ensure that the benefits realized by EDI are retained and that growth can be accommodated.

In addition, both Anderson Graphics and the MLN indicate that user groups play an important role in successful implementation. User groups provide a forum for small firm concerns and allow firms to keep abreast of technological developments. The non-profit MLN consortium is very similar to the industry user groups attended by Anderson Graphics, where competitors share their EDI experiences. This indicates that, although EDI can serve as a competitive weapon, the long-term benefits of the technology may be enhanced through the cooperative efforts of all members of an industry.

Both MLN and Coyne Leasing indicate that an absence of standardization concerning data formats has proved to be a substantial obstacle to the expansion of an EDI program among multiple trading partners. Although Coyne uses the ACH standard format for electronic funds transfers, it has found that because different banks implement the standard in different ways, there exists substantial variation in different trading partners' use of the same standard. Due to this problem in standardization, Coyne has found that it has been unable to expand its EDI program as rapidly as it would like. Coyne did not indicate that it saw an imminent resolution to this problem on the part of NACHA. On the other hand, members of the MLN have found that the problem of multiple standards among different library networks is being resolved by the software vendors who have decided that facilitating standardization is a selling point. Therefore, network interconnects are becoming easier to achieve.

As the use of EDI increases across industries and becomes an integral component in the way firms operate, businesses and consumers are becoming reliant on the increased amount of information that is readily accessible due to this technology. Perhaps one of the most interesting indications of the scope of EDI's impact is observed in the statement by one of the MLN member's that libraries that do not subscribe to a network will become obsolete. As the use of EDI increases, consumers are becoming reliant on the increased amount of information that is accessible due to
this technology such that even a non-profit organization such as a library must integrate this technology into its service or become outdated.
Chapter X
Summary and Recommendations

The case studies, although by no means exhaustive in determining the various ways in which EDI has affected small business, have, nevertheless, pointed out certain common themes regarding impacts on small firms. In this chapter we discuss some of the more important conclusions and issues which have arisen as a result of several of the case studies and discuss possible recommendations and actions that SBA might consider to assist small firms in realizing the potential benefits afforded by EDI. In addition, we also point to areas of future research concerning the study and analysis of EDI technology.

We have found that industry-wide, non-proprietary open standards are a critical element which facilitates the adoption of EDI by small firms in a variety of industries. These standards provide information and assurance to users that EDI will work and ensure compatibility with a wide range of trading partners. The existence of industry-wide standards also tends to reduce the costs of EDI and often permits small firms to implement EDI sooner and with more trading partners than where a proprietary standard exists. On the other hand, large firms have more resources to devote to standards activity and may have a better technical understanding of issues relating to EDI standards thus giving large firms an edge over small firms. In addition, many industry-wide standards evolved out of the proprietary systems of the first movers and may be biased toward large firms.

One important issue we discovered in several case studies is the fact that often a standard is not implemented in a truly standardized manner by all firms. Rather certain firms may modify a standard format to meet their own particular needs, often to the detriment of others, including small firms. Only the firms that initiate and use the selective modifications (most often large firms), are in a position to properly implement the technology. This hampers the ability of firms to implement and use EDI to its fullest capability and thus realize all of the potential benefits.

In several industries, it appears that VANs play an important role, especially for small firms which are either unsure about how to implement EDI or which have to deal with multiple trading partners using different systems. For example, in deciding what EDI system is "right," small firms do not have the resources or the time to consider various options, and often simply "follow the
leader" in deciding what EDI system to install. As a result, small firms make suboptimal decisions in their first EDI implementation. VANs help small firms overcome various implementation issues relating to EDI such as software selection, identification of trading partners, and general consulting services with first-time evaluation and installation. Where the technology is still evolving and new standards are still taking shape, VANs can buffer small firms from having to become involved or instantly knowledgeable about such issues, thus reducing the investment in human capital required by small firms to monitor and understand the evolution of EDI technology. It does appear that in the applications of EDI which we reviewed in which VANs played an active role, small firms were able to achieve many of the benefits of EDI sooner and to a greater extent.

Within organizations, we found that where firms, either small or large, had an "EDI leader," that is a person that pushed the technology from within and understood the ramifications of the technology on the organization, that firm stood a better chance of successfully implementing the technology. This is not a surprising finding nor is it inconsistent with other studies on the diffusion of new technologies (Kanter 1983). It appears that one driving force which leads to the adoption of EDI originates from the understanding and foresight of one or more individuals within the organization. This emphasizes the need for greater understanding and education especially among small business owners of the potential benefits of EDI and how it can best be implemented in various circumstances. In most instances, this person is a business person rather than strictly a technical person. In the words of one EDI consultant, "EDI is a business issue, not a technical issue." The EDI leader must understand the existing workflow within the organization and be able to promote a change in workflow to realize the full benefits of EDI. In conjunction with this point, we also found that small firms often do not fully understand the concept of EDI and its ability to facilitate electronic commerce. Small firms are at times intimidated by the technology, concerned about the ability of "outsiders" to tap into the workings of a small firm via computers, and do not have the time or resources to devote to developing an understanding of how EDI can help small firms gain competitive advantages.

Related to the above point is the finding that the small firms who adopt EDI earlier and most successfully already have related information technologies in place. These firms have realized the benefits of information technology to control and streamline the flow of information within their organizations and, therefore, recognize that EDI can achieve similar interorganizational benefits. These firms view EDI as a tool for expanding their existing information technology programs rather
than an intimidating new technology and are more likely to integrate it with their existing internal computer applications.

The adoption and acceptance of EDI as a new technology within a given industry is most often triggered by large "entities," whether they be large firms (for example, "hubs" in the case of retail) or the government (as in the case of customs, defense procurement, and mortgage brokerage). As a result it is more difficult for small firms to realize first mover (first tier) benefits from EDI and greater pressure is placed on small firms to follow quickly to implement the technology and realize second tier benefits through work flow reengineering. Small firms especially tend to adopt EDI as a reaction to external stimuli such as competitive pressure or consumer demand. Also integration of EDI with other forms of information technology make it easier for small firms to realize these benefits.

The costs of EDI are not viewed as being so substantial so as to pose a barrier to the adoption of the technology. As the technology has evolved and as the costs of computing technology have plummeted, it is easier and far less costly today to implement electronic commerce including EDI than it was even five years ago. Many applications can now be run on PC-based systems and as small firms automate their activities organization-wide, the incremental costs of integrating EDI with these other technologies has diminished considerably. In certain markets, however, EDI technology has not fully progressed to permit complete implementation. For example, software development and greater standardization are still needed to permit CHINs to fully realize their potential benefits.

Many small firms find it easier in the short run to implement EDI technology strictly as a means of satisfying trading partner mandates. However, it is not until these firms use EDI and other related information technologies to change the workflow within their organizations that they will realize the full benefits of these technologies. The purpose of EDI is to control, streamline and accelerate the flow of information between trading partners. It is important for small firms to regard EDI as a tool that, through efficient use, will result in increased efficiency not increased burden. This will only occur if small firms keep in mind their own current and future needs when implementing the technology, in addition to the needs of their trading partners.
Finally, user groups and trade associations play an important role in assisting firms who have questions or are uncertain about implementing EDI or identifying various trading partners who may be using EDI already. Whether industry-specific, vendor sponsored, or regional these organizations serve as a forum where small firms can share their experiences and voice their concerns relating to EDI standards development, hardware, software, and telecommunications selection, and trading partner education.

Policy Recommendations

As a result of our research on the effects of EDI on small firms and the empirical evidence gathered as a result of our case studies, we have several policy recommendations that we believe the SBA should consider. Several of these recommendations require some initiative on the part of the SBA and obviously necessitate a "proactive" role on the part of the SBA with respect to the implementation of EDI. Since our research indicates that EDI is going to be implemented regardless as to whether small firms feel it is right for them, we believe that it is important that small firms approach the adoption process with a clear understanding of the technology, how it can benefit small firms, and in what direction the technology is headed. The SBA currently is providing some support for small firms interested in learning about EDI in the form of disseminating basic information about EDI. In addition to this informational support, we feel that there are other ways the SBA can assist small firms in these areas and can play an important role in accelerating the adoption process and thus facilitate small firms in their ability to realize real competitive advantages from EDI.

As a first step, it is important that SBA monitors the development and implementation of EDI in various industries so that it can understand more fully the costs and benefits of the technology as well as be knowledgeable about areas in which further technological development may be required. This is also important because SBA can assist small firms to understand the state of the technology and recognize the importance of moving quickly to adopt the technology.

The Federal Acquisition Streamlining Act (FASA), enacted into law in October 1994, raises the threshold for Simplified Acquisition Procedure from $25,000 to $100,000 and requires all federal acquisition below this level to be conducted electronically by the year 2000. The law also requires the development of a Federal Acquisition Computer Network Architecture (FACNET), which will be implemented government-wide and provide for the public notice of solicitations, receipt of solicita-
tions, public notice of contract awards, and payment to contracts via electronic funds transfer. Any business that wishes to do business with the government will need to be EDI-capable by this time, thus this Act has broad implications, especially for small businesses. To ensure a smooth transition for small businesses under the requirements of this Act, the SBA has been asked to assist the Office of Federal Procurement in a number of ways. First, the SBA will offer a series of seminars on EDI and the changes planned in the acquisition procedures (discussed in more detail below). Second, the SBA conducted a national teleconference on these same topics when the law was enacted in 1994 and has prepared a brochure for interested businesses that is available from SBA offices as well as electronically via the Internet. Finally, SBA is actively commenting on the implementation regulations as they are developed by the Office of Federal Procurement to ensure that small businesses are involved in the regulatory process and that the implementation regulations do not create barriers that might prevent their conducting business with the federal government.

The SBA can also act as a clearinghouse for EDI technology information to assist small firms in understanding the technology. One concern voiced over and again by small firms is their lack of education and understanding about EDI; SBA can help fill that void by providing information about EDI. The SBA currently provides basic information about EDI on an electronic bulletin board. This information, intended to help small firms gain a basic understanding of EDI, includes: a glossary of EDI terminology, an introductory overview of the Federal Acquisition Streamlining Act, a listing of federal and private sector training events and conferences, and a booklet providing information on EDI software vendors and approximate costs. In addition to this information, the SBA could publish a brochure or pamphlet on the purpose of EDI, its objectives, how it works, what the different forms of EDI are, and what benefits can be realized from implementing EDI. Also, because of the apparent importance of user groups to implementing and successfully using EDI, SBA should also publish a listing of user groups in various industries or regions so that small firms can identify such groups. SBA should also emphasize the importance of user groups to small business as they perform a very important function in educating EDI users.

The SBA could use its existing on-line bulletin board system to create a forum for small firm EDI issues. Small firms could use the electronic bulletin board as an electronic user group, sharing experiences and suggestions on small firm-related EDI concerns. This type of electronic user group would benefit small firms that do not have the time, staffing or financial resources to send a person to an offsite user group meeting.
The SBA could also help the business people in small firms to become computer literate. One service bureau representative stated that small firms have a tendency to treat EDI as a technical issue, handing off the implementation to the technical person rather than addressing it as a business issue. Business people are often intimidated by computers and are not willing to experiment in this area. The SBA could provide some basic education, in the form of computer seminars, to help overcome this intimidation. A higher rate of general computer literacy in small firms would ensure that EDI and other information technologies are treated as business issues and used as tools to reengineer the internal workflow of organizations.

As part of our research on the effects of EDI on small business, the authors of this report attended a number of private sector seminars and conferences on EDI and although the seminars generally were quite informative, we found that the agenda was not geared to the needs of small business. Greater emphasis should be placed on the fundamental aspects of EDI as well as to offer information on the various options that are available to small firms wishing to adopt EDI. There is clearly a need to disseminate information about the different types of EDI and how small firms can optimally select an EDI system that is right for its needs. The potential cost savings and benefit enhancement of properly selecting an EDI system "the first time out" cannot be overemphasized. The SBA's Office of Business Initiatives is currently organizing one-day training conferences to provide a basic introduction to EDI. These conferences outline the use of EDI to bid on contracts with the federal government, the benefits and drawbacks to electronic trading with the federal government and steps to aid small firms in implementing EDI. We commend the SBA for initiating these training conferences and encourage the organization of additional conferences to disseminate information about EDI as it relates to the private sector as well.

The SBA along with other government agencies must recognize the potential effects that EDI can have on small business, especially when it is "mandated" by large organizations. Small firms are often left out, either by choice or more often simply because large organizations have the resources, time, and know-how to devote to various aspects of EDI such as standards activity, training, and education. The SBA should determine which government agencies are involved in EDI and where agency task forces or other working groups have been established to work with them to foster the viewpoint of small business. Representatives of SBA should sit on various agency task forces to ensure that small business is represented. For example, Fannie Mae and other government agencies are primarily responsible for the implementation of EDI in the mortgage
banking industry. Small firms have been very slow to implement EDI. Greater input from SBA in terms of the needs of small mortgage brokers will accelerate the adoption of this technology, and permit small firms to realize many of the benefits of EDI. As we discussed in the customs brokerage area, many small firms have been pushed aside with the advent of EDI in part because these firms did not accept the technology rapidly enough and because large firms were able to realize costs savings and economies with the implementation of EDI that small firms failed to realize. Proper government intervention on behalf of small business in this area might have prevented the loss of small businesses.

SBA can also play a role encouraging small firms to become more involved in the EDI standards process. Large firms appear to have a disproportionate role in the development and implementation of EDI standards in many industries. Although large firms do not appear to have pushed aside small business, nevertheless the fact remains that small firms do not have a strong voice in the standards process. As we have noted several times, the development of standards is a key factor in the acceptance of EDI and other electronic communication technologies. Small firms must be pushed to become involved. At this point, there is no interest group representing small firm concerns in the ANSI X12 standards process. One service bureau that works with over three hundred small EDI users, in addition to over 40 hub firms, suggested that the SBA provide some type of liaison to ANSI X12 such that small firms which cannot afford to send individual delegates to the ANSI subcommittee meetings have a voice. Perhaps the SBA can promote and/or coordinate the development of an ANSI X12 small firm subcommittee such that small firm interests are aggregated and better represented.

Areas for Future Research

The focus of this study has been to gain a broad understanding of the impacts of EDI technology on small firms and to determine some of the factors affecting the rate of diffusion of the technology and the benefits and barriers facing small firms' use of EDI. The technology continues to change at a rapid rate which makes any empirical study difficult and likely to be somewhat outdated before completion. Nevertheless, this study has identified certain interesting implications.

\footnote{We are not suggesting that SBA become an active participant in the standards process, because small firms are in a better position to understand their role and perspective on the effects of various EDI formats, etc. Nevertheless, the void in this area is so acute that we feel that SBA must take a proactive role in encouraging small firm involvement in the EDI standards process.}
regarding the use of EDI which point to areas for future research which would enhance our understanding of the technology and its effect upon firms' behavior and organizational structure.

Clearly one area for additional research is to understand more fully the organizational implications of EDI and how firms must alter their internal organizational structure to utilize the technology more efficiently, thereby realizing the full potential of the "second-tier" benefits of EDI. A study of workflow patterns within an organization both before and after implementation of EDI, and analysis of how various organizations have adapted their work rules for internalizing EDI could serve as a very useful model for other firms to follow. Workflow reengineering is a popular topic in organizational studies today, and this would serve as a very potent case study in this area.

Several interesting hypotheses regarding EDI have been generated as a result of this study and could be analyzed by means of a more rigorous empirical model. For example, we found that various factors such as open industry standards and the existence of VANs were important to the diffusion of EDI to small firms. Statistical analysis of the rate of diffusion in the presence or absence of such factors would provide further insight into the validity of these tentative conclusions. Also it is strongly believed that first movers gain certain benefits from using EDI that others may not realize; more rigorous testing of this hypothesis could ultimately provide another rationale for adopting the technology.

Additional research on the role of both VANs and user groups is necessary. As telecommunications technology becomes more advanced and as software technology improves, the role of VANs may change, but it is likely that they will continue to play an important role for small firms interested in using EDI, but unable to commit large-scale resources to the effort. User groups are also important to small firms, but are often not well-publicized and their long-term effects are unknown. More research on the role that these two groups play vis-a-vis small firm use of EDI would be needed.

The development and migration of standards from proprietary to open systems has been studied in other industries, but given the critical importance of standards in the diffusion of EDI, it would appear to be an important issue for future EDI research. Finally, a related topic for future research would be to investigate more fully the integration of EDI with other forms of electronic communication and what the future holds as business moves toward the concept of the virtual corporation.
Chapter XI
Bibliography


The rash of mergers among large retail chains may hurt small suppliers, in part because the large retailers expect their suppliers to invest in elaborate computerized inventory systems.


This article outlines the Internal Revenue Service's policy toward EDI filings and gives suggestions for how to adapt record keeping to this process.


This article gives a general rundown of communication platforms, hardware, software, VANs, and implementation issues. It lists vendors and prices for translation software and discusses trends in EDI implementation.

Anthes, Gary H. 1993. "Rivals Team up for EDI." Computerworld, March 15, pp. 64.

The Federal Home Loan Mortgage Corporation, the Federal National Mortgage Association and the Government National Mortgage Association are teaming up with the Mortgage Bankers Association of America to develop standards for electronic data interchange that can more efficiently create, service, and sell these mortgages. The ultimate goal is to make it easier for lenders to send information to each of these agencies by using common systems.


This article outlines how VANs are offering expanded value added services such as X400, international EDI capabilities and fax services to customers to compete with the services available through the Internet and fax machines.
This article presents a comprehensive framework for understanding the relationship between a firm's innovation strategies and its overall economic performance. The framework is presented and discussed in the context of the U.S. semiconductor industry.

This article discusses the problem of security breaches on the Internet and suggests precautions that commercial Internet users can take to ensure the security of business data.

This article is an excellent resource for the roles played by various regulatory and government agencies in the mortgage banking industry. It further delineates the effect of a number of federal and local laws on the lending process, and the reporting required of the mortgage banking industry to satisfy their requirements.

This article outlines Royal Bank of Canada's EDI implementation. RBoC integrated their internal EDI needs for purchasing supplies with a customer service EDI product for transmission of electronic funds and data.

This article is a summary of Ballantine's statistical research analyzing how the competitive activity of mortgage bankers in the 1980s helped to more closely align the residential mortgage rate with capital market rates. The author shows that competition in the residential mortgage market during the 1980s benefitted consumers by providing cheaper and more customized competitive mortgage products. The article gives an informative overview of the mortgage banking market as a whole in the 1980s, and the experience of mortgage banks, commercial banks, and thrifts.

This article outlines the transition of EDI from simple file transfer to electronic commerce. Barber defines the integration of EDI with existing business systems as EDI II.


This is a continuation of a previous article and discusses the theory of the "extended enterprise" as the result of tighter links between buyers and suppliers due to EDI. The author discusses vendor managed inventory (VMI) and evaluated receipt settlement (ERS) as extended enterprise applications.


This article outlines the process of workflow reengineering as the radical redesign of business processes, management systems, job definitions, organizational structures, beliefs and behaviors to achieve EDI II.


The author describes the mortgage lending process with emphasis on the kinds of information traded among the various players in this industry. The article focuses on the development of standards in the mortgage banking industry, and what the industry has done to encourage their use. The author also describes how the Lending Task Group under ANSI's Finance Subcommittee was developed, and the extent to which it has worked to encourage new standards in mortgage lending.


This article provides a background for understanding the roles of the Federal Housing Administration (FHA) and the U.S. Department of Housing and Urban Development (HUD) in providing affordable housing. Much attention is given to the costs associated with a paper intensive origination process, and how HUD and FHA are using innovative ways and new technology to make owning a home more affordable.


This article gives an overview of the necessity of ensuring that healthcare information can be shared by many entities and the obstacles to integrating this information. The author discusses the various standards and policymaking groups who are involved with developing
standards for healthcare. Furthermore, the author describes various regional/local EDI initiatives that are under way, including the various Hartford Foundation grantees and the California Health Data Interchange project.


This article provides an interesting discussion of how the benefit of EDI implementation has changed from a competitive weapon to a competitive necessity. The article also gives an interesting classification of EDI applications.


An updated excerpt of the above article.


This article suggests that the benefits of information technology (IT) are not being realized because investment is biased toward technology rather than managing changes in process and organizational structure. It outlines the principles for managing the change enabled by information technology (IT) in order to reap productivity gains.


This article examines a proposal by the Computer-Based Patient Record Institute (CPRI) to establish a public/private project over four years to accelerate the development of standards for the computer-based patient record. The CPRI would work with the Health Informatics Standards Planning Panel (HISPP) to draft the standards.


The author gives an overview of the codependency between buyers and sellers established through the use of Quick Response and Just-in-Time EDI applications. The article outlines the benefits of each.

This article discusses the growing popularity of financial EDI. The author estimates that companies save $.75 each time they do not print, handle and mail a check. The article discusses the problem of banks not being able to handle remittance data along with EFT payments; less than ten can cause them to lose this portion of the business to nonbank data networks.


This publication addresses Electronic Funds Transfer (EFT) issues for bankers and cash managers such as Automated Clearing House (ACH) transactions, accounting system integration, and security concerns encountered with electronic payment systems.


The authors describe the process of converting one hospital’s accounts payable operation through the use of EDI. The hospital first began working with the suppliers with whom they purchased electronically, and began receiving electronic invoices from these suppliers, and electronically paying those invoices. As a result of this plan, staffing has been reduced by 1.5 FTE (full-time equivalents), and the cost of paying each invoice has dropped from $1.25 per transaction to $0.80.


Nissan uses EDI technology to keep track of inventory and to reduce shipping time to dealers in hopes of becoming more competitive with Japanese import giants such as Toyota and Honda.


This article provides a good background on the HL7 standards, and discusses how the Inter-Enterprise Committee has planned to evolve the HL7 standards so they may be used to exchange information between physicians' practice management systems and hospital information systems.

This article discusses the barriers to EDI success including cultural, technological, MIS, financial, marketing, operational, and integration explaining why the payoff from EDI may be less than projected.


Although networking may well be an important part of the Clinton administration health care reform plan, the authors conclude that the costs to providers and payers prevent its implementation. While individual providers have made progress on developing internal systems, they have had little incentive to integrate their systems with other health care providers. Standards continue to be another obstacle. To encourage implementation, the federal government is willing to allocate money from the Department of Defense's Technology Reinvestment Program into a project that would test how a fully automated health care system would work.


This article, authored by two people involved with Freddie Mac's introduction of EDI into their organization, describes how EDI can change the flow of information throughout the cycle of a loan. The article briefly touches on how EDI can be combined with other technologies, and enumerates the benefits of EDI to address the business problems of the mortgage banking business.


This article discusses the need for the manufacturing process to be flexible when using Just In Time (JIT) manufacturing technology. It also addresses the necessity of a good manufacturer/supplier relationship.


The author examines in this article the concept and impact of electronic commerce, identifying the tools needed to achieve electronic commerce and the importance of workflow reengineering.

This article outlines different approaches to EDI and the types of costs and benefits associated with each. The author also discusses techniques for cost/benefit analyses.


This article provides some information on communications network options. It seems to be misleading and not very useful.


This article is a bit dated but contains some interesting information addressing the problems encountered by small companies in justifying the cost of EDI implementation. The article also includes statistics on number of EDI users and information on standards setting organizations.


This article outlines the U.S. Navy's Integrated Contracting, Invoicing, and Payment System (ICIPS) which allows for the paperless processing and transmission of invoices, payments, and related data.


This article, written to coincide with the Mortgage Bankers Association annual conference, describes the MBA's focus on technology in the upcoming year and the goal of secondary marketing agencies to be responsive to consumer needs. Highlighted is the use of laptop originations.


This article summarizes the results of Deloitte and Touche's 4th annual Bar Code/EDI/QR survey conducted in 1991, providing statistical information on the use of these technologies in the retail industry.

The authors discuss new uses of bar coding in the healthcare industry. These new uses move bar coding away from purchasing/inventory and into clinical practice areas, including drug administration, laboratory results reporting, and tracking of samples.


This editorial comments on the federal government mandate for the use of electronic commerce for acquisition. A prediction of a 10 percent cut in the federal budget for small purchases should have widespread effect on the 500,000 businesses that do business with the federal government.


This article focuses on how mortgage companies are using information technology today and what trends seem likely for the future. In particular, the author concentrates on the following six categories of technology as being most likely to impact the mortgage banking business: laptops, local area networks (LAN), wide area networks (WAN), expert systems, open systems, imaging and information robotics.


This is a brief case study of the implementation of an EDI system between a consumer goods manufacturer and its brokers. The article addresses the problem of different versions of one standard when dealing with multiple trading partners.


This presidential memorandum outlines the federal government's electronic commerce initiative.


As EDI is being implemented in the healthcare industry, it is reducing costs and creating efficiencies. This article describes two purchasing projects. CareNET Services is a Canadian government-initiated venture that links hospitals and their trading partners, but will eventually expand to nursing homes, labs, pharmacies, and related health care providers. The system
uses Harbinger's InTouch*EDI on PCs and a VAN, Transact Data Services (TDSI). Baxter Healthcare has expanded their EDI project to a target market of 6,700 hospitals and other medical facilities, using Trading Partner from TSI International.


This brief report summarizes the results of a survey conducted by the COMNET Society about the types of health information networks already established, and the types of transactions that are being exchanged in these networks. The survey results emphasize that the networks are beginning to be formed, but that full implementation will require more information provided to the networks, and the ability of the healthcare industry to overcome some significant hurdles.


This article briefly addresses the controversy surrounding the cancellation of plans to expand the Department of Defense's GATEC project. Many critics charge that the project created a proprietary system that is not suitable for DoD-wide use. According to one DoD vendor, "Politics has reared its ugly head again and made a great mistake."


This brief article describes computerized loan processing systems that use some form of rules-based artificial intelligence. The author details how artificial intelligence systems can be combined with EDI capabilities to streamline the loan origination process.

________. No Date. "Electronic Data Interchange — Applications Continue to Expand." *Mortgage Originator.*

In this article the author explains how EDI is being used to order and receive credit reports in the mortgage industry. Mr. Cooley also anticipates the use of EDI for electronic loan submission.


This article provides an extensive history of the airline reservations system.


This article outlines the federal government's attempt to cut costs by getting its agencies on-line with EDI. Discussed are efforts by the Department of Defense (DoD), Health and
Human Services (HHS), Customs, and the Postal Service. It states that about 20 agencies report one or more EDI applications either in operation or in the planning stages.


This article outlines the petroleum industry's investment in EDI and the evolution of the Petroleum Industry Data Exchange (PIDX).


This article briefly states that the primary goal of firms employing EDI is strategic gain such as improved customer service, reduction in errors and lower inventory levels.


This is a brief article outlining the Government Open Systems Communications-Profile (GOSIP) requiring government contractors to conform to OSI networking standards.


This article addresses the concept of retailers outsourcing their distribution processes to third parties using EDI as the key enabling factor.


The author discusses how EDI can help a small firm achieve the same efficiencies achieved by larger companies. The article gives case study examples of Hallmark independent retailers and suppliers and retailers of Levi jeans.


This article examines in-depth several of the Congressional proposals for healthcare reform (as of the spring of 1994), and the need for technology and standards development. The article emphasizes that progress on the various information technology plans could be impeded by concerns about security, confidentiality, and privacy.


This article attributes the high cost of automation as the driving force behind the merger and acquisition trend among customs brokers and freight forwarders. Customs' computer requirements such as ABI and ACH have driven some small firms to merge with large firms in
order to absorb the cost of getting on-line. Enhancing the trend may be the preference of some importers for national brokers.


These survey results present statistics on the use of EDI and related technologies by retailers.


The U.S. Army Tank-Automotive and Armament Command (TACOM) has implemented the Direct Vendor Delivery/Electronic Data Interchange (DVD/EDI) program to reengineer its multi-million dollar spare and repair parts acquisition process. TACOM spent 67 million procurement dollars in 1993 on tires and hopes that this program will streamline the tire procurement process which has a 28 day turnaround time.


This article outlines the importance of integrating EDI systems with core applications to realize the full benefits of EDI through the use of translation software.


This article outlines the services offered by Datamatix, a VAN which specializes in interactive EDI in government purchasing. This article concentrates on the contract Datamatix has with the State of California to set up an electronic procurement system for the state and to provide customized procurement system development and services for California local and county governments. The result will be a single statewide multilevel electronic bidding system.


This article describes EDI seminars for vendors doing business with California State and local governments under the electronic procurement program which was designed to link bid procedures at city, county and state levels. The new system is forecasted to be especially beneficial to small businesses who are looking to increase their market share.

This somewhat outdated article outlines the DoD's use of the Corporate Trade Exchange (CTX) standard to pay its bills electronically via the National Automated Clearinghouse Association's network.


This article addresses the extent of automation within the mortgage lending industry by focusing on recent developments within the secondary market agencies, primarily Freddie Mac, Fannie Mae, and HUD. The article provides valuable insight into the different ways these agencies are making strides to automate routine functions while addressing a more global need for standardization and affordable technologies for large and small lenders alike.


This article outlines the retail industry's use of EDI to gain efficiencies in inventory, consumer demand forecasting, and shipping. Also states that bank relationships improve due to EDI because banks know that users have a precise handle on their business.


These training materials provide introductory EDI education on several issues including: EDI applications, technical requirements, data standards, training, EDI program management, and cost/benefit analysis.


This interview addresses the Internal Revenue Service's implementation of an EDI system for electronically filed tax forms. Mr. Burton discusses the issue of retaining tax filings for potential audit purposes.


This article, addressed to large firms, presents strategies for "hub" firms to follow to get small trading partners on-line with EDI. Features Arrow Products, a small manufacturer turned service bureau, which helps small firms become EDI-capable. Characterizes small firms as being PC-based, limited in IS resources, suspicious of EDI, having many manual processes, and employing only one or two staff members who understand EDI.
1994a. "IBM Trims Medical Expenses with EDI." January 24, p. 4.

This article discusses IBM's use of EDI to control its self-insured health care costs. The necessity of reengineering is addressed as well.


This article discusses the services EDI users should look for when shopping for a VAN.

1994c. "PCS Uses IMS Stake to Reach Directly into Doctor's Offices." March 21, p. 5.

This brief article outlines the acquisition of a minority interest in Integrated Medical Systems Inc. by McKesson Corp., the parent company of PCS Health Systems Inc. The IMS network links physicians and other healthcare providers with managed care organizations and health plan sponsors. The acquisition will provide IMS and its physician and healthcare clients electronic access to PCS's pharmacy network.


This article discusses the pros and cons to using the Internet for EDI transmissions. The article addresses the issue of lax security measures on the Internet and discusses the DoD's use of the Internet in their GATEC program.


This article outlines the use of existing E-mail systems to send EDI. The X435 standard enables EDI users to send EDI messages via the electronic messaging X400 standard.


This article outlines the evolution of the Cash Concentration or Disbursement Plus (CCD+) format which was jointly developed by the U.S. Department of Health and Human Services and the National Automated Clearinghouse Association (NACHA) to enable courts to better enforce child support laws. The system is being implemented by several states allowing courts to use EFT to collect payments from the wages of delinquent parents.
This article discusses how to justify an EDI system. It estimates that 85 percent of all received EDI messages are keypunched more than once, increasing the rate of errors and increasing the cost of processing. The article also estimates that pre-EDI processing costs range from $50-$75 per transaction while post-EDI costs approximate $6 per transaction. It also states that often a larger up-front investment in EDI will end up resulting in a higher pay-off.

This article outlines vendors' attempts to accommodate the X435 standard which allows users to combine electronic messaging and EDI networks.

DEC's client/server EDI product suite may signal a trend in software that offers seamless interface between EDI processing to applications.

Baxter Healthcare Corp., Bergen Brunswit, Boise Cascade Office Products, and Eastman Kodak Company announced that they will assist TSI International with defining the requirements of OnCall*ED I, a Windows-based software platform for hospital procurement. Components of the planned software will include Windows as the user interface, EDI translation facilities, a built-in database for capturing and maintaining procurement transactions, and communications support for direct connections between hospitals and suppliers, as well as access to VANs.

This article discusses EDI outsourcing as a way for small companies to become EDI-capable to comply with their large trading partners' requests. EDI outsourcing allows small businesses to become EDI-capable while keeping their focus on their core business.

This article briefly outlines auto manufacturers' efforts to incorporate EDI into their relationship with second tier suppliers. The article outlines one supplier's effort to integrate its EDI applications with its parts manufacturing software.

This article outlines a British automotive supplier subsidiary's implementation of EDI. The article states that EDI is a necessary business tool for survival in the automotive component industry.


This article documents the explosive growth in administrative healthcare costs, estimated at one-quarter of total spending by The New England Journal of Medicine. A study by the Tiber Group indicates that using EDI for claims processing alone could save $4-10 billion annually. Combined with savings from using EDI for purchasing, the savings could be $7-18 billion per year. The article cites useful facts about the growth in EDI use in the healthcare industry. The article also cites Healthcare EDI Corporation's success with forming Healthcare/EDI Users Groups (HUGS) throughout the country.

1994o. "EDI Meets Cyberspace: Do Future Internet Services Pose a Threat to VANs?" August 8, pp. 1-4.

This article asserts that VANs will have to expand their services offered to meet the growing trend toward electronic commerce over the Internet. It discusses the evolution of an "industrial strength" Internet for business use.


This useful article discusses the features a firm should look for when choosing a VAN. Provided is a chart outlining various VANs and services offered, standards, prices, etc.


This article outlines the anticipated Federal Acquisition Streamlining Act of 1994 which calls for the expansion of the electronic procurement systems of several federal agencies. In an attempt to present a "single face" to suppliers who deal with more than one federal agency, each federal agency will build its own leg of FACENET, a government-wide electronic commerce network which will link existing agency networks to three entry points and to selected VANs. The network will operate using ANSI X12 transaction sets.
This article addresses the controversial proposed alignment of ANSI X12 and EDIFACT data standards. A compromise has been reached within ANSI that acknowledges the 1992 vote to adopt EDIFACT as the single EDI standard beginning in 1997 while still allowing the development and adoption of new ANSI X12 transaction sets for as long as "business needs exist."


The presentation notes from these conference proceedings address several EDI applications and related issues including: basic and advanced EDI education, EDI management, healthcare EDI, EDI for purchasing, financial EDI, and EDI for small business.


This directory of EDI software products provides information on the offerings of various software vendors including prices, standards supported, and software package descriptions.


This chart provides details on which financial institutions are performing financial EDI and how they are doing it.


This article discusses DEC's implementation of an EDI system for procuring office supplies and outlines key issues to be considered when implementing EDI.


This article discusses regional and industry EDI user groups as providers of basic EDI knowledge as well as links to what others are doing.


This one-page pamphlet describes MORNET-EDI, its benefits, and its schedule for delivery. MORNET-EDI is a value-added network using ANSI X12 standards to provide lenders with a single dial-up source for origination and closing services.
This article gives statistical information on the use of EDI in the United States. Key observations include that smaller companies are getting much more involved in EDI than in the past, the cost of adding new trading partners is decreasing, and that the market for EDI products and services was $1.2 billion in 1993.

This brief article discusses the benefits of EDI versus the facsimile using the healthcare medical supplies ordering process as an example. The author compares error rates, transmission times and order confirmations to show benefits of EDI over faxing.

This article focuses on the experience of USAA, a San Antonio, Texas insurance company that is currently implementing electronic data interchange technology in several areas of business. In its homeowners' insurance business unit, EDI has been implemented to collect premium payments from the mortgage companies that collect the funds from homeowners.

This article provides a useful overview of "community health information networks" and the potential CHINs offer to provider and payer communities to afford access to comprehensive healthcare information via a network. The author describes some of the benefits to be derived from use of such a network, as well as some of the hurdles that need to be overcome, including how to maintain the confidentiality of patient records, the need for standards, and the need for providers and payers to view information as a community resource, not a competitive advantage.

This fairly technical discussion of the ANSI X12 standard developed by the TeleCommunication Industry Forum to serve industries with complex billing structures. The primary use for the 811 is the telephone bill.
This gives general information on the DoD's efforts to implement EDI and future plans for DoD EDI implementation.


This article briefly outlines the efforts of the cargo industry to implement EDI technology to trade in-transit cargo logistics. The Harper Group, a holding company owning 12 specialized transportation businesses employing over 3,500 people, cut the accounting staff in its San Francisco branch from 15 to 2 people saving $400,000 per year with an investment of $40,000 in systems development and $100,000 in capital equipment.


This article addresses the consolidation of EDI software companies as they move to reduce cost rather than emphasize technological innovation. Also discussed is the software companies' emphasis on targeting vertical industries as customers, signing on hub firms in the hopes that their spoke trading partners will follow suit.


This article outlines the DoD's efforts to use EDI to revolutionize its procurement process starting with the Electronic Assisted Solicitation Exchange (EASE) in 1989. This article identifies the use of VANs which act as the "expeditor between government and the vendors" as the key to EDI at the DoD.


This status report discusses the current Administration's initiative to reinvent the way the federal government works. Information technology is identified as the most powerful tool to serve customers and as a central key to the Administration's goals of rebuilding the economy and improving quality of life for all Americans.

This article outlines the integrated applications of EDI and E-mail as E-mail evolves from person-to-person communication of text to application-to-application connectivity of more complex data using industry-standard protocols.


This article addresses the problems with EDI technology that has not been updated and the need for tighter industry standards.


This article discusses the widespread implementation of EDI technology by U.S. shippers and carriers despite the obstacles of having the two prevailing standards of ANSI X12 and EDIFACT. The merger of the two standards was predicted to spur EDI use in this industry even more.


This article addresses the issue of reengineering business processes to realize the benefits of information technology. The computer automation experiences of Ford and Mutual Benefit Life Insurance are outlined. Principles of reengineering are discussed.


This book provides an insightful discussion on how to change work processes to realize the full benefits offered by EDI and other information technologies.


This report provides a cost/benefit analysis of the Department of Defense's electronic commerce program finding that electronic commerce should cut DoD's costs by over $1 billion in 10 years with an investment of $79 million.

This somewhat dated article gives a brief history of EDIFACT and presents survey results concerning the attitude of U.S. business toward the adoption of EDIFACT standards.


The author reviews the state of EDI technology diffusion in the retail, customs brokerage, and automobile industries. The article discusses the development of EDI by the U.S. Customs Service, noting that by 1988, 50 percent of all transactions going through Customs were done with EDI. The author explores the use of the proprietary standard, ABI (automated broker interface), versus EDIFACT, and its effects on implementation of EDI.


The increased affordability of PC-based EDI software over mini-computer software has increased the demand for such software in the cargo industry. List prices for PC-based cargo software range from $900 to $4,500 with prices dropping. Motor carriers especially are increasingly automating functions.


Use of EDI in the transportation industry for cargo transportation is beginning to make real progress. This article outlines the airfreight industry's use of EDI with Customs in its Automated Broker System, Automated Clearinghouse, and the Automated Manifest System. It also outlines the evolution of data standards for freight transportation discussing the TDCC, TDI, and EDIFACT standards.


This brief viewpoint discusses general industry applications of financial EDI including examples of use in the petroleum and automotive industries.

———. 1993b. "What Can We Expect?" Transportation and Distribution, April, p. 42.

This article addresses the future alignment of EDIFACT and ANSI X12 standards and the issues this raises in the transportation industry.

This book gives an informative introduction to the three building blocks of data communications: the computer, the conversion device, and the communications channel.


Representatives from government agencies like HUD, Fannie Mae, Freddie Mac, and Ginnie Mae share thoughts on how EDI has been able to enhance the way they trade information. The goal at HUD is to make the administration of approximately 13,000 claims a year more efficient with claims filed and paid electronically. HUD has already submitted a project proposal to ANSI for the development of an electronic claims process. Both Freddie Mac and Fannie Mae have been supportive of EDI development. Mortgage bankers benefit from uniform standards because they use only one reporting function for each application and thus save staff time and programming time.


This short article describes how through the use of EDI, mortgage lenders and the Department of Housing and Urban Development were able to successfully complete an electronic transmission of the request and subsequent payment of a mortgage insurance claim to the U.S. government.


This article discusses Snapple Beverage Corp.’s implementation of a new PC-based EDI system.


This article discusses the Small Business Administration’s on-line service which electronically provides information to small businesses on agency programs, services and publications, as well as mailboxes for the storage and forwarding of electronic messages.


The NACM Government Receivables Department was founded in 1990 to ensure faster payments to government contractors. This article outlines the integration of electronic payments with EDI by several government agencies including the Veteran's Administration and the DoD.

This article discusses York Rubber Company's implementation of computer aided design (CAD), imaging, bar coding and EDI technologies to improve customer service, enhance the design process and reduce inventory.


This article explores the Multi-purpose Internet Mail Extensions standard, the Internet's version of X400, which allows EDI, text, CAD/CAM, sound and other electronic objects to be included in E-mail transport.


This article gives a good introduction to commercial use of the Internet, with emphasis on telecommunications. The author discusses security measures that can be taken to protect the Internet from hackers.


This somewhat dated article discusses the benefits offered to small business by Integrated Services Digital Network (ISDN) technology. It claims that ISDN can offer an alternative to VAN service at a more affordable price. ISDN networks are offered by local telephone companies and do not offer the value added services offered by VANs.


This article emphasizes the importance of technology in the health care reform debate. Technologies such as EDI will be used to curb costs, provide quality service, and offer flexible products. Contacts interviewed believe that the federal government will mandate more extensive use of EDI and other technologies, and that providers will be forced to embrace EDI in order to stay competitive.


This article anticipates that the Clinton health care reform proposal will include EDI as a cost-saving measure to implement many of its reforms. Electronic networks connecting providers, payers, purchasers, and patients could be used to reduce administrative costs (estimated at between $40 billion and $90 billion annually) and enable the delivery of more
effective and higher quality health care. Additionally, the article states that there are approximately 450 different forms used to file four billion medical claims each year, so currently 450 different connectivity formats and standards would be required.


This brief article describes the plans of four managed care plans in California to begin use of an EDI network to share information on billing and eligibility using standard formats. The EDI network, called the California Health Information Network (CHIN), is expected to reduce by $40 million the annual administrative expenses of the four managed health care plans. Other plans are expected to join.


This article outlines some obstacles to successful EDI implementation. It includes a description of the experience of a small food brokerage firm pushed into EDI implementation by its suppliers.


The book addresses how individuals can contribute to their company's success, helping corporations stay ahead of a changing environment by moving into the "uncertain realm" of innovation. By putting resources into internal innovation, corporate leaders can more effectively compete in the global market.


This article offers a brief, general outline of the issues that should be addressed when considering the implementation of EDI technology.


This article discusses the federal government initiative to create an electronic commerce system. At the time of this writing, 26 EDI development projects are under way in federal agencies. In addition, state governments have started using EDI for purchasing. Local governments are slower to respond to EDI but will have little choice once federal agencies mandate that they submit information electronically.

This article addresses the use of EDI technology in manufacturing programs and evaluates the impact of the technology on manufacturing performance.


This somewhat dated article addresses the attempts of EDI users with proprietary systems to translate to X12 standards.


This article outlines the interest of bankruptcy courts in implementing Judicial Electronic Data Interchange (JEDDI) to electronically file case documents. Problems and obstacles to implementation are discussed.


This article looks at the cost and benefits involved in performing EDI and how these costs can be reduced for small firm implementation.


This article is an extension of a previous article. It outlines ways in which small firms can become EDI capable, exploring less costly alternatives to traditional EDI.


This article outlines the U.S. Customs Service's Automated Commercial Systems (ACS) operation which electronically oversees cargo entry into the United States at over 300 ports of entry. ACS processes 600,000 on-line transactions and 17,000 batch jobs daily and has approximately 10,000 users.


This article covers the topics covered in a conference of EDI users including the merger of ANSI and EDIFACT standards, the importance of EDI to small businesses and international trade and the use of EDI among foreign countries.
Knight, Robert M. 1992. "Firms Must Do Up-Front EDI Planning." *Computerworld*, October 18, p. 82.

This brief article addresses the issue of EDI integration with existing application systems. It emphasizes that different firms have different integration needs.


This article outlines the DoD's LOGMARS standard for controlling inventories. The LOGMARS standard uses bar coding technology. This article outlines integrating the LOGMARS standard into the procurement process through the use of bar coded shipping labels.


This article briefly discusses the applicability of bar coding technology to a number of industries. The author includes a discussion of the Uniform Code Council's (UCC) Uniform Product Code (UPC).


This article discusses some of the benefits realized through the use of EDI by importers and the U.S. Customs Service. The author indicates that over 90 percent of Customs Service transactions are done using EDI. Use of the proprietary standard system has caused users to incur higher costs and have limited participation in the Customs Service system to large brokers due to high up-front costs.


This article discusses the use of EDI in the healthcare industry as it relates to the procurement of medical supplies.


This article summarizes the different applications of EDI in freight transportation and the benefits of each.


This article outlines the reasons for unsuccessful EDI implementation on the part of shippers. The author addresses education, standards, resources, outsourcing, and planning.

This article outlines the efforts of the motor rail industry to identify processes required to provide Customs with electronic motor and rail information.


This article outlines the Health and Human Services Department's $19 million contract to put the Medicare system "on-line." The author also addresses the issue of keeping medical records private.


This brief article describes the State of California pilot program to use EDI in its procurement process.


This article outlines the Defense Fuel Supply Center's (a DoD branch) use of EDI to coordinate bulk fuel oil delivery by tanker, barge, rail truck and pipeline to several military sites. The DFSC uses ANSI X12 and PIDX standards and the same electronic business forms with its suppliers that are used with other contractors. The DFSC is also planning to host workshop sessions on EDI for contractors.


This article summarizes the results found in the most recent edition of a study called "MORTECH 92: Technology Use in the Mortgage Industry." The survey notes a rising "sophistication gap" between the firms that have implemented technology and those that have not. Other trends noted are the lack of standardization within the industry, the increase in hardware downsizing, and a slight rise in the adoption of new technology.


The SEC's electronic data gathering, analysis and retrieval (EDGAR) system mandates that more than 3,000 public U.S. companies must electronically file their SEC filings. Remaining companies will be phased in by May 1996. Although the software is inexpensive, it does have some bugs, according to this article, such that the typical attorney may have problems in implementation.
This article outlines the SEC's Electronic Data Gathering Analysis and Retrieval (EDGAR) system for electronic corporate securities filings. The author discusses necessary changes in corporate filing procedures to accommodate electronic filing.


This article addresses some frequently asked questions concerning the Internet. It contains general information, the future of the Internet and pricing issues.


This book investigates the manner in which new processes and products are conceived, developed, commercialized and accepted, affecting the rate of technological change. Issues addressed include: the nature of R&D expenditure by the federal government and private industry, firm size, and timing.


This article outlines low cost implementations of EDI for use in filing Blue Cross and Medicare payments.


This article outlines General Electric Information Service's strategy of working with big companies to help them recruit the small firm trading partners needed to make EDI practical. This article also addresses the issue of whether Regional Bell Operating Companies (RBOC) will get involved in EDI telecommunications issues such as inter-network connections. The author also discusses how different VANs target different industries.


This article discusses the problem that large hubs have in getting smaller trading partners to implement EDI and the incentives they offer to achieve this goal.
In the manufacturing industry, small suppliers are being forced by large customers to get EDI-capable. The article states, "Of the 355,000 manufacturers in the United States, 85 percent have fewer than 50 employees."

This article discusses the 811 telephone bill transaction set which allows companies to run automated analyses of their telephone resources and usage.

The author discusses several fundamental questions related to the implementation of EDI technology such as whether information systems (IS) technology builds barriers to entry, changes the basis of competition, changes the balance of business relationships, generates new products, etc. The article discusses how some companies seize the advantage offered by IS technology while others spend large amounts of time and money just trying to catch up to their competitors. Also discussed are the varied roles IS technology can play in different organizations and outlines the issues and challenges management faces in implementing IS technology.

This article details how the Health Care Financing Administration (HCFA) is trying to persuade physicians and hospitals to submit Medicare claims electronically. Though electronic submission rates are currently higher than all other insurers, the HCFA intends to increase the physician rate to 75 percent by 1994. HCFA is also asking Congress to change payment times for Medicare, so that electronic medical claims would be paid two weeks earlier than paper claims; should this provision become law, HCFA anticipates that electronic submission could reach nearly 100 percent by 1995.

This article discusses the role that "smart cards" may play in encouraging adoption of electronic filing/medical records technology by physicians. Some insurers and physicians have raised concerns about the cost of smart cards for eligibility and benefit verification, as well as concerns about patient confidentiality.

This article outlines three basic cost justification approaches. The authors estimate that only 20-25 percent of EDI-enabled companies have performed any type of cost benefit analysis and that 20-25 percent of companies that do perform a cost/benefit analysis are hub companies.


The authors examine the problems with delivering laboratory results via the traditional methods (mail or telephone), and explore the pros and cons of reporting the results using fax or EDI. Although EDI is preferable, many hurdles need to be overcome before its full implementation for this application. Standards need to be consolidated (ASTM, HL7, and X12) which will result in proprietary systems being outmoded, and security procedures need to be established to ensure confidentiality of patient information. The authors also explore the role of VANs to assist with this application.


This brief article discusses the SEC's EDGAR system for electronic corporate filings. It recommends Internet as the mode of communication.


This article deals generally with the information superhighway and whether Internet or the telephone and cable industries are in the best position to offer these services.


This article outlines the Electronic Commerce Operation Net (ECON) pilot program operated by the DoD. ECON is described as the nucleus of the military's strategy for eliminating paperwork in favor of EDI.


This article outlines the goals of the DoD's GATEC project including making contracts more accessible to small vendors.
This article describes the DoD's GATEC project and outlines some of the technical glitches in the GATEC set-up. Since GATEC's inception Wright Patterson has electronically processed an average of 275 transactions per day including RFQs, purchase quotes, and award summaries.

This article describes the National Competitiveness Act of 1993 which includes legislation which would allow the Commerce Department to establish Manufacturing Outreach Centers and other programs to promote the use of EDI and other technologies.

This book gives general coverage of the basics of EDI, discussing standards, related technologies, telecommunications, VANs, user groups, legal issues and strategic implementation. Included are some useful case study examples of EDI implementations.

The author provides a good overview of the various technologies that are emerging to change the mortgage lending business, including artificial intelligence, electronic data interchange, and image processing.

This article provides an excellent foundation for understanding the different types of standards that are being forged for Community Health Information Networks. Described are the strengths and weaknesses of the ANSI X12, HL7, and ASTM E 1238 standards, and which standard controls the various aspects of information shared on a CHIN. The author concludes that the agreed upon collaboration of ANSI and HL7 will provide the promise of standards needed for CHIN development and growth.

The South Carolina State Ports Authority's ORION system allows accurate information exchange and control of freight movements between all businesses and governmental
agencies involved in the water to land transition of import entry. The ORION system uses MCI EDI*Net** as its VAN which provides connectivity for freight forwarders, agents, manufacturers, consignees, terminal operators, custom brokers and steamship lines, trucking lines and railroads. This system is compatible with the Customs Service's ACS system.


This article announces that PCS Health Systems, Inc. has initiated a Health Care Information Network (HCIN) in nine states as the first step toward creating a nationwide network for exchanging health care data. PCS is operating the system for the National Electronic Information Corp. (NEIC), a group of commercial insurance carriers. The network is modeled after PCS' existing Recap system, which processes nearly 200 million pharmacy claims annually and verifies eligibility.


The author provides an overview of the use of EDI and related technologies in the retail distribution channel.


This article describes the experiences of several healthcare systems with designing integrated delivery systems. Included are Baystate Health Services, Sharp Healthcare, Geisinger, and Methodist Hospital of Indiana. The author concludes that the first step toward integrating delivery of services is to change procedures so that different components of the healthcare service interact with each other. Also important is designing a unique patient identifier. Less important is the consideration of data depository versus storing the data in various places and using indices to locate them. The author encourages healthcare entities to use both technology and reengineering to effect integration.


This article provides an excellent up-to-date rundown on the formation of Community Health Information Networks throughout the United States. The article discusses the pros and cons of a central repository for patient information, the types of situations where direct links with only one physician, one hospital are useful compared with those situations where a CHIN will best meet the needs of the community, and the obstacles to forming CHINs. Highlighted are the CHINs in Chicago and Milwaukee, and a network based from Methodist Hospital of Indiana.

This implementation guide serves as a working guide to investigate, quantify benefits and install a bar coding system to track documents throughout the mortgage banking industry. The guide contains useful background information about bar coding, as well as detailed how-to’s for what is required to implement such a system and what the industry can expect in return for its investment.


This white paper explores the need for establishment of common data formats for delivery and reporting requirements for the mortgage banking industry. The report contains statements emphasizing the mortgage industry’s commitment to using EDI as the first step in the process of leveraging technology and reengineering work flows to solve competitive issues in the industry.


This white paper describes the concept of establishing a Whole Loan Book Entry system to track multiple transfers of loans, thus allowing loans to be transferred electronically. The paper is preliminary, and requests feedback from the mortgage banking industry for the general concept, which is modeled after a similar concept used in the securities market.


This brief commentary urges healthcare providers to begin using EDI immediately. The author addresses several fallacious arguments used for delaying EDI implementation, including lack of resources and lack of sufficient mandate to implement. The author recommends using an outside vendor to assist with EDI implementation, and starting EDI with a supportive, experienced trading partner.


This article documents how EDI can be used to streamline human resource functions at hospitals. Information collected for payroll purposes can be passed along using EDI to benefits administrators and used to update benefits and eligibility, resulting in efficiencies and reduced staffing levels for the hospital.
EDI Forum, No. 4, pp. 41-44.

This article discusses the use of the ANSI X12 Benefit and Enrollment standard (834) to connect the human resource department of an employer or benefit plan sponsor to benefit administrators.


This article provides a good overview of the development of Community Health Information Networks. The authors perceive that the development of CHINs is inevitably driven by two emerging technical capabilities: electronic claims processing and the computerized patient record. The authors believe that some organizations will use the investment in personnel and equipment required for compliance with Medicare mandates to expand their EDI capabilities into other areas. The Hartford Foundation grants are discussed, as are the standards relating to CHINs.

Muller, E. J. 1990. "Forwarders Face the Future." 
Distribution, May, pp. 117-119.

This article maintains that the shipping and forwarding industry must utilize EDI or face going out of business. Briefly discussed is the Automated Broker System used by the U.S. Customs Service.


This press release-type article describes how technology is now available to originate a mortgage loan via a laptop and EDI technology.


This brief article announces an alliance between Integrated Medical Systems and PCS Health Systems, which will enable IMS to offer online prescription authorization to the CHINs which it operates. This capability allows physicians to get prescription authorization in a few seconds via PCs in their offices; future capabilities will include recommending generic alternatives and alerting physicians about patients who have not picked up ordered prescriptions. IMS owns and manages 34 CHINs nationwide; it plans an additional 12-15 this year. IMS networks do not charge physicians; hospitals are willing to bear the expense because the online networks reduce their costs, boost employee productivity, and improve service to physicians and patients.

A trade group for CHINs has been formed, called Community Medical Network Society (Comnet Society), which is a non-profit organization to assist health care professionals with CHIN formation and organization. In a survey of 193 senior hospital executives, Comnet found 57 percent have electronic claims with physicians, but only 34 percent of those have expanded their networks beyond their own medical staffs. The survey also showed the number of doctors on networks is low; only 30 percent of the hospital-doctor networks have two-way communications.


Health Communications Services (HCS), a subsidiary of Blue Cross-Blue Shield of Virginia that operates one of the largest claims clearinghouses in the country, will set up CHINs around the country over the next three years. A key feature of the CHINs is that there will be no central depository; instead, the CHINs will access the patient information using a Hughes Aircraft-developed database management technology that can identify requested clinical data, retrieve it from various databases stored by hospitals, doctors, and payers, and deliver the data in a common format to doctors and other users.


A recently completed feasibility study has determined that a Chicago CHIN could save $30-140 million annually for Chicago hospitals and $49-64 million for Cook County's 10,000 doctors. The network could reduce duplicate tests and treatments, avoid medication errors, improve medical diagnoses, boost efficiency, and enhance the quality of care. The article also details two other conclusions of the feasibility study: first, the CHIN will not have a centralized clinical repository, and second, the network should be "community coalition-driven, not vendor driven."


EDS and IVANS have collaborated on a service to speed up workers compensation claims. The Workers Compensation Reporting Service (WCRS), which will begin in California and expand to six other states by early 1995, will work with Windows-based ClaimIX to translate workers comp claims in proprietary formats into ANS EDI standards and transmit them to payers, state agencies, and employers. WCRS will reduce the time for claims payment from 15-20 days to 3-7 days, and will reduce the cost per claim from $7-12 for a paper-based claim by 30-35 percent.
This article describes how the Greater Cincinnati Hospital Council has contracted for a feasibility study for a Cincinnati-area CHIN. Additionally, the Greater Dayton Hospital Association is moving forward with plans to set up its own CHIN; it is not clear whether this would be part of the Cincinnati area CHIN. These plans have cast doubts on the feasibility of the CHINs being organized in these areas by Ameritech.

_________. No Date. "Get Ready to Link Up with Community Networks."

This article describes the progress that has been made toward establishing Community Health Information Networks, focusing especially on those established using Integrated Medical Systems, Inc.'s software. The article describes some of the costs of establishing these linkages, and the benefits to hospitals of incorporating everyone in the community into the network.


This article discusses Quantas Airline's use of EDI technology to link its airline reservation system to other airlines, hotels, tour operators, and travel industry locations in order to improve customer service.


This article discusses JCPenney's implementation of Quick Response technology with its suppliers.


This article outlines the legal issues to be considered when executing trading partner agreements. Trading partner agreements are especially important for use on the Internet due to security issues.


This paper addresses the trend toward product variety and the increased frequency of promotional sales in the fashion retail industry.

This study responds to the DoD directive issued in 1988 that DoD would use EDI as a way of doing business. The purpose of the study was to evaluate where in DoD EDI should be implemented first and how various functions within DoD would have to be modified to take account of EDI. The study identifies five target areas for EDI to enhance logistics, including shortening procurement lead times, by broadening access to the industrial base, closer monitoring of vendor performance, providing short-term, heads-up notice to vendors and DoD actors, and to allow for better responses to unpredictable surges in the demand for mission critical goods.


This case study outlines the EDI pilot project of a large consumer goods manufacturer implemented to purchase from suppliers. Hardware, software and communications issues and trading partner concerns are addressed.


This book provides an interesting investigation into the factors which affect the adoption and diffusion of EDI. Discusses the socio-technical requirements for EDI, configuration options, and the results of a survey of the implementations of several organizations.


This article outlines the experience of a small textile supplier trying to supply Walmart through its electronic order tracking system.


To enjoy the speed, accuracy and low inventory costs associated with EDI it is necessary to integrate EDI into business processes in a standardized format. Proprietary standards are costly.


This article outlines the process of electronically transmitting student loan proceeds and remittance data via the University of Missouri's student aid management system (SAMS). The school used a combination of the NACHA CTX standard with the ANSI X12 820 transaction set for moving proceeds and remittance data.

This article provides a framework for analyzing the strategic significance of new information technology (IT). It outlines the way in which IT is changing the way companies operate internally as well as relationships with competitors and trading partners. Also discussed are the ways in which IT affects competition and the steps managers can take to assess the impact of the information revolution on their companies. The authors introduce the "value-chain" concept to the role of IT in gaining a competitive advantage.


This article supplies a case study of Nexxus Products Company's implementation of JIT software and the steps that must be taken to evaluate the different EDI software on the market.


This is a listing of EDI software vendors with products for purchasing. The guide outlines the capabilities of each software.


This article discusses an effort by Electronic Data Systems Corp. and Federal Tax Administrators, a non-profit organization representing all 50 states, to create and operate TaxNet, a service allowing corporations to electronically file state income tax forms. The author outlines standards to be used and concerns in implementation.


This article outlines Target's attempt to perform EDI with 100 percent of its trading partners. Target allows all firms to exchange documents via a mailbox service.


This article outlines the efforts of the shipping and manufacturing/retail industries to implement EDI technology. The ocean shipping industry is using an EDI package, Ocean Carriers' Electronic Access Network (OCEAN) operating under the ANSI X12 standard. Byer California is X400 E-mail and EDI protocol to link up with its retail trading partners.
In this article, the author describes how electronic bulletin boards are becoming a valuable way to gain access to contacts in various industries. Featured is the USFN Connection, an on-line interactive service created for the mortgage banking industry. The USFN Connection was started by the U.S. Foreclosure Network, a 100 member organization made up of attorneys, trustees, and associated vendors who focus on foreclosure, bankruptcy, and other legal services who wanted to find a way to connect all members with the industry. The USFN Connection, established as a private section on Prodigy Consumer Services system where users pay a flat fee of $15 per month to be connected to the system, has, in effect, become the "communication medium" of choice for much of the mortgage banking industry.

This article focuses only on electronic claims submission, but gives concrete facts about what a small- to medium-sized practitioner can expect to pay to set up an EDI system and what to expect back as benefits of the system. The author interviews many practice management consultants who describe the pros and cons of direct ECS versus dealing with a clearinghouse. The article emphasizes that this technology is affordable for the small guy, and the benefits (mostly improved efficiency and improved cash flow) will be most important to the smaller practices.

This article describes the economics of electronic payment networks and the question of the finality of electronic payments made over the CHIPS network.

This article discusses the Transportation and Distribution working committee, a joint venture between the Voluntary Interindustry Communications Standards (VICS) group and the Transportation Data Coordinating Committee (TDCC), and its attempt to standardize data formats between shippers and retailers.

This article discusses the Voluntary Interindustry Communications Standards group's newly approved EDI standards.

This article anticipates the publication of an interagency task force memo on electronic commerce in the federal government. A full-scale, government-wide electronic commerce implementation is expected to be in place by January 1997 which will provide "a single face to industry."


This study finds that information technology networks can offer either cooperative advantage which arises when a firm uses a common standard or competitive advantage which arises when a firm pushes its own proprietary standard.


This article discusses the use of EDI to provide better customer service in the less-than-truckload industry. The author provides case studies of Newell, IBM and Masterchem EDI programs.


Focusing on an interview with Gregory Samp, the 1992 MBA Technology Committee Chairman, this article addresses the goals of the MBA Technology Committee for the coming year. Samp cites the top goals of the committee to be formation of the Interagency Technology Liaison Group to work with government agencies to develop common standards within the mortgage banking industry. The second goal of the committee is to work on making servicing transfers between buyers and sellers more efficient.


This article focuses on the experience of several mortgage insurance companies, and how they have met the challenges of an increasingly automated industry. Some of the new technologies considered are artificial intelligence systems, electronic transfer of certificates, and automatic claims adjusting. The need for standardization for EDI is also mentioned as vital to promoting "paperless loan transactions."


This article draws from the experience of several mortgage insurance companies who are experimenting with the cost and benefits of using artificial intelligence to originate mortgage
loans. The major benefit in using artificial intelligence software is that the system can be taught to evaluate potential mortgage applicant information from various sources and identify problem areas that may prevent the loan from being approved. The system saves the underwriter a lot of time by sifting through paper and facilitates a quicker turnaround of loans that normally would be automatically approved.


This somewhat outdated article focuses only on using EDI for purchasing and inventory decisions. The author differentiates between EOE (electronic order entry) and EDI, and discusses in what ways hospitals at this time are using EDI for purchasing. She discusses the health care industry’s adoption of the ANSI X12 standard for these purchasing transactions and the benefit gained by the adoption of standards. Additionally, the article includes some general, non-specific information about the types of costs and benefits involved with the implementation of EDI.


This article is somewhat dated but is a good source of information on earlier rate of adoption of Custom’s ACH program by the trade community. As of 1990, 70 percent of customs releases were filed through ACS.


This article discusses the Department of Defense’s attempt to use EDI to make vital business information more accessible to small firms. The Electronically Assisted Solicitation Exchange program given as an example of a DoD effort to increase small business opportunities, stimulate competition and reduce prices.

This brief article describes regional support groups which help corporate EDI users deal with their automation problems.


This article discusses the U.S. auto industry's risk of falling behind international competition unless they adopt international EDI standards. At the writing of this article, U.S. automakers felt uncomfortable with a "premature" switch away from ANSI X12 to EDIFACT.


This article outlines Aetna's effort to reengineer its workflow to get the most out of its $600 million per year investment in information technology. Before reengineering, Aetna went through 26 repetitive steps in 30 days to process a life insurance policy. Analysis found that only 15 to 30 minutes of valuable work was being performed. The "Aetna User Interface" is a company-wide system that ensures that all word processing and spreadsheet programs used throughout the company are compatible. In addition, computerized links with suppliers have helped the company reduce its vendors from 8,000 to 400. Health insurance claims will be the first to undergo the reorganization of the claims process centering around the use of common data standards.


This article gives a brief and general rundown of EDI implementation cost, standards, auditing and security concerns.


The use of EDI by short-line and regional railroads to exchange data with connecting railroads is increasing rapidly. Two rail industry computer initiatives have been developed to enhance seamless transportation: the Interline Settlements System (ISS) and the Rate EDI Network (REN).


This article outlines the affordable options now available to small and mid-size firms for implementing EDI. The author discusses the lower costs of EDI implementation today compared to in the early 1980s.

This article focuses on how savings institutions which dominated the mortgage arena years ago are being replaced by larger banks. Commercia I banks have been successful in penetrating this market because they possess the size and budget to use advanced technology. How small banks can compete in this increasingly technological environment is also covered, with emphasis on midrange and smaller PC options.


This article describes how the Mortgage Bankers Association of America's InterAgency Technology Task Force, in conjunction with Fannie Mae, Freddie Mac, and Ginnie Mae, have been working on implementing a "whole-loan book-entry" system that can be used to electronically register and transfer interests in mortgages. When a loan is originated, the loan originator registers the closed loan with a "Clearinghouse" using a personal computer, modem and translation software. The mortgage is recorded in public land records while the note is kept in the Clearinghouse by a document custodian. Any subsequent transfer of interest for the given loan is registered only in the Clearinghouse's records. The system enables whole-loans or mortgage servicing rights to be sold without physically endorsing notes and recording mortgage assignments.


In this outdated article the author describes how vendors see purchasing EDI/EOE as a means to get hospitals interested in "the next phase" of EDI. The author predicts the new areas for EDI in the health care industry include payment collection, sharing of medical record information, and communications with physicians' offices.


This collection of readings authored by information professionals serves as a sourcebook on the role of standards as an essential element of managing information.


This article investigates the textile industry's implementation of EDI and provides statistical information on who is implementing the technology and how it is being implemented.
This brief article addresses how EDI is being applied in the retail industry and the benefits that can be realized.

This article generally addresses how to get trading partners to use EDI. It discusses how to define a business plan, prepare for expansion of the EDI program and get trading partner participation.

This article describes the benefits to be derived from implementing EDI.

This article addresses how to use a task force or EDI consultant to manage the reengineering process within a firm.

This article reports the results of a study of intra-company data movements of U.S. companies with subsidiaries in the Andean Pact nations as an illustration of the importance of international EDI development.

This article addresses the Department of the Army's development of an EDI gateway which involves the connection of 270 user sites with multiple VANs and thousands of vendors. This article identifies issues that should be considered by anyone developing an EDI gateway.

This article outlines the attempts of Connecticut Mutual Life Insurance to cut paper trading by implementing EDI technology. Also addressed are the implementation efforts of the Royal
Bank of Canada, U.S. Government, Sears, Walmart, GM, and Ford. The impact of EDI implementation on the business forms industry is also discussed.


This somewhat dated article provides a brief overview of Sear's EDI system and goals.


This article provides an overview of how retailers are using a combination of Quick Response and Point of Sale technologies to decrease inventories and boost sales. Statistical information on the number of retailers using this type of technology is provided.


This report contains several articles addressing the legal validity of electronic and facsimile signatures. Contains a lengthy article on the use of electronic signatures in health care.


This book gives a background of EDI applications in finance and accounting. Also covered are the essential elements of an EDI system and the steps to take when exploring the feasibility of an EDI system as well as strategies for successful EDI implementation. The book contains case study examples of EDI applications in several industries.


This article discusses Conrail's Access EDI system which allows customers to obtain "real-time" information on shipments in transit.


This Congressional hearing explores the potential effects of EDI on small business in the United States. The record contains insightful discussions of EDI applications in several industries and the effect on small businesses within these industries. There is also a discussion of the legal issues to be considered when signing on trading partners.
Concerned with the privacy issues raised by the linking of computerized health information through a national network, this report was requested by the Congress. It examines the nature of the privacy interest in healthcare information and the law protecting that information currently, the proposals that have been put forth to computerize healthcare information and the technologies available to computerize and protect privacy in the information, and models available for protection of healthcare information.


This Customs Service publication outlines the Automated Broker Interface (ABI) component of the Automated Commercial System (ACS) covering its features, benefits, communications standards, and technical requirements.


This Customs Service publication outlines the AMS portion of the Automated Commercial System (ACS) and its goals, costs, operational and data standards, technical requirements and features.


This brief publication describes the Automated Clearinghouse Program, describing its benefits and answering some typical questions about the system.


This Customs publication outlines the features of the Automated Commercial System and its major accomplishments. Very useful for general information on the ACS system and its technical requirements.


This report to the House Committee on Ways and Means presents a review of Custom's Entry Summary Selectivity (ESS) subsystem which is intended to provide an automated means of assisting import specialists in determining whether appropriate duties are paid and if trade laws are being violated on over 8 million entry summaries. The effectiveness of this
system cannot be currently determined and Customs has agreed to improve the system and enhance its management controls.


This report to the Senate Committee on Appropriations assesses the DoD's Corporate Information Initiative which is intended to simplify and improve business processes, centralize responsibility and authority in functional areas, and develop an integrated communications and data processing infrastructure based on department wide standards. The success of CIM is threatened by the ineffective interaction of technology and business goals within Defense.


This report to the Senate's Committee on Governmental Affairs reviews the DoD's efforts to improve the management of communications resources. In 1991, the DoD established the Telecommunications Management Program (TMP) to analyze its telecommunications management problems. This report finds that the DoD is not effectively implementing TMP to achieve long-term improvements in telecommunications management and is instead focusing on short-term, band-aid solutions.


This report describes what progress has been made by voluntary standards-making organizations in advancing toward an automated patient record. The GAO concludes that although the federal government prefers to let private voluntary standards groups lead the way in standards formation, the lack of adequate progress toward the healthcare patient record standards may require some leadership from the federal government.


This report to the Senate Committee on Governmental Affairs reviews the DoD's EDI program as part of a continuing assessment of the Corporate Information Management Program (CIM) (See GAO/IMTEC-92-77). This report finds that due to a lack of leadership and ineffective management, the DoD is not realizing the benefits of EDI technology. Without adequate direction in its approach to EDI implementation, the DoD will not realize the broader, DoD-wide goals of EDI implementation.
This annual report summarizes the role of small business in the U.S. economy, providing statistics on small business status in the economy and small business contributions.


U.S. Customs is planning to spend $100 million in the next five years to overhaul its Automated Commercial System (ACS) which electronically processes imports entering the country from land, sea or air. The ACS system will migrate from a mainframe based architecture to a distributed computing environment.


This paper discusses the effect of electronic integration in the property and casualty segment of the insurance industry. An interesting issue raised is the insurance carriers' perpetuation of proprietary standards in order to create a captive audience among agents and thus prevent them from shopping around for the best price.


This article dealing with EDI implementation in manufacturing, the obstacles of implementing bar code scanning technology are addressed.


This article describes how one small manufacturer successfully implemented EDI with Sears, Roebuck and Co. and eventually became an EDI service bureau for other small firms and a third party warehouse provider for Sears and other large retailers.


This article outlines the Department of Defense's EDI Test Facility. The DoD hopes to certify and register 300,000 trading partners for doing business electronically with the federal government in an attempt to present a "single face" to trading partners no matter which
federal service or agency they trade with. The cost for this testing cycle is estimated to be $2,000 to $3,000 per trading partner.


This article describes the State of California pilot program to test an all-electronic bidding system. Vendors sign up with Datamatix, a VAN, which provides software allowing vendors to compile bids and send and receive information from an electronic mailbox. Datamatix collects and sorts the bids then forwards them to the vendors. The electronic bidding system is expected to save taxpayers millions of dollars.


This article briefly discusses the application of EDI to the cross-docking process.


This article addresses the use of financial EDI in the accounts payable process to decrease the costs of posting payments.


This article discusses the ways in which an electronic patient record can be kept confidential and private. The author asserts that a computer-based information system, managed by competent individuals, can control information and enhance privacy far better than a comparable paper-based system because computers can afford so many options to protect the system. Unauthorized access can be prevented through various strategies, including audit trails, security passwords, gatekeepers, and "time-outs" on computers.


This article maintains that advances in computer and communications technologies have allowed for a seamless, paperless environment in the intermodal transportation industry.


This article outlines Texas Instruments' experience in implementing large-scale EDI with 1,900 trading partners in 23 countries.

This article is a good primer for addressing commonly encountered EDI implementation issues such as standards and workflow re-engineering. The authors also outline the three levels of EDI use: end-to-end communications, intraintegration and interexploitation.
Glossary

**Analog Network**: A telecommunications network designed to transmit voice signals. Data transmitted over an analog network must be translated from a digital to an analog format.

**Application Software**: Software used internally by a company which enables a computer to do a specific job, such as word processing, purchasing or accounting.

**Bar Code**: A series of bars printed on an item's label or tag to uniquely identify that item. Usually placed on individual products, boxes, cartons, pallets and containers.

**Batch**: A collection of information set up as tasks created at one time and scheduled to be processed at a later time.

**Computer-Aided Manufacture**: Term used to describe software that allows a computer to direct manufacturing machines.

**Computer-Aided Design**: Term used to describe software that produces designs and drawings using a computer. Used by manufacturers for design, testing, and production of plans, blueprints, etc. Often combined with EDI to transmit information between remotely situated designers and manufacturers.

**Dedicated Network**: A telecommunications network that connects from one designated point to another designated point.

**Dialup Line**: A switched circuit established either by manually dialing a telephone or by having a computer or modem perform the dialing.

**Digital Network**: A telecommunications network designed to transmit data signals.

**Electronic Commerce**: The practice of conducting business electronically within a trading community through the use of EDI and other related information technologies.

**Electronic Funds Transfer**: The electronic payment or transfer of money between bank accounts.

**Electronic Mail**: The free-formatted sending and receiving of messages from one computer to another.

**Fedwire**: A payment process between banks. Enables the transfer of funds and limited information which all banks can accommodate. Also called a wire transfer.

**Functional Group**: A related group of transaction sets belonging to the same type of documents.

**Functional Acknowledgement**: The electronic transaction set used to indicate the receipt of another transaction set.

**Hard Copy**: Printed computer output.
Hub: A term applying to a large trading partner, often a first mover in EDI technology, who activates EDI with multiple smaller trading partners (spokes).

Interactive EDI: Back and forth, two way electronic data exchanges that occur at real time. An example would be electronic searching of remote data-bases.

Internet: The largest computer internetwork in the world. Originally developed for research and academic use, the Internet is increasingly being used for commercial data transmission.

Integrated Services Digital Network (ISDN): A switched telephone network which can accommodate both voice and data transmission without translation.

Just-In-Time: A manufacturing management program designed to reduce manufacturer's inventory cost by scheduling the production of inventory just as that inventory is demanded by customers.

Mailbox: The file where electronically transmitted data is stored before it is retrieved into the applications software. Usually provided by a VAN.

Mainframe: A large, powerful computer that stores vast amounts of data and can simultaneously perform multiple tasks.

Mapping Software: Software used to translate data from an EDI syntax into a company's internal application format.

Modem: Modulator-demodulator, a hardware device that enables computers to transmit data to other computers over an analog telecommunications network.

Open Systems Interconnection (OSI): A globally agreed framework developed by the International Standards Organization (ISO) for the interconnection of systems. Provides a common basis for the coordination of existing and developing standards.

PC-LAN: An intraorganizational network of PCs linked by a central processing unit. LAN is an acronym for local area network.

Point of Sale (POS): Term used to describe the capturing of information at the time and location of a purchase. Information may include item, UPC code, supplier, cost, store location, etc. May be transmitted via EDI to suppliers to enable Just-In-Time and Quick Response programs.

Quick Response: An inventory management program used by retailers which is designed to reduce inventory by scheduling the arrival of new inventory as close as possible to the time when existing inventory has been depleted. Also referred to as Rapid Replenishment.

Scanner: A device used to electronically read and identify printed materials, such as bar codes and text.

Seamless Interface: A channel through which data flows from one EDI system to another EDI system or to core applications without human intervention.
Server: The gateway for electronic data interchange. A server acts as the reception point for incoming electronic data and as the send-off point for outgoing EDI communications.

Spoke: A term used to refer to a small trading partner of a large partner (hub).

Switched Network: A dial-up telecommunications network that connects to any point. An example of this is a standard telephone connection.

Trading Community: The group of trading partners that a firm deals with in conducting its business. A trading community can span industry boundaries.

Transaction Set: Term used to describe approved EDI documents which are used between trading partners.

Translation Software: Translates data from a company’s internal applications format to a standard EDI syntax or between different EDI syntaxes.

Universal Product Code (UPC): A number issued by the Uniform Code Council (UCC) that is used by all parties in the retail industry to uniquely identify a given item.

Value Added Network (VAN): A commercial communications network which supplies data communication services, mailboxing, translation, and other related administrative services for subscribers.

Vendor Managed Inventory (VMI): An enhanced Quick Response inventory management program in which the supplier uses the retailer’s scanner data to determine the amount of inventory that the retailer needs, and the supplier provides that inventory without the retailer ever placing a purchase order.

Virtual Corporation: A dynamic network of trading partners operating on a single electronic infrastructure toward cooperative goals.