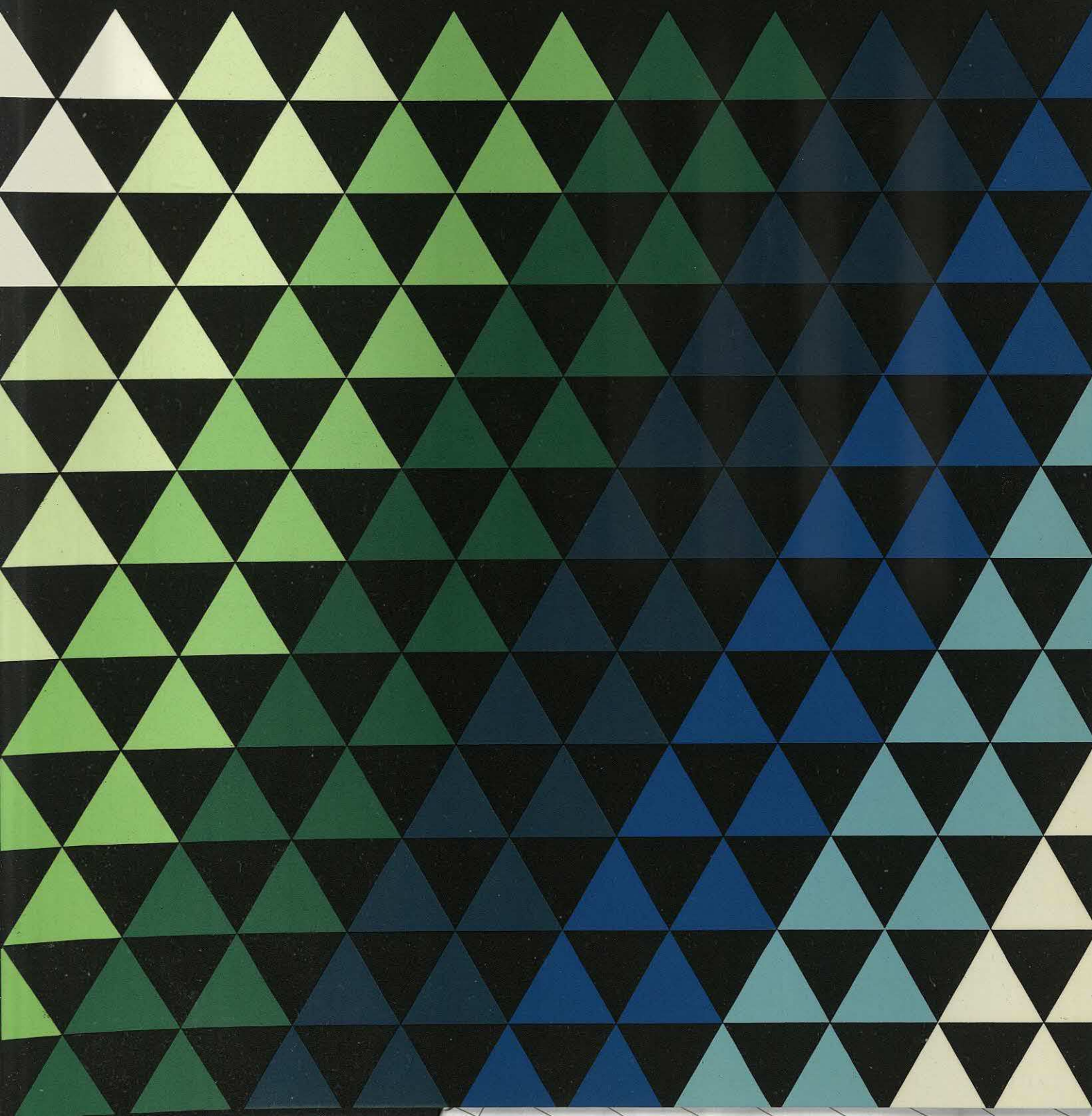
Electronic Data Interchange

BUTLER COX FOUNDATION

Research Report 59, September 1987



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Management Summary

A Management Summary of this report has been published separately and distributed to all Foundation members. Additional copies of the Management Summary are available from Butler Cox

Chapter 1

Electronic data interchange — a significant new application area

A car dealer sends orders for new cars from a personal computer in his showroom direct to the car factory in France. Members of an aerospace consortium exchange magnetic tapes containing design information generated by computer-aided design systems. A large company pays its employees' salaries by generating payment instructions on its computer system and transmitting them online to a clearinghouse that distributes them to individual banks. Another downloads information from its bank about recent transactions passing through its accounts for analysis on a personal computer in the company's treasury department. These are four examples of electronic data interchange (EDI), the transfer from one company to another of structured data in electronic form between computers.

WHAT IS EDI?

Information has been exchanged electronically between organisations for many years, and in a variety of forms. The telegraph played a major role in communications between businesses over a hundred years ago, and, more recently, telex has been the mainstay of international trade. Telegraph and telex are both essentially dependent on a person handling and processing the information when it is received.

EDI is a more recent development, and less familiar. It allows the data received to be processed automatically by computer. It has evolved from the proliferation of computer applications that process data received from other organisations. The introduction of computer-to-computer communication eliminates the need for data to be reconverted to machine-readable form by the recipient, saving both time and money. But a prerequisite for such interchange is that there are standard types of message, with prespecified structures, agreed by the parties who wish to exchange data in this way. The need to agree such application-level standards with other organisations is a distinctive feature of EDI. This need does not arise for the exchange of data between computers within a single organisation or for the use of a public general-purpose message service where the standards have already been defined. It is clearly an important factor influencing how quickly and in what form EDI will be implemented.

We define EDI as the transfer of *structured* information in *electronic form* between *computer systems* in *separate organisations*. There are four key elements to this definition:

- The information must be structured. Electronic mail for sending free-format text, or the facsimile transmission of images is not EDI, but standard-format messages or plans coded on the basis of drawing content (the output from computer-aided design systems, for example) are.
- The information is transmitted in electronic form. EDI communications usually now take place online, but early users of EDI relied on the exchange of magnetic tapes, and this approach is still preferred for some applications where low cost, or security considerations, outweigh the extra time taken for information transfer.
- The information is transferred between computer systems. Terminal-to-computer communication is not regarded as EDI, but the distinction between EDI and terminal-based services is becoming blurred now that personal computers are being used as EDI terminals. Some services, such as those for corporate cash management, can be offered in a form where a remote computer system is accessed interactively from a terminal, whereas in other cases they are accessed from desktop computers into which information can be downloaded and manipulated. For the purposes of definition we regard the service as an EDI application if it requires the transferred data to be processed in the personal computer.
- The communication is between separate organisations. The need to ensure compatibility between the computer systems at either end poses particular problems in communications between organisations. Similar problems arise in large conglomerate organisations

where there is no corporate policy controlling the choice of computer systems or communications formats used.

THE DIVERSITY OF EDI

It is often assumed that EDI is concerned primarily with the exchange of financial and trading data. Although there are many EDI applications of this type, it is also used for the exchange of technical and operational information. Figures 1.1 to 1.4 provide brief descriptions of four well-known EDI applications — SWIFT, the financial messaging network; the interchange of trade data by the US retailer K-Mart; the interchange of design information between Aerospatiale and the other Airbus consortium members; and the SITA network for the interchange of data between airline reservation systems. These examples illustrate the diversity of EDI applications.

Because of the diversity, it is not sufficient to describe EDI in global terms. Each type of application has reached different stages of development, has different implications for its users in terms of costs and benefits, and presents different problems to those implementing it. We have identified four generic types of EDI application, however, which include most of the situations Foundation members are likely to be faced with. They are:

- *Trade-data interchange*, the interchange of information relating to business transactions. Examples of trade-data interchange are the transfer of purchase orders and invoices, or import/export documentation. This type of EDI typically uses store-and-forward techniques.
- *Electronic funds transfer* (EFT). EFT relates specifically to messages concerning the transfer of payments, for example payment instructions sent to BACS (Bankers' Automated Clearing Services), the UK automated clearinghouse, or payments made via SWIFT. Electronic funds transfer applications differ from the others because they deal specifically with financial transactions; the additional security required necessitates a specialised approach to their design. We discuss them in this report only insofar as they illustrate the broader applicability of EDI.
- *Interactive applications*, such as information and reservation services, and online corporate cash-management services. Although applications of this type used to be accessed from a terminal, they are increasingly accessed from PCs, so the user may download the information for local manipulation, rather than merely inspecting it via the terminal. The dividing line between interactive EDI applications and the broader spectrum of interactive services is not well defined, and EDI and non-EDI approaches are possible for many applications. We limit our discussion of interactive services to examples of EDI applications.
- *The exchange of graphics and other design information*, for example between firms

Figure 1.1 EDI for funds transfer: Financial data on the SWIFT network

The Society for World Interbank Financial Telecommunications (SWIFT) is a cooperative society, headquartered in Brussels, formed by banks to provide an international interbank message-transfer service. By the end of 1986 the SWIFT network served more than 2,000 banks in over 50 countries, and carried nearly 200 million messages a year (equivalent to six messages a second, assuming continuous operation). SWIFT offers a variety of messaging and transaction services, including:

- Customer funds transfer
- Bank transfers
- Credit/debit advices
- Foreign-exchange and money market confirmations
- Collections
- Documentary credits
- Interbank securities trading
- Balance reporting
- Payment systems

Standard message formats are defined for each type of service and transaction.

Figure 1.2 EDI trading data: Purchase orders and invoices at K-Mart

K-Mart is the second largest US retailer, with approximately 2,100 stores across the nation. It has been one of the pioneers of EDI, using it since 1978 for communications with its suppliers. It now has EDI links with more than 800 suppliers, including almost all of its major ones. The system is used primarily for the transmission of purchase orders, and about one-third of all its purchase orders are transmitted via EDI. It also accepts invoices via EDI from about 200 suppliers.

When K-Mart began its EDI operations there were no accepted message standards, so the company defined its own. However, it now also supports the US grocery industry's EDI standard, UCS (Uniform Communication Standard), and the American National Standards Institute's (ANSI) X.12 generic business data interchange standard, both of which are widely accepted in the retail trade in the United States. To leave or collect messages, suppliers dial up over the public switched network and access minicomputer-based mailboxes at K-Mart. The mailbox system is separate from K-Mart's mainframes.

Figure 1.3 EDI graphics information: Design drawings at Aerospatiale

The European aerospace industry is based on collaborative projects. The efficient exchange of drawings generated by computer-aided design systems is important to collaborative design work, especially as the information is subsequently used in electronic form in computer-aided manufacturing systems. (The aim for the Airbus 320 was for all of the manufacturing to be computer-aided.)

Aerospatiale originally used datapost to deliver magnetic-tape files from its computer-aided design system to its Airbus 320 partners, British Aerospace in the United Kingdom and MBB in Germany. Since 1984, millions of drawings have been delivered this way. The consortium has developed its own standards, SET (Standardes d'Exchange et de Transfert), for coding the drawings.

Aerospatiale is now beginning to experiment with online file transfers over direct links, using networks based on the SNA and DECnet architectures.

Figure 1.4 EDI for interactive services: Reservations on the SITA network

SITA, the Sociéte Internationale de Télécommunications Aeronautiques, was founded in 1949 as a cooperative venture to provide telecommunications services for airlines. it now serves nearly 300 airlines in 169 countries. Its packet-switching network, claimed to be the largest in the world, supports more than 30,000 terminals in over 16,000 airline offices. A wide range of services is carried on the network. In particular, since 1971 the network has carried query/response traffic generated by computerised airline reservation systems. The main message types concern passenger-seat availability and reservations, cargo reservations, requests for flight plans, and lost-luggage enquiries. In 1985 the system carried more than ten billion messages (equivalent to an average of 300 per second, assuming continuous operation).

working together on aircraft or motor-vehicle design, or in electronic publishing applications. The designs may be generated on computer-aided design systems or by desktop publishing software.

THE SIGNIFICANCE OF EDI

The original motivations for introducing EDI were to reduce costs and errors (because the data does not need to be rekeyed on receipt) and to save time (because electronic transmission is faster than physical mail). But it is now clear that EDI has far more fundamental implications for the success of the businesses that use it, and perhaps more importantly, for the prospects of those organisations that do not use EDI. In some countries and business sectors the use of EDI is already a precondition for doing business at all. In others, the use of EDI has led to dramatic changes in the market share and competitiveness of supplier organisations. It has also changed the trading relationships between suppliers and customers, and, in some markets, between the suppliers themselves. In short, EDI is proving to be not just another application of IT, but one that has fundamental implications for businesses, and one on which organisations need to take action, either to exploit the opportunities or to counter the threats. However, many organisations have simply not recognised the potential impact of EDI on the future of their business. As a result, EDI is misunderstood and underexploited in many organisations.

The use of EDI is spreading and it is being used more extensively for some applications and in some areas of business than in others. It is beginning to be used in new ways and by additional business sectors. To avoid the threats or take advantage of the opportunities from EDI requires a pro-active approach. The introduction of EDI can lead to very rapid changes in an organisation's market and, unless the organisation is well prepared, the business will suffer. Some organisations have found that EDI is easy and inexpensive to implement, but others have found the introduction of EDI to be a long and costly process. Potential users need to understand the barriers to the implementation of EDI and to have their internal systems prepared in advance.

At present, the use of EDI is more developed in those countries with a more liberal and less-regulated telecommunications environment (the United States and the United Kingdom in particular). However, the business significance of EDI is so great that other countries will not be able to ignore it. We believe that EDI is set to become a permanent feature of the business environment throughout the developed world. Present telecommunications regulations may delay its introduction in some countries, but not for long. The business pressure for EDI services will be such that governments and PTTs will not be able to stand in the way of EDI developments.

PURPOSE OF THIS REPORT

The purpose of this report is to alert Foundation members to the potential of EDI, the threats that it poses, and the barriers to its use, and to recommend what actions need to be taken.

The first action required is to alert senior managers to the possible implications of EDI for your organisation. Will it affect the way your business is conducted or your competitive position, and if so, how? These questions are addressed in Chapter 2. In assessing the implications for your business it is helpful to understand why business managers

currently do not appreciate the importance of EDI, the real benefits it can bring, or the barriers to its use. These topics are covered in Chapter 3.

Chapter 4 describes the characteristics of EDI, how it is being used to meet different types of data interchange requirements, the need for standard message formats, how EDI services are provided (and how secure they are), and the technologies that can be used for EDI. You also need to be aware of how EDI is currently being used in your business sectors and the geographic areas in which you operate, and how it is likely to develop in future. The status and the future of EDI are reviewed in Chapter 5.

In Chapter 6 we present an action plan for those Foundation members about to embark on an EDI programme. It covers the most important decisions that need to be taken, including the identification of opportunities, factors affecting the approach (including selection of suppliers where appropriate), timing, and choice of technology.

The report concentrates on the electronic interchange of structured data between companies. It is not concerned with the transmission of unstructured data, for example by electronic mail systems. Nor is it concerned directly with the communication of data within an organisation, although the implication of EDI for internal systems is assessed.

RESEARCH ACTIVITIES AND TEAM

To develop our recommendations we undertook a substantial programme of research during the first half of 1987 on the experience of existing users of EDI and on the activities and plans of suppliers and others concerned with its introduction. The questionnaire sent out to Foundation members at the beginning of the research produced 94 responses that provided a substantial amount of information about members' use of EDI, their views on the technology, and their experiences with its implementation. In addition, we conducted 30 interviews with advanced users of EDI in Europe, the United States, and elsewhere, and 26 interviews with suppliers, industry bodies, and others concerned with the provision of EDI services and the development of standards for EDI. We also carried out extensive desk research on the reported case histories and analyses of the use of EDI.

The research was led by Karol Szlichcinski, a senior consultant with Butler Cox in London. He was assisted by Simon Forge, a senior consultant with Butler Cox SARL in Paris, and significant contributions were made by Tim Chapman of Butler Cox BV in Amsterdam and by Warren Waldbrand, a senior consultant with Butler Cox in New York.

Chapter 2

EDI has fundamental implications for business

At first sight, EDI may appear simply to be a way to avoid having to rekey data that is already held in another computer system. As such, it might save time at the job-input stage, but in most cases it would not warrant substantial management attention. In practice, however, the implications of EDI for businesses are often much more fundamental because EDI has the potential to:

- Win or lose you business.
- Radically change your market structure.
- Change your relationships with your trading partners.
- Lead to changes in your internal organisation.

EDI CAN WIN OR LOSE YOU BUSINESS

In a few businesses, it is already necessary to use EDI to stay in business. Some large organisations are insisting that their trading partners use EDI, and, even where such extreme situations do not exist, the use of EDI has resulted in significant changes in market share.

EDI CAN BE A PREREQUISITE FOR DOING BUSINESS

In some business sectors, particularly those where it is well established, EDI is already a prerequisite for doing business. One UK bank we interviewed, Standard Chartered Bank, has found that many of the banks with which it does overseas business insist on the use of the SWIFT network, the international financial messaging system, as an essential condition of business. And the electronic exchange of seat reservation information and bookings has been an essential capability for airlines for many years. As the use of EDI increases, similar situations will develop in other business sectors.

SOME ORGANISATIONS INSIST THAT THEIR TRADING PARTNERS USE EDI

In other sectors, particularly in retailing and the motor industry, large organisations are beginning either to insist that organisations dependent on them (whether as suppliers or distributors) use EDI, or to favour those organisations with an EDI capability. For example:

- Two European car manufacturers, Renault and Fiat, have recently told all their UK dealers to install PCs for inputting orders to the company's headquarters. Another car manufacturer now insists that all significant suppliers accept orders via EDI.
- One large UK retailer, Boots, now receives invoices from most of its major suppliers in electronic form (mostly on magnetic tape). This is the result of an active policy to obtain maximum benefits from EDI.
- A European aircraft manufacturer is selecting suppliers of minor components on a points classification system, which includes EDI capability as one criterion.

EDI CAPABILITY CAN HELP TO WIN CONTRACTS

In project-oriented areas of business, EDI capability can win contracts, or at least get you on the shortlist:

- A UK construction company won a contract for refitting a refinery because of its ability to accept in electronic form large volumes of plant drawings produced on a computer-aided design system.
- The ability to exchange in electronic form the outputs from computer-aided design systems is now an essential condition of participation in most aerospace consortia.

USE OF EDI CAN INCREASE MARKET SHARE

Sometimes, the use of EDI has led to substantial increases in market share, particularly where customer service, and not price or product design, is the main basis for competition in a market:

- One consumer product is supplied to United Kingdom supermarkets by three major suppliers. The ability of two of them to accept orders by EDI led to a considerable increase in their market share.

— The UK engineering industry in the West Midlands is served by five major toolmakers. After two of them had introduced EDI for the receipt of orders, a third experienced a 24 per cent reduction in its business. Now, all five toolmakers accept orders via EDI.

The competitive impact of EDI is greatest in sectors where customer service, as opposed to price, product design, or quality, is the main basis for competition. Electronic ordering can provide an immediate reduction in the time from placing an order to receiving the goods, and the improvement is often enough to give an immediate advantage in the marketplace to the company using EDI. EDI can have an impact on price and product quality as well, but the link is an indirect one, and it is less likely that the effect will be big enough to have an impact on the market.

EDI CHANGES MARKET STRUCTURES

The use of EDI can allow different types of company to enter existing markets, and, in some cases, it can transform the structure of the market completely.

EDI CAN ALLOW NEW COMPETITORS

In addition to redistributing market shares, the use of EDI can open up markets to different and geographically remote companies. Online financial services, such as cash-management services, are reducing the dependence of banks on a network of branches to deliver their services. This removes one of the barriers to new market entrants, and as a result foreign banks are expanding into the European corporate banking markets. Electronic payment services also eliminate the need for a network of branches and a labour-intensive infrastructure, so that retailers, for example, can offer payment services such as EFTPOS where regulations allow them to do so. Similarly, home banking enables customers to access banking services from their homes, thereby reducing reliance on the local bank branch and allowing organisations such as building societies to expand further into traditional banking markets.

The advent of electronic dealing for shares and other financial instruments has removed the need for a trading floor and has thus opened up the financial markets to geographically remote participants. Indeed, the trading floor of the London Stock Exchange is no longer used following the 'Big Bang', the advent of electronic trading. The consequence is that customers now have a greater choice.

EDI CAN TRANSFORM MARKETS COMPLETELY

The most fundamental way in which EDI can change the relationships between trading partners is to change the structure of the market as a whole. The availability of online financial services has been one of several elements leading to a radical change in the way organisations buy financial services. Historically, there was considerable emphasis on the relationship between a company and its main bank, and companies tended to look to one (or just a few) banks to provide them with a complete range of banking services. Now companies tend to use different banks for specific services, and to shop around for the best supplier for a particular service. In some cases, banks have been eliminated completely from their role as intermediaries in certain types of financial transactions. (This process is known as 'disintermediation'.) Major companies in the United States now often make payments to their suppliers via an automated clearinghouse operated by a third party, who may be a VAN (value-added network) operator, rather than through their banks.

EDI is one of several technologies that is making 'just-in-time' manufacturing possible. The advent of new manufacturing techniques, such as flexible manufacturing and just-in-time manufacturing, has fundamental implications for manufacturers as well as their suppliers. The use of EDI for sending orders from dealers to a manufacturer, coupled with flexible manufacturing, would, for example, allow customers to have their cars made to order instead of buying from completed stocks. This would change the whole process of car buying and the role of distributors.

Fears about the possible impact on market structure have been a major factor in delaying and even stifling some major EDI initiatives. For example, road haulage contractors were unwilling to let their customers have access to a VAN service operated by the UK Road Haulage Association displaying available space on trucks, and the initiative eventually had to be abandoned. (The contractors feared that their hitherto 'captive' customers would realise they could take their business elsewhere.) We have encountered other similar examples, but the topic is a sensitive one, and we have been asked not to publicise the details of other cases.

EDI CHANGES RELATIONSHIPS WITH TRADING PARTNERS

Even where the structure of the market is not affected, the use of EDI often changes the relationships between organisations and their trading partners. In particular, the use of EDI can

redistribute functions between suppliers and their customers, to the advantage of the more powerful partner. For example, since the adoption of EDI for airline seat information and booking, many of the booking functions previously carried out by the airlines have now been taken over by travel agents. One car manufacturer we spoke with saw EDI as a key element in its strategy of placing more responsibilities (for stock control, for example) on its suppliers.

One motor-industry supplier found that most of the contact with its major customer prior to EDI concerned disputes arising from errors in the handling of orders and their documentation. When this source of friction was removed through the introduction of EDI, relations improved substantially. Another supplier, in the retail sector, found that discussions with its trading partners about EDI links enabled it to get to know and understand them better, and as a result many other problems were solved at the same time. The respective systems departments were involved in these discussions, and it is a characteristic of EDI that systems departments have a frontline role in relationships with other companies, in parallel with the departments that traditionally manage these relationships.

In some circumstances, however, EDI can adversely affect one of the trading partners. Manufacturers supplying the grocery trade used to send sales staff to supermarkets to take the retailers' orders. EDI, in conjunction with several other developments (particularly the centralisation of warehousing and ordering), has enabled major retailers to eliminate these sales visits. This development has not been welcomed by the suppliers; in addition to the opportunity the visits provided for selling extra stock, the salesman could influence the display and promotion of the products and gather useful market intelligence. And in the financial-services sector, online services are one factor in the decline of the personal relationship between bankers and their customers.

EDI PROMOTES COOPERATION BETWEEN PEERS

Companies who would normally see themselves as competitors often need to cooperate to bring about the implementation of EDI in their sector. For example, banks are increasingly cooperating on a national basis to offer EFT services and are establishing relationships with banks in other countries to exchange account information at the customer's request.

USE OF EDI WITHIN A COMPANY CAN IMPROVE ITS EXTERNAL RELATIONSHIPS

Even where EDI is used only within an organisation, it can improve the organisation's relationships with the outside world. Communications within large conglomerates can have much in common with those between separate companies. Different subsidiaries may well have their own purchasing policies, their own computer systems, and their own sets of document standards, so that the problems of exchanging documents between them are the same as for unrelated companies. In this context, the use of EDI between separate units in the organisation can bring the same benefits as it does for communications between independent organisations, but it can also bring benefits to the conglomerate as a whole in its dealings with the outside world.

One multinational uses EDI for collecting quarterly account information from its subsidiaries around the world. The speed and accuracy of EDI enables it to publish results more often and more quickly than was possible before, enabling the group to improve its public image, and to maintain a higher profile in the financial markets to support its share price.

EDI CAN LEAD TO ORGANISATIONAL CHANGE

The use of EDI obviously brings new responsibilities for the systems department. But EDI may also require, or may provide management with the opportunity for, introducing other organisational changes. In the longer term, it may have far-reaching effects on organisational structure.

ORGANISATION FOR EDI

Several large organisations, particularly those with several EDI applications across the range of their operations, have appointed a manager with specific responsibility for the introduction of EDI, its promotion within the organisation, the identification of priorities, and the coordination of all EDI activities. However, in sectors where EDI is well established, such as air transport and banking, it is now treated in the same way as any other computer application under the responsibility of the systems director, and there is usually no specialist manager or organisational unit devoted to it. (The responsibilities of the EDI manager are discussed on page 32.)

STAFF CHANGES

In some companies the introduction of EDI has reduced the numbers of staff performing functions closely related to the handling of paper documents — data entry and mail room personnel, and staff handling telephone enquiries, for example. Sometimes, craft skills may be threatened by the use of EDI. For example, the construction of engineering models for a new car requires a skilled

technician working from an engineering drawing to make a plastic or wood model. Some companies are now receiving the outputs from computer-aided design systems electronically and are feeding them into a machine tool that makes the model automatically.

In some cases, EDI has led to the centralisation of functions previously performed at outlying sites, with corresponding redeployment of staff. This has occurred in a shipping company participating in the DISH pilot EDI project (see Figure 5.3 on page 24). Other companies plan to do the same when their EDI applications are better established.

ORGANISATIONAL CHANGES RESULTING FROM CHANGED RELATIONSHIPS WITH TRADING PARTNERS

Where the company at the centre of a trading cluster decides to use EDI to push some functions out to its trading partners, the organisational changes on both sides are likely to be more far-reaching. For example, a move to just-in-time manufacturing supported by EDI will greatly reduce or eliminate the manufacturer's warehousing requirement. In practice, changes of this kind are likely to take place over several years, and it may be difficult to separate the effects of EDI from other factors. Airlines now employ proportionately far fewer sales staff than they did before EDI was introduced for seat reservations. Their pre-EDI sales organisations could not have coped with current service levels and volumes, but the changes have taken place over some twenty years, during which the air transport industry has changed radically. Nevertheless, the changes that have taken place could not have come about without EDI.

EDI therefore has the potential to reshape businesses. It can change the markets in which an organisation operates, and it can change the relationships with trading partners. These implications of using (or not using) EDI should be a strategic concern. Yet despite the importance of EDI, it is widely misunderstood and under-exploited. We explain why this is so in the following pages.

Chapter 3

EDI is underexploited and misunderstood

There is still a widespread lack of awareness about EDI and its potential impact. Suppliers of EDI services believe that lack of awareness and a lack of understanding of its implications are the biggest barriers to the use of EDI. The lack of awareness has been quantified in recent surveys. A survey for the UK Department of Trade and Industry interviewed company directors with the most senior responsibility for computing in their companies. It found that 69 per cent had never heard of VAN services or value-added data services (VADS), the broader categories of telecommunications services that include EDI, and of those who had, 16 per cent knew nothing specific about them.

A survey of financial managers conducted in the United States by the First National Bank of Chicago found that only 14 per cent of them considered their senior management knowledgeable about EDI. Fifty-eight per cent reported that their management had only limited knowledge of EDI, and 28 per cent expressed no opinion.

Earlier, we highlighted the increases in market share that could result from the introduction of EDI. From our research, it is clear that the managers of the companies that lost out had not anticipated the strategic threats to their business from EDI. The danger may not have been foreseen, or it may not have been possible to take action in time because of factors delaying the implementation of EDI in the companies concerned. The timescales required for the implementation of EDI can be significant.

In general, managers perceive EDI as a means of reducing costs, but they fail to see the more important benefits. They also misunderstand the barriers to implementing EDI, in particular the need for appropriate in-house automated systems.

MANAGERS SEE COST SAVINGS BUT NOT THE MORE IMPORTANT BENEFITS

Although the use of EDI does reduce document handling costs, the savings may only be marginal. Most managers do not recognise the opportunities or threats, or other important benefits (such as better cash flow or improved stock control) that EDI can provide for their business.

EXPECTATIONS OF MANAGERS

The surveys referred to above also researched the benefits that managers expect from EDI. The expected benefits are somewhat contradictory, but it is apparent that many managers see EDI as a way of reducing costs in the functions immediately involved with handling the specific documents concerned. However, the UK survey showed that just over half the interviewees expected the use of VAN services to reduce the time between order despatch and delivery, to increase competiveness, to improve supplier relationships, and to improve customer relationships. Forty-nine per cent expected reduced operating costs, and over 40 per cent also expected faster billing and increased profitability. These findings must, however, be set in the context of the very low awareness of VAN services identified by the survey.

The US survey presents a very different picture. Over half the respondents said cost savings compared with the use of paper documents was the reason they felt EDI would be useful to their company. Time saved by sales personnel was the next most frequent response, from a third of those surveyed.

The benefits sought by Foundation members, as identified in the responses to the questionnaire sent out at the beginning of our research, are shown in Figure 3.1 overleaf. Cost savings are the most widely anticipated benefits, although in most cases they were not the only benefit expected. The ability to provide a better customer service through faster responsiveness and more timely communications, and improved or maintained competitiveness were the next most sought-after benefits.

EDI OFTEN LEADS TO COST SAVINGS THOUGH THEY MAY NOT BE LARGE

The three most common types of EDI can lead to useful cost savings.

Figure 3.1 Benefits expected from EDI by Foundation members

Expected benefit	Percentage of members
Cost savings*	36
Better customer service	32
Improve/maintain competitiveness	12
Improve cash flow	5
Better management information	4
Improved security	4
Better stock control	2
Improve company image	2
Lock-in customers	2
Other	18

* The most frequently quoted areas of cost saving (in descending order) were:
- — Fewer errors and resultant queries
- — Less paper
- — Reduced data preparation
- — Less staff
- — Lower service charges
- — Reduced administration

Note: Percentages add to more than 100 because of multiple responses.

Trade-data interchange

Several studies have shown that trade-data interchange can provide worthwhile reductions in document-processing costs. A study commissioned by Istel showed that on average in the United Kingdom it costs £10 to process an order or invoice, and that the costs could be reduced by up to 25 per cent by using EDI. First National Bank of Chicago has calculated that between about $4 and $6.50 per document can be saved with EDI, depending on the type of document. The full range of savings for different types of document is shown in Figure 3.2. Motor-industry studies have estimated that EDI could save $300 per car.

However, substantial savings from trade-data interchange have not yet been demonstrated in practice on a widespread scale. Cost reductions for document processing are not achieved easily or quickly. Major savings will not occur until a high proportion of the relevant documents are sent via EDI, and few EDI users are yet in a position to do this. It usually takes several years to reach this stage, and it is difficult to make an accurate comparison of costs across the timespan. Also, savings will be offset by the initial capital investment required to implement the new system.

Nevertheless, significant cost savings specifically related to document processing have been achieved in a few cases. One large retail organisation has eliminated the need to rekey more than 10,000 invoices a day. A US company is reported to have reduced the cost of processing a document by between $40 and $60. And one major food manufacturer is believed to have reduced production and despatch costs for order documents by 83 per cent.

Electronic funds transfer

The electronic capture of credit-card transaction data has brought substantial savings in the handling of vouchers both for the retailer and the credit card company. Moreover, the latter has the added bonus of eliminating the need to key the data. As a result, retailers have been able to negotiate reductions in the fees paid to the card companies. Other types of EFT also bring savings. For example, a small stockbroking firm was able to save $8 on each high-value payment it made (an average of six per day), when it changed from wire transfers to initiating the payments online from its offices.

Exchange of design data

Useful savings are also reported with other types of EDI. The production of engineering models for the motor industry used to take skilled technicians working from engineering drawings many days of work. Electronic transfer of data from a computer-aided design system that is input into a numerically controlled machine tool can reduce the time required to hours. For example, the modelling of a windscreen housing, which used to take 150 hours by the manual method, now takes six hours. And the transfer of design data between aerospace companies in electronic form is estimated to save five man-years per project because the data does not have to be re-entered into another computer system.

EDI IMPROVES CUSTOMER SERVICE

Electronic receipt of orders enables companies to offer better service to their customers, by allowing orders to be transmitted and acted on more quickly and accurately. This is how EDI brings about changes in market share, and why some

Figure 3.2 Cost savings with EDI for different types of document

Type of document	Average savings per document ($)
Purchase orders	6.42
Invoices	5.77
Payment advices	5.23
Material releases	4.12
Shipping documents	3.78

(Source: First National Bank of Chicago)

organisations insist on exchanging data electronically with their trading partners.

EDI BRINGS OTHER MANAGEMENT BENEFITS

EDI can also bring a range of other management benefits.

Better cash flow
One company found that, on average, 30 per cent of invoices to its major customer were unpaid because of real or suspected inaccuracies. The introduction of EDI for order placement and invoice transmission reduced the proportion to less than 5 per cent. Better cash flow for one side of a trading relationship necessarily means worse cash flow for the other. Both sides benefit, however, from the greatly increased predictability of the timing of payments.

Improved stock control
One US retailer we interviewed estimated that using EDI for sending purchase orders saved it from carrying two weeks' worth of inventory. And by using EDI, a European car manufacturer has been able to move from weekly to daily ordering.

Better management information and control
A European supermarket chain runs a very decentralised operation, and uses EDI for direct ordering from individual stores to suppliers. The chain finds that EDI permits tighter management control of its distribution operation. And another firm that has implemented EDI for the receipt of purchase orders from and despatch of invoices to its major client has found that the more accurate information, and the rapid feedback when mistakes occur, permits far more effective management of the relevant functions.

Overcoming operational problems
EDI can also help to overcome the operational problems encountered with existing methods of exchanging information with trading partners. For example:

- An Italian supermarket chain had major problems in ordering from its suppliers because of the slowness and unreliability of the Italian postal system. It now places orders by telexes that are generated automatically, but sees EDI as its ultimate objective. It now no longer has to carry additional stock to cover postal delays (at least a week), and can sell fresher goods.
- A European car manufacturer used to place orders with its suppliers by telex, a process it found increasingly unsatisfactory. The final straw came when it had to send a telex 45 metres long to a supplier. It has found that EDI enables it to place orders daily rather than weekly.

MANAGERS MISUNDERSTAND THE BARRIERS TO EDI

Organisations may encounter several significant barriers that may delay the introduction of EDI, even when commercial pressures dictate that it should be adopted. The most significant barriers are the time it may take to reach agreement with trading partners, legal requirements and regulations that may make it difficult to use EDI, the lack of message standards, inappropriate internal systems, and the length of the learning cycle. Other barriers, in particular cost and security, are often exaggerated, however.

RESPONSE OF TRADING PARTNERS

A few organisations are in a position to impose their wishes on their trading partners, but most will need to negotiate the introduction of EDI with their trading partners, or at least educate them about the advantages of using EDI. The US survey mentioned earlier found that the majority of suppliers to the companies interviewed had never discussed EDI with them. There may be initial resistance to EDI, especially from customers, because they fear being locked into the supplier by the technology.

A programme to educate suppliers and sell them the idea of EDI may be required. One company we interviewed, a retailer with a large number of suppliers, believes that educating the suppliers and selling them the virtues of EDI is the most important activity of its EDI implementation programme. This company told us that above all else, it is necessary to follow up with their trading partners in order to make EDI work.

LEGAL REQUIREMENTS

In some countries (France and Italy, for example) and in some circumstances, a paper document is required before a communication is recognised legally. In other cases the legal status of an EDI communication is unclear. These issues need to be clarified for the specific application in question. Sometimes, however, paper documentation can follow (or precede) the EDI communication, freeing the transaction from the delays inherent in paper communication. In Italy, it is a legal requirement that payment and order conditions accompany each order. One supermarket chain sending orders electronically overcomes this problem by issuing a notice of its terms and conditions each quarter, and referring to this notice in the electronic order.

Customs and tax authorities may require documented audit trails; in most cases, however, these can be provided electronically.

INAPPROPRIATE INTERNAL SYSTEMS AND PROCEDURES

One barrier that may prevent a company from implementing EDI when its competitors are doing so is its own systems. The benefits of EDI, and even the practicability of implementing it at all, often depend on the presence of an appropriate infrastructure of systems within the organisation. Just as EDI is often needed to enable companies to reap the full benefits of introducing other IT systems (such as computer-aided design and manufacturing systems, or point-of-sale systems), so in many cases EDI needs to interwork with computerised systems within a company in order to be fully effective.

One retailer we interviewed did not plan to implement EDI until its internal system for handling invoices had been upgraded. At present invoices are matched manually with a goods-received note. If the company is to gain any advantage from the electronic delivery of invoices, the invoice-checking system will first need to be automated. Another company's procedures require all invoices to be checked by a supervisor before being sent out. Procedures of this kind would negate the advantages of EDI.

Similar examples can be found in connection with financial-information and funds-transfer services. For example, online cash-management services, giving up-to-date information on account balances and recent transactions, provide the most benefits when they are integrated with in-house treasury systems, because:

- More systematic, precise, and detailed record-keeping is possible, giving greater control over cash management, with consequent better performance.
- Savings on professional time used for routine tasks can be achieved, allowing more effective use of professional skills.
- Paper flows can be reduced.
- Savings in clerical time can be achieved.

Similarly, the greatest benefits from the transfer of payment instructions, whether payroll or payments to suppliers, arise where the payment instructions are generated automatically. Electronic transfer, whether on magnetic tape or online, can then bring substantial increases in efficiency and substantial savings in clerical and administrative effort. The benefits are reduced if the data for electronic transfer has to be specially keyed in.

Graphics information provides perhaps the most obvious examples of the need for automated systems before EDI becomes worthwhile. Without computer-aided design or manufacturing systems at either end of the EDI link to generate and decode the data, there is no advantage in sending design data electronically.

LACK OF MESSAGE STANDARDS

The lack of suitable message standards is often seen as a barrier to the implementation of EDI. This need not be the case, because direct EDI links can be set up with trading partners and the message formats to be used can be agreed with them. However, it may be difficult to persuade trading partners to take action in the absence of standards. In addition, the costs and other resources required for writing the necessary software and setting up the link without standard software or a prepackaged service from a VAN operator may well be a deterrent.

LENGTH OF THE LEARNING CYCLE

There is often quite an extended learning period before an organisation can implement EDI effectively with its trading partners. Although not strictly a barrier, the time required to learn about EDI can prevent a rapid response to a commercial requirement — to combat a competitor who is using EDI to gain a market advantage, for example. In the simplest case, where a PC and standard software are used (to allow a small supplier to exchange trade data with a large retailer or manufacturer, or to allow a bank's customer to connect to the bank's treasury cash-management service, say), implementation need take only a few days. Even where an element of software customisation is required, implementing this simple form of EDI can take as little as 20 days.

However, where a large organisation wishes to implement EDI links with a substantial number of suppliers, the process can take considerably longer, because:

- Analysis may be required to define the applications precisely and to construct a business case for using EDI.
- Technical and commercial issues will need to be negotiated with the service supplier if one is to be used.
- Negotiations with trading partners can be lengthy, and agreement may have to be reached on such matters as the definition of terms used in messages. Disputes over who pays what can prolong the process indefinitely, as has occurred in the case of some EFTPOS projects. (The introduction of debit cards in the UK has been delayed because retailers have disputed the transaction charges the banks proposed to make.)

- Interfacing EDI to existing applications can require substantial effort.
- Practical problems of connectivity can delay the project by months, or longer.

A pilot project may be required to resolve many of the above issues. The planning, operation, and evaluation of a pilot may take a year or more.

Many of the organisations now engaged in programmes to provide EDI links with a substantial proportion of their trading partners have planned for a three-to-five-year timescale between commencing the project and the point when most of the documents are sent electronically.

COST

Cost, in particular hardware costs, software costs, and the cost of changes to existing systems, is often seen as a major barrier to EDI implementation. However, low-volume trade-data interchange applications and interactive EDI applications can be implemented for as little as $4,500 to $6,000 using a personal computer (provided the transaction volumes are low). But where EDI applications have to be interfaced to existing mainframe-based applications to achieve the desired benefits, the cost of interfacing to existing applications software is likely to be the most significant cost. Costs can be higher where security is a major consideration. The entry price for software and hardware to access SWIFT is $20,000, and the average bank spends between $40,000 and $100,000 in setting up its SWIFT connections.

During our research, we heard of organisations that had spent more than $80,000 in making their existing applications software compatible with EDI, and had diverted scarce development staff into the project for a significant length of time. The cost can be even higher for those organisations that take the lead in their business sector. They will have to expend considerable effort in carrying out pioneering technical work, in piloting applications, and in standards activities. One large pioneering organisation estimates that it has spent about $120,000 to date on EDI, excluding modifications to existing applications.

Operating costs can also be significant. They typically include the payment of a flat fee and a volume-related charge to the VAN operator, and connection and, where appropriate, line rental and usage charges to the PTT. There is a trade-off between the fixed and variable charges made by different service operators, but fixed charges can be as low as $825 a year, rising to $5,000 for a leased line (including line rental). Volume charges range from $0.02 to $0.12 per thousand characters in the United Kingdom, depending on the service operator and the volume of data transmitted.

International messaging costs are higher: the cost per thousand characters is $0.40 across Europe; $0.50 to $1.30 across the United States; and $0.58 in the Far East. In most cases costs are higher because protocol conversion has to be carried out 'on the fly'.

In sectors where the use of EDI is well established and extensive, the cost of communications can be considerable. Airlines sending millions of messages a year can be faced with annual operating costs running into millions of dollars.

CASH FLOW

A major barrier to using EDI, either for trading partners or for the organisation, may be the adverse affect on cash flow for one of the partners. If EDI allows faster transmission of invoices and fewer errors in them, the customer may find it is paying earlier for deliveries than it would otherwise have done. Payment terms can, however, be renegotiated to largely or completely eliminate this effect. In the retail sector in the United Kingdom, for example, it is commonplace to specify that payment is due on a given day in the month following that in which the invoice is delivered. As one large retailer commented, "We pay when *we* want to."

SECURITY

Security is seen as a major concern in the implementation of EDI, particularly for electronic funds transfer and the exchange of sensitive trade data. It was by far the most frequently voiced concern by Foundation members, being identified in 30 per cent of the responses to the proposed scope of the research. The indications are, however, that in practice concerns about security prove to be more of a delaying factor than a barrier. Adequate security procedures are available, even to safeguard the networks carrying high-value funds transfers. Nevertheless, potential EDI users need to satisfy themselves that the security procedures of systems that will send EDI communications from their own organisation, and those of their trading partners and the VAN service operator (where one is used), are adequate.

In general, our research showed that senior managers had not yet given EDI the attention that it deserves. A starting point for appreciating the business impact of EDI is to understand the characteristics of EDI. We provide this understanding in the following pages.

Chapter 4

Characteristics of EDI

The different types of EDI application have different characteristics in terms of the type of data that is exchanged, the way it is exchanged, and in the relationships between the parties to the EDI communication. Figure 4.1 shows the main differences. EDI applications also differ in their intercommunications pattern and the message formats used. Sometimes an organisation sets up its own EDI connections, but it is now more common in the United States and the United Kingdom to use a public EDI service provided by a third party or by an industry body set up to provide an EDI service for a particular sector. Different types of application also require different levels of security. Finally, different types of networking, computer hardware and software technologies can be used to implement EDI. Each of these characteristics of EDI is discussed in more detail below.

INTERCOMMUNICATION PATTERNS

EDI communities can be based on a variety of intercommunication patterns. These patterns vary from one application of EDI to another and are important in determining the way in which an EDI service is provided. The different types of pattern are shown in Figure 4.2. The data interchange between organisations can be:

- One-to-one, as between a manufacturer and a major supplier, or between partners in an engineering project.
- One-to-many, such as a car manufacturer communicating with its dealers.
- Many-to-one, where suppliers communicate with a major retailer.
- Many-to-many, where similar organisations (peers) exchange data, as in the exchange of booking information between airlines. Other examples of many-to-many networks are where many suppliers and retailers intercommunicate on the same network, and where exporters, importers, and customs offices exchange information relating to international freight shipments.
- Mixed networks. Already some networks, notably SITA, are having to support a range of communications, both between organisations of the same type and between organisations of several different types.

Figure 4.1 Characteristics of the main types of EDI application

Application	Characteristic: Type of information	Data interchange requirement	Relationships between the parties
Trade data interchange	Text and data	Store-and-forward message	Customer/ supplier
Electronic funds transfer	Text and data (financial)	Store-and-forward message	Peers, customer/ supplier*
Interactive services	Text and data	Query/ response	Peers, customer/ supplier
Graphics and design information	Graphics (with text and data)	File transfer	Peers, customer/ supplier

*Less important relationship.

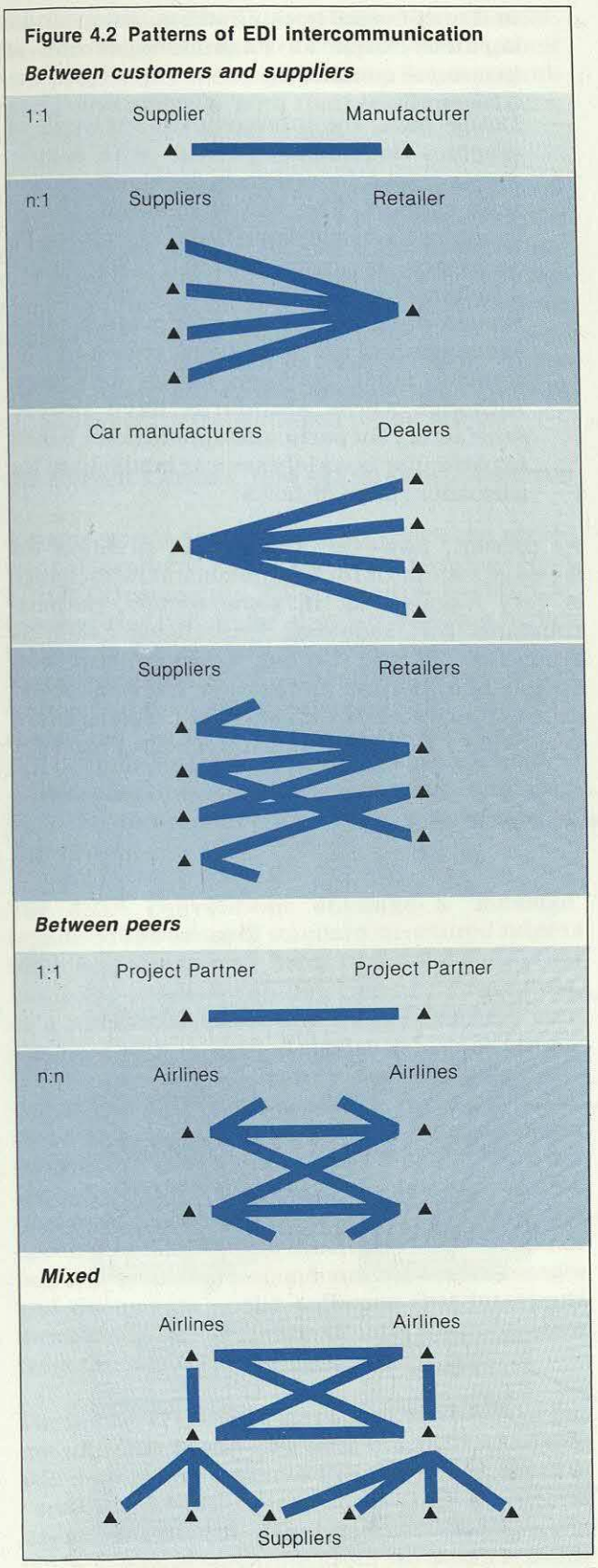
DATA INTERCHANGE REQUIREMENTS

In some EDI applications, files of data are transferred. In others, the data is transferred as store-and-forward messages. And sometimes the data is exchanged as the result of query/response interactions.

FILE-TRANSFER APPLICATIONS

In file-transfer applications of EDI, files of data, with a predefined content, are transferred between the two communicating parties, either over a direct link, across a network, or via magnetic media — normally tape. The files may be coded engineering drawings, payroll data, structured text, spreadsheets, and so forth. The structure and content of the files are agreed in advance between the communicating parties, and they are coded in ways that take advantage of their known structure and content. For example, the standards for coding

Figure 4.2 Patterns of EDI intercommunication



engineering drawings enable lines and the way they interconnect to be described economically; and specific meanings are defined for particular fields in payment instructions to an automated clearinghouse.

STORE-AND-FORWARD APPLICATIONS

Store-and-forward message transfer implies the sending of a message to the recipient's electronic mailbox; the recipient retrieves it by interrogating the mailbox. Many of the EDI applications regarded as most typical, for example the exchange of orders and invoices, and interbank financial messaging, involve store-and-forward message transfer, usually of messages whose structure is rigorously defined in advance.

QUERY/RESPONSE APPLICATIONS

Some types of EDI application require an almost immediate response to a query initiated by one of the parties. Examples are airline seat availability and booking services, quotation services provided by insurance companies for their agents, and online corporate cash-management services provided by banks for the treasury departments of their major customers. We refer to this type of EDI as query/response applications. A series of query/response interactions may take place, or the interaction may be followed by an instruction, as for example with a cash-management service when a request for a statement of current-account balances initiates the delivery of the statement, which is then followed by an instruction to transfer funds.

MESSAGE FORMATS AND CONTENT

Messages sent by one partner in an EDI arrangement need to be understood by the other. Decisions on the structure and content of messages, and on the processes by which they are re-created at the receiving end, have major implications for the feasibility of an EDI project. When a message such as an invoice is sent between two organisations, there are two options for ensuring that it is interpreted appropriately on receipt:

- It is processed on receipt in the same format as it is generated, which requires that a standard message format is agreed between the two parties.
- It is translated from the sender's format to the receiver's.

An additional complication arises when an organisation has EDI links with several different organisations. In this situation, there are two options, as shown in Figure 4.3 overleaf:

- Agree a standard format in which all messages are sent.
- Undertake different translations for each trading partner.

If EDI communications take place with only a few trading partners, the latter alternative may be more economic, or the organisations can agree to use the same internal systems. Standard message formats need to be agreed, however, when a large number of organisations are involved, and in particular where each of the trading partners in turn does business with several other organisations. Standard message formats reduce the number of translations that have to be carried out, and reduce costs by allowing standard interface software to be used instead of bespoke translation software. Message standards are therefore of vital importance in the development of EDI, because they allow many users to interact in a way that would not otherwise be practical.

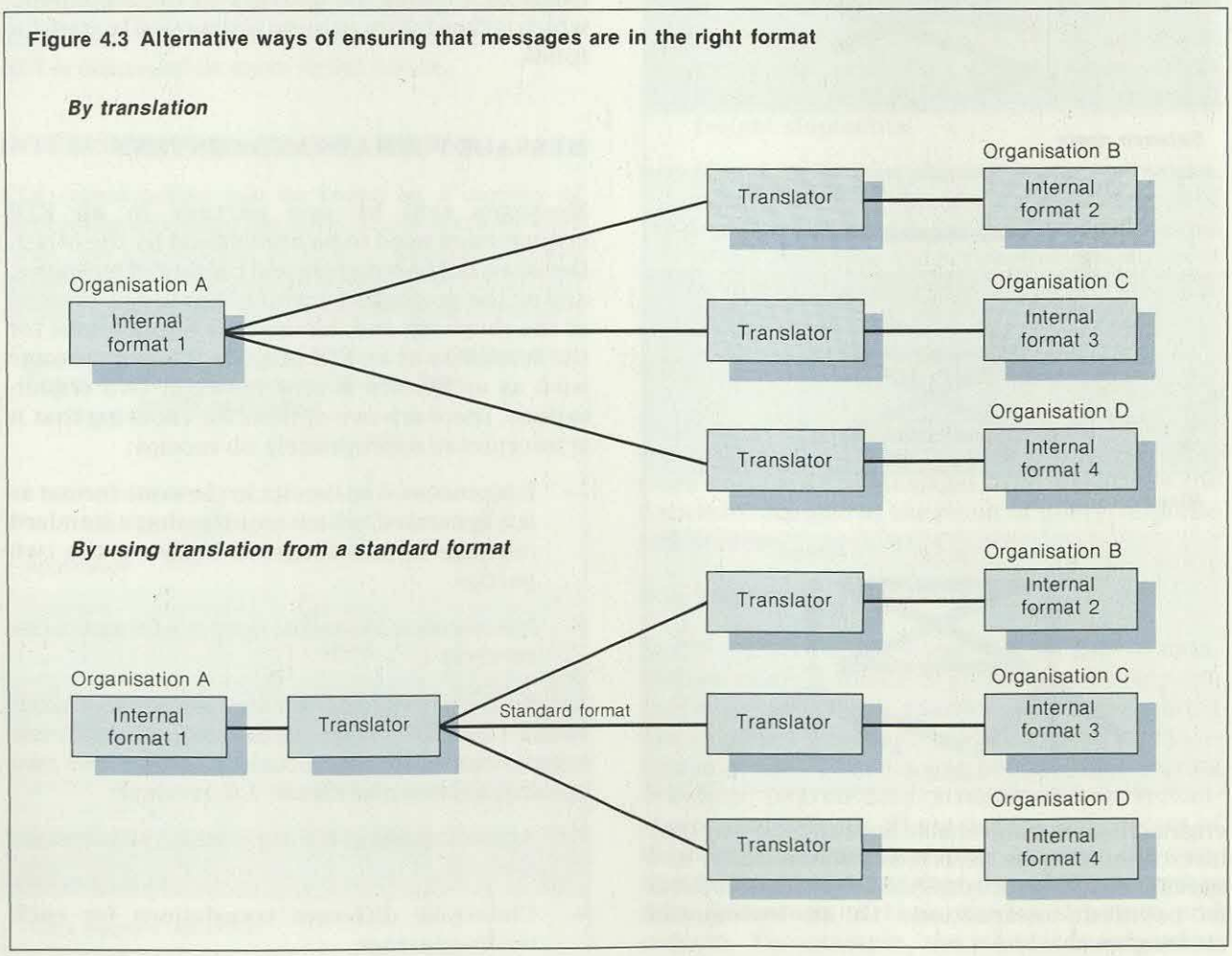
EDI STANDARDS ARE BEING AGREED

EDI standards have now been agreed for several types of document:

- Text documents: these include trading documents concerned with the movement of goods between companies, funds transfer instructions, communications between companies and customs and tax authorities, and specialist services such as cash-management or insurance quotations.
- Design data: the intercompany exchange of graphics documents, perhaps with supplementary text, for research, development, and sales support. The IGES3 standards (Initial Graphics Exchange Specification) from the US aerospace industry and SET (Standardes d'Echange et de Transfert), a proprietary French standard, are used for magnetic tape exchange and are now being tested in file-transfer mode between design databases. Although these standards have proved satisfactory for particular applications, IGES3 in particular is widely seen as inadequate for a broader range of tasks.

At present, however, the overall situation for message standards for text document interchange is very fragmented. In some sectors, national standards for trade-data interchange (such as Tradacoms in the United Kingdom) are well established. Other industries have adopted transnational standards; the SWIFT standards are very widely (although not universally) used for

Figure 4.3 Alternative ways of ensuring that messages are in the right format



international interbank messages. Nevertheless, there are many examples of companies using their own proprietary message formats for communicating electronically with their trading partners, especially in the United States.

EDI standards for electronic publishing (exchanging highly formatted material for newspapers, for the book trade, and for technical and promotional documents) are still at an early stage of development. At present, there are no specific standards agreements, but *de facto* standards have arisen, especially in areas such as laser printing, where documents are written in a language like Postscript or Interpress for transmission to the printer.

THE UNITED NATIONS JEDI STANDARDS INITIATIVE

A major recent development has been the agreement of standards within the United Nations Joint EDI (JEDI) committee. This committee has brought together the two major standards-setting bodies in the area, UNECE (UN Economic Commission for Europe) and ANSI X.12 in the United States, which were previously acting independently. The JEDI committee has agreed a structure and syntax for EDI documents for four prime business functions — ordering, transporting, invoicing, and paying. The basic conventions are summarised in Figure 4.4.

The JEDI conventions envisage a 'message' organised as a series of standard structured subsets (data segments) with fields (data elements) that may have controlled options (yes/no, for example, or a number representing the weight of a consignment with a specified maximum). An electronic 'envelope' and a means for setting up a transmission session are also necessary. The structured message may be checked for syntax and content errors by appropriate software before it is sent. At the receiving end, the message can be presented as a screen document by software that decodes and interprets the fields. There need not be a one-to-one correspondence between messages and documents — the software that interprets messages might generate 40 internal documents from ten messages, for example.

The impact of the JEDI agreement will be major but not uniform. In the long term the JEDI standards will do much to promote EDI. However, there is considerable uncertainty about their short-term impact. A first draft of the basic set of messages will not be available until the end of 1987, and it remains to be seen whether they will need further development before they can be implemented commercially. Moreover, the basic message set will not specify the complete range of documents needed by any one sector.

Figure 4.4 JEDI standards conventions

The basic conventions of the JEDI standards for intercompany trade involving movements of goods are:

- An electronic post bag, called the *connection,* with a number of *interchanges,* each of which could be an electronic envelope destined for a different recipient in a clearinghouse operation.
- Envelopes or interchanges consist of a header with the address details, followed by a *user-data* area and a *trailer control* segment.
- User data must be broken down into *functional groups* for North America, but not for Europe.
- Functional groups contain a series of *messages* consisting of *data segments.*
- Data segments are data sets containing the fields where *data elements* go, grouped functionally. Segments may be generic, that is, used in several message types, being tailored to a specific function by a *qualifier.* The data elements expected in a particular data segment type may be mandatory or conditional.
- Data elements are the parameters for each transaction — the basic contents of the message, which may be in any language. These are defined internationally in the UN Trade Data Element Dictionary (UN/TDED). Language translation is available via look-up tables.
- Format: the structure and layout of the data elements within the segment and the sequence of segments in the message. Format is defined in the JEDI norms by a message structure *branch diagram* that forms part of the message and precedes the message header. The data segment sequence is: heading area (refers to entire message); detail area (detail only — overrides header); summary area (totals and controls). The JEDI definitions provide for groups of functionally related segments to be concatenated; these are known as *loops.*
- Syntax: the rules for implementing the format and thus understanding the message. An agreed syntax was published by the JEDI working group in October 1986.
- Qualifiers provide specific meaning to a generic data element or data segment. For example, a data segment describing one of the trading partners may be qualified to indicate whether it is a carrier, buyer, seller, insurer, and so on.
- Codes: the message information must be represented in an agreed code, and it is expected that there will be a specific notation (six alphanumerics or four alphabetic characters, for example) for each field.

In countries and sectors where EDI standards have been defined but not yet implemented commercially, the proposed standards are likely to be modified to conform to the JEDI standards. Where EDI services working to different standards are already established, the impact of the JEDI standards will be more long term. Within the next five years most international trade-data interchange is likely to use the JEDI standards, but within national trading communities, the motivation to use JEDI standards will depend on

the importance of international trade. In the United Kingdom, for example, most suppliers of retailers are themselves UK-based, so there will be little pressure to switch from the established Tradacoms standards, and any change will only come about in the long term.

Even for international EDI, the JEDI standards will not replace well-established *de facto* standards immediately. SWIFT, for example, has developed a comprehensive and widely accepted set of message standards for international financial messaging. Although SWIFT will undoubtedly take note of the JEDI standards, and is pledged to following OSI standards for its new SWIFT 2 network, it is unlikely to adopt JEDI standards in the short term.

Despite the emergence of international EDI standards, there will be a continuing need to customise standards to suit the needs of particular sectors and to meet the needs of national trading practices. There will therefore be a continuing role for national and sector-specific EDI standards. The JEDI standards will specify a common syntax and common data elements, together with a basic subset of trans-sector messages, but the more specialist documents will have to be defined by the appropriate industry bodies.

MESSAGE STANDARDS WILL CHANGE OVER TIME

It is inevitable that message standards will change over time — in response to changes in statutory requirements, for example. Attempts to anticipate and act on standards such as the JEDI ones increase the risk of having to change the systems that process EDI messages, although the costs may be minimised if a constant structure, as in the JEDI proposals, is preserved.

There will also be a continuing requirement for translation between message formats. This will occur, for example, for occasional communications between trading communities using different standards, or as an interim measure until software changes are introduced. And in almost every organisation there will be a need to translate between internal and external document formats. In the long term, organisations should consider changing their internal document standards to match the external EDI standards. This is already happening in the banking community with SWIFT standards.

EDI SERVICE PROVIDERS

Where EDI takes place either by exchanging magnetic tapes or by direct communication links between senders and recipients of the data, arrangements for the communication are made directly between the two parties concerned. But where several senders and recipients of data are connected via a network, it is necessary for someone to be responsible for the operation of the EDI service and the network on which it is based. Three main types of suppliers operate EDI services:

- Independent value-added network (VAN) operators. Companies such as GEISCO, INS Ltd (the new UK-based joint venture between ICL and GEISCO), IBM, GSI (in France), and Istel (in the United Kingdom) offer a range of EDI services for a range of industrial sectors. These organisations are well placed to offer new EDI services because they already operate data networks that can be used for delivering the service, they have a base of existing customers, they have expertise in a wide range of applications, and they are geared to marketing new services.
- Industry bodies set up jointly by members of a particular industry or commercial sector to operate an EDI service. SWIFT and SITA are the most notable international examples. Some industry bodies define the service they require, and then request tenders from VAN operators for its provision. Organisations that have taken this approach include the German and UK Article Numbering Associations (with their SEDAS Daten and Tradanet services) and ODETTE, the industry body coordinating EDI in the European motor industry.
- Individual industry participants, or a consortium of industry participants. Industry participants are justifiably apprehensive about entrusting data interchange to an actual or potential competitor, but it has occurred in one or two instances, for example for airline seat reservations in the United States. Individual banks now provide international account-information exchange services, but only through independent subsidiaries. In other cases, several companies have formed a consortium to interchange data, often in competition with other similar consortia. ATM (automatic teller machine) and EFTPOS (point-of-sale) networks are the most prominent examples.

SECURITY CONSIDERATIONS

The level of security required for EDI varies considerably from one type of application to another. Some organisations will want to ensure that there is just about no likelihood of the electronic transmissions being intercepted (or interfered with) by anyone other than the intended recipient. The security measures

required to ensure this will increase the costs of an EDI service; costs that can be justified for the transfer of high-value funds may well be excessive for the transfer of ordinary commercial purchase orders. The user organisation needs to satisfy itself that the procedures are sound, that there are no weak links when the whole data interchange process is examined, and, most importantly, that the EDI service managers are security-conscious. Providers of EDI services are acutely aware of how critical security considerations are to the viability of their services.

There are three elements that need to be considered when assessing the security of an EDI implementation:

- The EDI communications link.
- The systems and procedures used for transmitting and receiving at each end of the link.
- Interactions, if any, between the EDI systems and existing in-house systems.

The security of each of these elements should be evaluated in terms of physical security, technical security, and contractual security.

The same general physical security arrangements should apply to EDI as to any other situation where security is required. Physical access to equipment should be controlled, access should be restricted to trusted personnel, and multiple-access authorisation should be used where appropriate. (This topic was discussed in some detail in Foundation Report 51 — Threats to Computer Systems.)

Access to the EDI service should also be regulated by technical features such as:

- Log-in procedures, requiring a terminal identifier and user password or authorisation code.
- Message authentication codes that indicate a message's point of entry into the network.
- Encryption, which is used for high-value, same-day funds transfers, but for very few other types of EDI application.
- Limit controls that specify, for example, the maximum permitted number or value of transactions.
- Logging of interactions to provide audit trails.
- Acknowledgement messages returned on receipt of a communication.
- Providing summaries of interactions, perhaps by a different communications channel. The UK BACS service for banking payments sends summaries of the number and total value of payments input to a predesignated recipient, together with other details as required. The payer receives the summary before the payment is cleared.

Where the EDI service is provided by a third party the service contract should protect the user organisation against the financial consequences of breaches in security for which the service provider is responsible.

TECHNOLOGIES USED FOR EDI

The technology used for EDI depends on the type of EDI concerned:

- Trade-data interchange can be implemented as an application on a personal computer or mainframe system, depending on the volume of data to be handled. Communication is via a dial-up connection on the public-switched telephone network or via a leased line, depending on the volume of traffic.
- A similar approach is often taken for interactive applications, although many airline reservation services are hosted on large mainframe systems and are accessed from IBM 3270s or other dumb terminals.
- Electronic funds transfer applications require high levels of security, and in many cases they require special terminals as well, for example automated teller machines (ATMs), and point-of-sale (EFTPOS) or SWIFT terminals. In other cases (corporate payments services, for example), the operating procedures provide the necessary degree of security, and conventional terminals such as PCs can be used. In almost all cases, communication takes place over private networks, although some payment services permit dial-up access. Moreover, exchanging data via magnetic tape is usual where large volumes of regular payments (the payroll, for example) are handled. Magnetic tape is also used for the exchange of graphics and design information, which usually originates from computer-aided design systems.

Decisions therefore have to be made about the networking arrangements that will be required and the computer hardware and software that will be used.

NETWORKING ARRANGEMENTS

The three main approaches to EDI networking are:

- To install leased lines between the organisation and each of its trading partners.
- To use the dial-up public network.

— To use the services of a third-party supplier, often a value-added network (VAN) operator, or a cooperative organisation set up to meet the EDI requirements of a particular industry.

In those countries where the use of EDI is growing fastest, the last approach (a VAN operator) is often the most popular option. However, in some countries, the present regulations prohibit third-party network operators, which means that some organisations are obliged to use leased lines. Where videotex services are well established, as in France, they are used to provide EDI-like services as well.

Several companies have implemented extensive EDI networks using dial-up connections, however. One example is K-Mart, the second largest retailer in the United States (see Figure 1.2). A major European car manufacturer has also based its EDI links with its suppliers and dealers on dial-up connections, but plans to implement its own international X.25 network for EDI.

The major EDI networking problems at present stem from setting up communications between different types of computer systems, either directly between users or in interfacing with a public EDI service. The difficulty arises from the different interpretation of the same protocol standards by different suppliers, in particular for mainframe connections. In countries where public X.25 services are well established, these may be used for EDI links because the network itself overcomes the incompatibility problems.

Most public EDI networks, whether provided by a cooperative organisation for a particular industry or a third-party supplier, offer a wide range of options for access to the network. The most common low-level communications protocols offered are IBM's 2780, 3780, and 3270 protocols, Teletype, videotex, and X.25. A range of transmission rates is usually supported as well. Access to the network may be via a leased line or by dial-up circuit. Those organisations who are concerned about the security of their EDI communications will usually prefer to use leased-line connections to the EDI network. Most EDI networks are based on one of the well-known proprietary network architectures (usually SNA or DECnet). OSI protocols are unlikely to provide a viable alternative for the foreseeable future, particularly for file-transfer applications. File-transfer OSI standards will not be agreed until 1988, and it remains to be seen whether they will then form a suitable basis for commercial products.

At present, prospective EDI users are fortunate if there is one third-party network that supports their EDI application. Sector-specific EDI services are broadening their coverage to adjoining sectors and new applications, however, and competing third-party VAN operators are entering the marketplace. Competitive survival will in some, but not all, cases require the service operators to provide gateways to other networks. This has already occurred with competing EFT networks in several countries (France and Belgium, for example) and is anticipated in other sectors, such as trade-data interchange for the motor industry in the United Kingdom.

In addition, the PTTs in most European countries will be launching X.400 public messaging services. Almost all of these will provide EDI facilities. As a consequence, in five years' time there is likely to be a wide choice of store-and-forward messaging services that can be used to support trade-data interchange, provided, of course, that the telecommunications regulations permit competition.

COMPUTER SYSTEMS

The type of computer system used for EDI depends on the type of EDI application and the networking approach chosen. The types of system used to interface to the main types of EDI are shown in Figure 4.5.

Organisations using third-party trade-data interchange services usually access them from PCs or connect their mainframes to the service. However, where direct links to a substantial number of trading partners are required (a large retailer or manufacturer communicating with its suppliers, for example), it is more usual for the EDI communications to be handled by a separate minicomputer or fault-tolerant system that provides the interface to internal systems. This arrangement is also used for interactive services, such as the cash-management services offered by banks to their corporate clients.

The additional security requirements of electronic-funds-transfer EDI services place special constraints on the computer systems used. Some services (CHAPS, for example) require special terminals based on powerful microcomputers because of the security algorithms used. In other

Figure 4.5 Systems used to interface with the main types of EDI

Type of EDI	Systems
Trade-data interchange	Mainframes, minicomputers, PCs
Electronic funds transfer	Mainframes, fault-tolerant systems, PCs, specialist terminals
Interactive	PCs
Graphics	CAD, CAM systems

cases, however, where security can be assured in other ways (by limiting the set of potential payees, for instance), the choice of computer system is less constrained.

Several organisations have found PCs to be more convenient for trade-data interchange than interfacing mainframes directly to communications links. One organisation started its EDI by using remote job entry for intercomputer file transfers with its suppliers, with the connection being made via dial-up modems. However, the process of adding new suppliers was very slow because of the different types of computer system that had to be connected. Standardising on PCs has enabled this organisation to connect additional suppliers much more quickly.

Another organisation has found that using a PC as a front-end processor to handle EDI communications enabled it to isolate EDI from its mainframe operations. Changes to the EDI software are therefore easier and less expensive because they do not affect the mainframe systems.

Our research shows that PCs are a good vehicle for early implementations of EDI and for gaining experience. Their main disadvantage is their capacity limitations, especially when they are used as a front-end gateway (and document translator) for mainframe systems. Full-scale EDI implementations, involving links to perhaps hundreds of organisations, will require more powerful equipment, such as a superminicomputer.

SOFTWARE

The software needed to support EDI applications has three main components:

- Translation software. This is the key piece of EDI software, taking information from a file and using it to construct messages in a standard format, and vice versa. Standard translation software is available for a wide variety of computer systems. In Europe, 'Interbridge', developed by SITPRO in the United Kingdom, is widely used, and in the United States several standard packages are available. These packages do not meet all needs, however, and the alternative is to have custom software written. Standard packages are, of course, far cheaper than custom software.
- Communications software to provide the interface with the chosen protocol.
- Control software to provide run-control and security procedures for message sending and receiving. Software to print reports may also be required.

In addition, it may be necessary to create interface files that can receive data from, or input data to, existing applications in a suitable format. In some cases, existing applications may have to be modified to take advantage of the efficiencies of EDI.

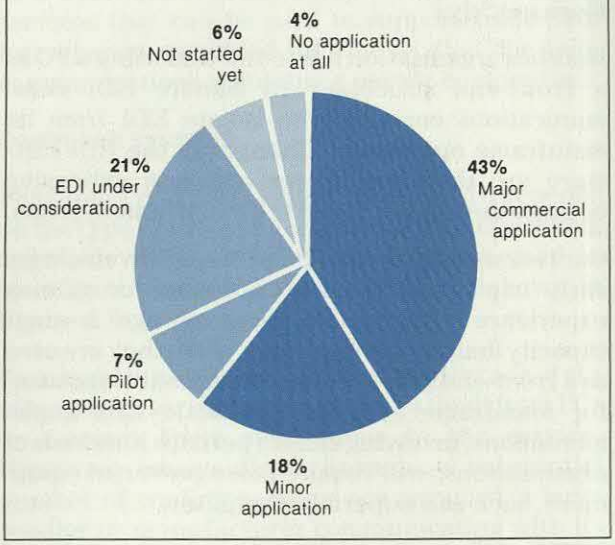
Having described the characteristics of EDI, we now turn our attention to the ways in which the use of EDI is increasing and spreading. You need to be aware of how EDI is currently being used in your sector and how it will develop. In the following pages, we review the present state of EDI in the various sectors and countries, and its likely development.

Chapter 5

The use of EDI is increasing and is spreading to new business sectors

The business impact of EDI can be considerable. The threats from EDI, and the opportunities it offers, depend on the use that the organisation's business sector currently makes of EDI, and on the likely rate of development of EDI in that sector. It is therefore necessary to understand the current status of EDI, and the speed with which it will spread, before considering how EDI might affect your organisation. We now provide the basis for that understanding by describing the status of EDI in different business sectors and countries and assessing the likely developments in EDI over the next five years.

Figure 5.1 Extent of EDI use among Foundation members



THE USE OF EDI IS INCREASING

The use of EDI is increasing, but the current level of use and rate of increase depends on the type of application, the business sector, and the country.

CURRENT LEVEL OF USE

Our research showed that the use of EDI is now well established, at least among larger organisations. Nearly half the Foundation members who responded to our questionnaire use EDI for at least one major commercial application, as can be seen from Figure 5.1.

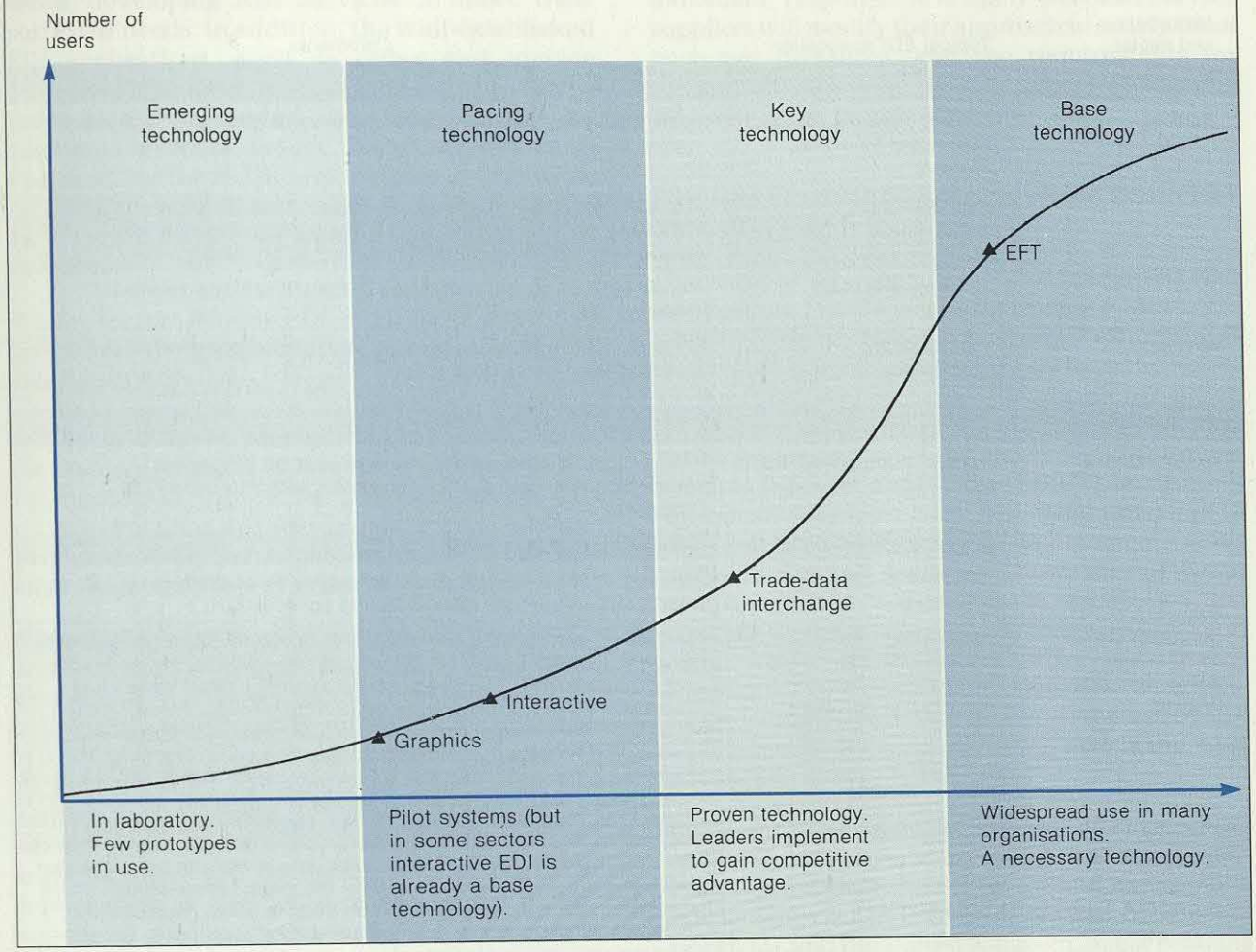
In most cases, the most important EDI application concerns the transfer of payments (EFT). The other three types of application are not so well developed. Indeed, the four types of EDI we have identified are at very different stages of maturity, measured in terms of the number of users (see Figure 5.2). For many organisations EFT is already regarded as a base technology. Trade-data interchange is quite widespread and is a key technology for competition in some businesses, whereas the electronic interchange of graphics information is still an embryonic application. It occurs in a few instances between members of aerospace consortia and between car manufacturers and their suppliers; there are few examples outside these sectors. One interactive EDI application, airline seat information and reservation services, is very well developed, although some of the largest systems use file-transfer technology and are not truly interactive. Elsewhere, the use of personal computers to interface to interactive services has developed in only a few markets, for example corporate cash-management services and insurance quotations; most of these EDI applications are small and undeveloped, and many of the services concerned are still at the pilot stage.

GROWTH IN EDI USE

The use of EDI is increasing rapidly. In applications where it is well established, such as airline seat reservations and EFT, it is showing continued growth. SITA, for example, is experiencing 30 per cent growth per year in the volume of messages that it handles. And SWIFT increased its number of users by 11 per cent and the volume of messages handled by 23 per cent in the last year.

In areas where EDI is less well established, the growth has been even more spectacular. In the United Kingdom, online trade-data interchange services were started two years ago by two VAN operators, ISTEL and ICL; there are now more than 500 users of the services, and ICL reported a 77 per cent growth in the user base during the three months prior to our interview. Reuters reports an overall growth in its services of between 25 and 30

Figure 5.2 Maturity of different types of EDI



per cent (although not all the services can be classed as EDI), and 100 per cent growth in its dealing services. Over the last two years there has also been a proliferation of pilot EDI activities in many countries and industrial sectors.

One multinational now piloting EDI believes that a third of its business will be handled in this way in three years' time; another now handling less than 5 per cent of its purchase orders and sales invoices electronically expects the proportion to rise to 40 per cent in two years' time. One car manufacturer now using EDI to communicate with 15 suppliers expects to connect to a further 50 to 100 suppliers in each of the next two years, and intends in five years' time to be handling electronically the majority of its transactions with between 70 and 80 per cent of the companies it deals with.

Results of our survey of Foundation members confirm that a lot of new activity in EDI is imminent. Nearly a quarter of the respondents are actively planning or conducting a pilot EDI application, and nearly a half have one or more new applications under consideration. Even if only a fraction of these projects progress to full implementation, they will represent a major increase in EDI activity.

The implication of these high growth rates is that organisations need to move quickly if they are to keep up with EDI developments in their sector. Those who delay may well be surrendering to their competitors any competitive advantage opportunities available from using EDI.

For some industries (banking and airlines, for example), EDI is already a base technology. For others, it is not yet as mature, as Figure 5.3 overleaf shows, but the list of industries and business sectors for which EDI is now an emerging or pacing technology is growing all the time. Figure 5.3 describes typical EDI applications for a range of business sectors and indicates the stage of development that EDI has reached in each of the sectors.

In some sectors, the volume of EDI communications is now very large. Volkswagen, for example, exchanges 0.5 gigabytes of data each day with its trading partners.

Many EDI initiatives, and many of the developments described in Figure 5.3, were started

Figure 5.3 Maturity of EDI in different business sectors

Maturity and sector	Typical EDI application	Comments
Base technology		
Banking	CHAPS (Clearing House Automated Payments System)	UK electronic clearinghouse for high-value payments; it processed 42% of all such payments in 1986.
	Corporate cash management	Usually provided as videotex services, but there are now 2,000 treasury workstations installed in large companies in Europe, which allows the cash-management services to be used for EDI.
	Currency and bond dealing	Over 50% of such transactions in the UK are now handled electronically
Airlines	Seat and cargo reservations	There are now some one million terminals worldwide that can access the reservation networks.
Key technology		
Motor Industry	Transfer of purchase orders and	Up to 25% of transactions are now sent by EDI. Some manufacturers have EDI arrangements with more than 100 suppliers.
	Parts and vehicle ordering	Dealers place their orders via EDI.
	Components delivery scheduling	General Motors sends delivery schedules to its carriers via EDI as part of its just-in-time manufacturing scheduling.
Consumer goods manufacture, distribution, and retailing	Exchange of orders, invoices, and other trade information between retailers and suppliers	In the UK, some retailers despatch and receive 50% of their orders and invoices electronically. More than 200 companies now use the UK Tradanet service, exchanging up to 30% of their orders and invoices. In France, more than 200 companies use the GENCOD standards to exchange orders on magnetic tape and floppy discs, and a pilot online scheme has also been set up. In Germany, 16 manufacturers and seven wholesalers are using the SEDAS standards to exchange data electronically. In Sweden, 52 wholesalers and 82 retailers are connected to DAKOM, an online mailbox service.
Aerospace	Exchange of design information generated by CAD systems	For new projects, 100% of geometric data is likely to be exchanged electronically. Most transfers are via magnetic tape, although online communications are beginning to be used to avoid postal delays. 50% of structured alphanumeric data will be exchanged electronically in five years' time.
	Airlines ordering spare parts	Orders are placed via the SITA network.
Pacing technology		
Engineering	Order of supplies	All five major firms of toolmakers supplying the engineering industry in the West Midlands in the UK now accept orders via EDI.
Import/export	Transfer of customers' information	The UK Direct Trader Input system allows freight forwarders to send information about shipments to the customs' computer systems. 70% of import declarations and 10% of export declarations are now made in this way for the 25 largest ports and airports. A similar development is under way in France (the CADDIA project, headed by STERIA).
	Exchange of shipping information between importers and exporters	Two pilot applications are under way in the United Kingdom — DISH, using the Tradanet network, and SHIPNET, using IBM's Managed Network Service.
Insurance	Quotation services	Often provided by VAN operators, although some are based on videotex. Most use PCs to provide an interactive EDI application, but the ICL Brokernet service uses Tradanet to connect five insurance companies with about 600 brokers.
Chemicals	Manufacturer/customer links	Some European chemical manufacturers have set up EDI links with their customers.
Transport	Placing of orders	In France, DISTRI +, a major videotex-based service concerned with the transport and distribution of goods, will soon be accepting input from clients' computer systems.
Emerging technology		
Construction, energy, travel, public sector	Various	Individual organisations in each of these sectors are beginning to develop EDI links with their trading or business partners.

within the last year by organisations in a particular sector developing EDI services to meet their particular needs. In addition, the well-established EDI applications, such as order and invoice transmission and the communication of payment instructions, are being used increasingly by additional business sectors. For example, British Coal and 13 of the 15 UK regional electricity boards recently initiated programmes to implement EDI for the transmission of purchase orders to their suppliers.

Within sectors where EDI is already used, it is spreading to new applications, sometimes by using existing services in new ways — using an automated clearinghouse service for transferring instructions for payments to suppliers as well as for the payroll, for example, or using a trade-data interchange link for invoices as well as for purchase orders. EDI service providers are also expanding the facilities they offer: SWIFT now has standards defined for more than 80 different types of message.

More significantly, experience of one type of EDI is often followed by implementation of other types. Companies that use an EFT service are beginning to use other types of EDI, although in many cases it is not apparent that there is an obvious transfer of experience. And when one EDI application central to the business is developed, there is a tendency to look for others. For example, vehicle manufacturers are beginning to transfer design information as well as purchase orders to their suppliers, and aircraft manufacturers, having started by transferring the output from computer-aided design systems, are now implementing systems to allow airlines to order spares, systems to update alphanumeric indexes of design modifications, and other applications as well.

The use of interactive EDI services is likely to increase faster than other types of service, albeit from a currently low base. Simple information and transaction services will increasingly be offered in EDI form. For example, financial-information and treasury cash-management services that were designed originally to display information at a dumb terminal now allow data to be downloaded to a PC, and the trend towards providing information in a form in which it can be manipulated will continue.

At present, many organisations prefer to use store-and-forward EDI rather than query/response technology because of concern that interactive working may compromise the security of their internal systems. Nevertheless, in many cases where EDI services operate as simple store-and-forward message applications today, customers would like additional facilities that require a more interactive approach. Thus, once an order has been input electronically, customers would like to be able to enquire about its progress and to receive an immediate response. It is likely that EDI service suppliers will modify their approach to satisfy these customer pressures, and the requirements for interaction are now being considered at the planning stage of new services.

EDI DEVELOPMENTS VARY FROM COUNTRY TO COUNTRY

The stage of development of EDI (excluding EFT applications) varies markedly from one country to another. The key factor underlying the differences between countries usually appears to be the extent of deregulation of the telecommunications market. Thus, in the United Kingdom most EDI communications use one of the clearinghouse services (such as Tradanet and ISTEL's EDICT), but in other European countries most EDI communication to date has been over direct links between trading partners. Figure 5.4 overleaf shows the number of companies in the consumer goods, distribution, and retailing sector using online EDI services in several countries, to illustrate the differences in the adoption of EDI in different countries. Whilst the United States is the clear leader in the use of EDI in this sector, Sweden (given its size) is the most advanced country in Europe.

In the more advanced countries, most purchase orders and invoices between the consumer goods retailing and distribution sector and its suppliers will be sent via EDI in five years' time. In Sweden, Germany, and the United Kingdom, major retailing companies are expected to be sending and receiving 80 per cent of orders and invoices electronically by 1992. In France and Italy, however, the proportion is not likely to reach 50 per cent until later.

UNITED STATES

In the United States, the use of EDI is now well developed in several business sectors, especially in retailing and distribution, the motor industry, transport, and chemicals.

Until recently, however, these 'islands' of EDI worked to different standards, and this lack of common standards has slowed the take-up of the technology. Several VAN operators, notably McDonnell-Douglas, IBM, GE, and AT&T, offer EDI services.

UNITED KINGDOM

The EDI market in the United Kingdom has expanded very rapidly during the last two years, largely due to the activities of two EDI network service suppliers, ICL and ISTEL, who between them now have more than 500 users. ICL was commissioned by the UK Article Numbering

Figure 5.4 Number of companies in the consumer goods manufacture, distribution, and retailing sector using trade-data interchange services varies by country

Country	Number of users
United States	2,000+
United Kingdom	215
Sweden	134
Germany	23
France	12
Belgium	6

(Source: First National Bank of Chicago)

Association to develop an electronic clearinghouse service using the ANA's Tradacoms standards; ISTEL originally provided a service just to motor-industry suppliers. Both service suppliers now offer a general EDI service.

FRANCE

France leads the rest of the world in the implementation of EFTPOS and videotex services, two technologies closely related to EDI. Videotex in particular is used to provide services that in other countries are provided as EDI applications (cash-management services and reservation services for the leisure and travel sector, for example). The retail, automotive, and aerospace sectors are well advanced with the development of EDI over direct links, but the reluctance of the government and the PTT to allow third-party suppliers to offer EDI VAN services capable of serving a range of sectors has hindered the development of a broader market.

GERMANY

In Germany, several car manufacturers have developed extensive EDI networks to provide direct links to their suppliers. In general, however, the market has been inhibited by the restrictive regulatory attitude to VAN services.

REST OF EUROPE

In Italy, there has been little EDI activity to date. The PTT is not encouraging the growth of EDI, and the streamlining of procedures and staff reductions that are among the main benefits of EDI seem to be given a lower priority in Italy than elsewhere. There are several EDI initiatives in Scandinavia and the Benelux countries, however. EDI is well-developed in the retail and distribution sector in Sweden, and several services have been proposed or launched in the Netherlands. Elsewhere in Europe pilot trials have taken place, and individual large companies have set up EDI links with their trading partners.

REST OF THE WORLD

There has been considerable interest in EDI in Australia and the Far East, but little activity to date other than in international services.

INTERNATIONAL SERVICES

Some of the most important and longest-established applications of EDI to date have been international services (SWIFT and SITA in particular). There are no other comparable worldwide services, although some of the other bank networks that exchange balance and other information about bank accounts at the customer's request have wide coverage. Within Europe, however, a number of trans-national initiatives are under way, notably ODETTE for communications between motor manufacturers and their suppliers. A number of VAN operators serving the EDI market, in particular GEISCO and IBM, operate international networks and services.

THE USE OF EDI WILL BECOME WIDESPREAD IN THE NEXT FIVE YEARS

The use of EDI is set to grow substantially in the next five years, with several major factors promoting its development. But there are also a number of inhibiting factors. You need to consider how both types of factor will affect the rate at which the use of EDI will spread.

FACTORS DRIVING THE GROWTH OF EDI

The main factors helping to promote the use of EDI are the increasing use of information technology, the progress that is being made in setting message standards, the availability of inexpensive software packages, the growth in the use of EDI services (which fuels the growth of the market for such services), and the activities of the VAN service operators.

The increasing use of information technology

The computerisation of internal systems has increased the potential benefits of introducing EDI. Often, an organisation's computer systems generate data that has to be processed by another organisation's computers, and vice versa. As a consequence, the major bottleneck in the production process is often poor communications with other companies. Just-in-time manufacturing, for example, requires faster and more reliable communications with suppliers than conventional manufacturing. The use of computer-aided design systems makes the manual re-entry of designs when they are transferred to other organisations working on the same project an obvious source of inefficiency, and causes project partners to look at the transfer of the data in electronic form. The use

of point-of-sale (POS) systems to capture stock information in retail outlets makes possible the direct generation and communication of orders to suppliers. The spread of personal computers has also ensured the widespread availability of computer systems suitable for many EDI applications.

Progress in setting message standards
Progress in setting message standards has in many cases eliminated the costs and problems associated with translating incompatible message formats. For example, a 'Single Administrative Document' is being developed by the EEC. This document will satisfy the requirements of export and import customs regulations, the enterprises sending and receiving the goods, and their agents. A physical document will accompany the goods, but its contents will be forwarded electronically. In the chemical industry, industry bodies are coordinating the development of European message standards (CEFIC), and national standards are being developed in Germany. Similar international developments are under way in the electronic components industry (EDIFICE).

Standard software packages
Standard message formats open the way for inexpensive standard software packages. The availability of cheap standard software packages for interfacing internal applications to EDI services will remove a major source of cost and difficulty. At present, the only widely used EDI software package in Europe is SITPRO's Interbridge.

The growth and development of the market
The use of EDI services has promoted further growth and development in the market for such services. For example, if an organisation's competitors use EDI to provide a better service to customers, that organisation has a powerful reason for using EDI. Also, pressure from trading partners can be a major factor in deciding to use EDI. Some organisations have found that their trading partners insist on using EDI communications, especially in situations termed 'trading clusters'. Here a large company has many smaller companies dependent on it, and a decision by the large company to use EDI will require its trading partners to follow suit. This is occurring, for example, with large retailers and their suppliers, and in the motor industry, where both suppliers and dealers are dependent on the major manufacturers.

In many cases, the benefits from using EDI depend on the proportion of interactions with trading partners that a company can convert to electronic form. Where one side of the partnership is not sufficiently powerful to dictate to the other, the decision to use EDI will often depend on the proportion of trading partners willing to make use of EDI facilities. Thus, there is a critical-mass effect: few organisations are willing to use EDI initially because they cannot use it for communications with most of their trading partners, but once a certain proportion of companies are using EDI it is inevitable that many others will do so.

Activities of VAN service operators
The suppliers of EDI services, whether sector-specific such as SWIFT or more general ones such as ICL and ISTEL in the United Kingdom, have been very influential in raising awareness of the benefits of EDI. They provide practical advice on implementation and provide the service in a form that is relatively easy to implement.

INHIBITING FACTORS

There are, however, still some major factors inhibiting the wider use of EDI, in particular the telecommunications regulatory environment, the lack of awareness about EDI and its benefits, the lack of message standards for some application areas, the shortage of skilled computing staff and money, technical connection problems, and a host of other problems that may be of concern to particular organisations.

The regulatory environment
The telecommunications regulatory environment in many countries, particularly in Europe, is not favourable for the widespread use of EDI. Either the provision of value-added services other than by the PTT is discouraged or forbidden, or specialised services for a particular industrial sector are permitted, but more generalised EDI services of the kind that have been central to the rapid growth of EDI in the United States and United Kingdom are forbidden.

Lack of awareness
There is still widespread lack of awareness of the commercial benefits of EDI, especially among senior management. Where company boards have become aware of the potential of EDI and its importance, they know that it is their responsibility to make decisions about using EDI, but they have postponed any decisions until they understand the implications of the technology better.

Lack of message standards
There is a lack of message standards for some areas of application, and for others the confused standards scene and apparent multiplicity of standards discourages potential users.

Competition for resources
In many organisations, EDI applications requirements have to compete for the scarce resources of skilled computing staff and money with other commercially important systems requirements.

Technical connection problems

Some potential users are still encountering technical problems in establishing network connections and making them work, and in a few cases EDI applications have not been wholly successful because of these technical connection problems. Most of the problems occur when attempts are made to interconnect computer systems from different suppliers.

Other problems

Some organisations have particular concerns about using EDI services, and these concerns are also holding back the development of EDI in particular cases. The problems include:

- Concern about the possible lack of security of EDI services.
- Disputes between trading partners about who pays what. These have seriously delayed some types of EDI, in particular between banks and their customers and between retailers and their suppliers.
- Difficulties with the legal status of EDI communications.
- Language differences in international communications.
- Political factors, particularly with regard to standardisation issues, the use of foreign service suppliers, and perceived threats to jobs.
- Conservative user attitudes, in particular where EDI threatens to change the structure of a market.
- Internal systems, either where they are unable to interface to EDI services effectively, or where questions of security arise with external access.
- Concern about an adverse affect on cash flow because EDI speeds up payments to suppliers.

Despite these inhibiting factors, the use of EDI will grow considerably over the next five years. The growth will vary, however, depending on country, business sector, and area of application. The growing use of EDI means that any organisation that has not yet devised an action plan for EDI should do so now.

Chapter 6

Action plan for implementing EDI

Although there are many business sectors where EDI has not yet been introduced, and although in many cases the technology is not yet ready for widespread commercial use, it is important that Foundation members develop an action plan for EDI. Once EDI is introduced on a commercial scale, its impact on a sector can be immediate and its spread may be very rapid. Unless an organisation has prepared itself in advance for the introduction of EDI, it may not be able to react quickly enough once EDI becomes essential.

The first action is to assess the commercial implications of EDI for the organisation, identifying both the threats that might arise if other organisations adopt EDI and the opportunities that EDI might provide for gaining commercial benefits. Once the threats and opportunities have been identified, the most suitable approach for the introduction of EDI can be determined, culminating in drawing up a shortlist of promising applications and setting strategic objectives. In most cases there will be a window of opportunity for implementing EDI, which needs to be identified. Decisions about message standards will have to be made, and some internal preparation for EDI — changes to the existing systems infrastructure, for example — may be necessary before EDI can be implemented. These changes must be made before EDI overtakes the business.

ASSESS THREATS FROM EDI

In assessing the threats from EDI it is necessary to consider how using EDI might provide existing competitors with a commercial advantage. The best way of doing this is to identify the main basis of competition in the marketplace. Is it price, customer service, design, quality, something else, or a combination of factors? You then need to identify the ways in which a competitor could gain an advantage in this area by using EDI. It is also necessary to consider how EDI might let new entrants into the market.

The main questions to ask are:

- Could EDI enable your suppliers to bypass you and sell direct to your customers?
- Could EDI enable your customers to provide for themselves the goods or services they currently buy from you?
- Could EDI enable suppliers in related markets to compete in yours?
- Could EDI allow completely new players to enter your market? For example, EDI might remove geographical barriers to entering the market, allowing foreign suppliers in; or it might remove resources barriers, enabling small, start-up companies to compete; or it might allow EDI service suppliers to compete in your marketplace.

IDENTIFY OPPORTUNITIES PRESENTED BY EDI

Having identified the threats from EDI, it is then necessary to identify the possible opportunities presented by EDI. The process of identifying opportunities is, in many respects, similar to that of identifying threats. The main questions to ask are:

- Could EDI allow your organisation to cut out middlemen in dealing with customers and suppliers?
- Could EDI allow you to sell your existing goods or services in new ways and in new regions?
- Could EDI allow you to provide new services to your existing customers?
- Could EDI allow you to compete in new markets?

EDI can also be of benefit by reducing the costs of existing business operations and making them more efficient. There are four main areas where EDI can be used in this way:

- Where the volumes of structured messages (or structured information) exchanged with other organisations are high. This situation may arise where messages are sent very frequently (or where there would be an advantage in sending them very frequently, but current methods

preclude it); where messages have to be sent to very large numbers of different organisations; or where large numbers of similar items have to be sent at the same time. The last situation occurs when payment instructions for salary payments are sent to a clearing-house, or when large numbers of engineering drawings generated by a computer-aided design system have to be sent to another member of a project consortium.

- Where speed and accuracy of communication are important, and when it is important to know precisely when the data is delivered. These features are particularly important for financial data.
- Where the recipients of communications are remote (even in other countries). EDI can help overcome some of the problems posed for trade in general, and for paper communications in particular, by distance and by political boundaries. The speed of electronic communication is independent of distance, although there is less chance of being able to connect to some of the more remote locations. The documentation required for international trade is considerably more complex than that required for national trade. EDI can be particularly advantageous in overcoming the documentation barriers to international trade, but additional types of EDI services will be required besides those within individual countries.
- Where several organisations need to process the same data. This situation is likely to occur where goods flow through several organisations in a supply chain. The export of goods through freight-forwarding agents and customs is a typical example. EDI can be particularly advantageous for this type of communication.

Having considered possible applications in each of the areas, a priority list of applications can be drawn up. The highest-priority applications should concern the major threats and opportunities identified. Applications providing operational benefits can be prioritised according to the type and size of benefit (reduced document-processing costs, reduced inventory, improved cash flow, and so on). Situations where external communications are the barrier to the introduction of improved internal systems, such as just-in-time manufacturing, or where they have become the bottleneck after the introduction of improved internal systems, will also be priority targets.

INDIVIDUAL INITIATIVE OR COLLECTIVE APPROACH?

An organisation wishing to implement EDI can either take an individual initiative in setting up a service with its trading partners, or it can participate in a collective industry-wide scheme. The choice of approach is very closely tied to the organisation's commercial reasons for using EDI. If it is seeking to gain a competitive advantage, it will have to take the initiative in providing an EDI service for its industry. The two approaches may not be mutually exclusive, however, because it may be practical for an organisation to set up its own EDI links in the short term, but to participate in the development of an industry-wide solution for the longer term.

The key questions to answer in deciding whether to take an individual initiative are:

- Is there a commercial benefit to be gained? This may take the form either of a competitive advantage, or of obtaining benefits earlier than if the organisation waited for an industry-wide solution.
- Will trading partners cooperate?
- Can the service be implemented? Does the organisation possess sufficient expertise and resources to set up the appropriate data interchange links?
- Can EDI be implemented in a timescale that makes the initiative worthwhile?

A collective industry-wide approach may be attractive if:

- It will cost less and provide more universal intercommunication than would otherwise be possible.
- It is likely to have a fundamental effect on market structure, and hence adversely affect the organisation's market share and sales revenues if it did not participate.

The choice of approach depends on how important the organisation believes EDI is for its future, and on its relationship with its trading partners. Few organisations can, or wish to, dictate to their trading partners, and in many cases they are not well placed even to sell the concept of EDI to them. The ability of the organisation to take a lead in setting up EDI links, in terms of resources and know-how, will also be important.

Trading partners may, of course, take their own EDI initiatives and try to recruit others for their EDI scheme. Organisations should judge these approaches in the light of their own strategy for EDI.

USE DIRECT LINKS OR SUBSCRIBE TO A NETWORK SERVICE?

There are two main options for establishing EDI links:

- Set up direct links with trading partners, either online or by exchanging magnetic tapes.

- Subscribe to a network service operated by a third party. This may be a VAN operator, a joint organisation set up by members of the industry to provide the service, or a combination of these. In some cases, industry bodies (such as the UK Article Numbering Association) have developed a specification for a service and have asked VAN service operators to tender for providing the service. In the future, the PTTs will also have a role as service operators.

The main factors governing the choice between setting up direct links and subscribing to a network service for online working are:

- Relative costs.
- Service availability. An appropriate network service is not always available.
- Type of service provided. Different trading partners may use different systems requiring different interfaces to the service.
- Acceptability of the different options to trading partners.
- Service coverage. The geographic regions in which the service is available should match the location of trading partners.
- Control. Many companies believe that running their own EDI links is vital to their effective control over these operations. There are obvious dangers in being reliant on a third-party supplier who could raise the tariffs at will, or of being locked into a service provided by a trading partner. Cooperative industry bodies are not seen as threatening in this respect, and, at least in some countries, the PTT is also seen as benevolent and supportive. The PTT will, of course, have to provide the physical link for online communications in almost every case.
- Resources. Using direct links requires greater internal resources and expertise to operate the network service and to provide support for the trading partners using it.
- Security, confidentiality, and integrity. Organisations may not find all networking options equally convincing in these respects, but circumstances will again determine which alternative is more acceptable.

DETERMINE WHEN TO IMPLEMENT EDI

A window of opportunity is likely to exist for implementing EDI to maximum advantage. Prior to the window, implementation of EDI may be impossible because of regulatory constraints on the provision of the service or because of legal requirements for paper documentation. Or trading partners may be unwilling to consider participating in EDI before standards are established. Moreover, the costs of premature implementation may be very high. If an organisation decides to proceed before suitable standard EDI interface software is available, it will be faced with the costs of writing custom software. And if it goes ahead before the relevant message standards are established, it may be faced with the costs of customising software so that a variety of formats can be read and transmitted. Early users of EDI may also experience difficulties because their equipment is incompatible either with the network service or with a trading partner's system. Overcoming these difficulties may require the organisation to commission special software fixes, or even special hardware. Such problems can take many months to solve.

On the other hand, those who make the earliest use of EDI will be the ones most likely to establish a competitive advantage.

Other factors that can slow down the introduction of EDI include:

- The time required for negotiations with trading partners and, where necessary, service suppliers.
- The time and effort required to modify internal systems so that they can interwork with EDI. Interfacing to existing mainframe applications can be a major problem, and it is discussed in more detail below.
- The need to carry out a more extensive pilot application.

DECIDE WHICH MESSAGE STANDARDS TO USE

Despite the progress that is being made in defining national and international EDI message standards, there are still considerable uncertainties in this area. The implications are as follows:

- If you can make a business case for EDI, implement it now using the best standards available in your trading community.
- Support all standardisation moves compatible with the JEDI proposals.
- Be prepared to change the message formats you use in response to strategic industry moves to bring standards in line with those internationally agreed.
- When the majority of your communications of a particular kind are handled by EDI, or when

you undertake a major change in the relevant internal systems, consider using external documents standards for internal documents.

— For the interchange of graphics information, standardise if possible on the same computer-aided design system as your trading partners. It will be some time before an international set of standards is agreed for the exchange of graphics information.

Because some organisations serve a variety of business sectors, they find they have to support several document interchange standards to deal with different groups of customers. Although this is undesirable in principle, it appears to cause few problems in practice.

ENSURE THAT INTERNAL SYSTEMS CAN WORK WITH EDI

We have already given examples of situations where internal systems were unable to support EDI, or where they would prevent the achievement of the desired benefits. Internal systems need to be assessed for their suitability for interfacing to EDI; if they are unsuitable, decisions on EDI need to be taken in the broader context of the updating of internal systems, and any EDI implementation will have to await the necessary system changes. Alternatively, a standalone approach to EDI might be considered in the first instance.

EDI may also cause organisations to review internal document standards. In the early days of using an EDI service, it is unlikely to be worthwhile changing internal document standards to make them compatible with the external service. However, where the use of EDI has become well established, some organisations have found it necessary to bring internal document standards into line with the external ones.

PREPARE THE ORGANISATION FOR EDI

The organisation needs to prepare itself for taking action on EDI. Major strategic applications usually need to be championed by a senior manager with a role related to the area of application, rather than by the systems department. In large, diversified organisations a complementary activity, based in the systems department, may also be required. The purpose of this activity is to promote EDI in general rather than a particular EDI application.

Some larger organisations, notably ICI and Philips, have appointed managers with specific responsibility for making use of EDI. The main responsibilities of the EDI manager are to:

— Create awareness about EDI and alert management and operational departments to the threats and opportunities.

— Identify opportunities for commercially attractive uses of EDI.

— Establish priorities for different applications across the organisation, and allocate resources accordingly.

— Provide a focus of EDI expertise and support.

EDI managers play an important role where EDI is to be introduced for the first time. Where EDI is well established (such as the airline industry), it no longer merits special treatment. And where the computer programs that support EDI are part of a larger system, they typically form part of the responsibility of the group that looks after the system as a whole.

REPORT CONCLUSION

EDI is a growth technology. Our research has shown that it is already well established in some areas of business, and it is developing new forms and spreading rapidly into new applications.

The implications of EDI are profound: It can have major commercial impacts on an organisation — on its success in the marketplace, on its organisational structure, on its trading relationships, and on the structure and even the existence of the markets in which it operates. Nevertheless, many managers are unaware of the importance of EDI for their organisations, of the threats it poses or the benefits it could bring them.

Foundation members should ensure that their organisations are alert to the implications of EDI and should develop an action plan along the lines described above. No organisation can afford to ignore EDI. It will change the way you do business.

BUTLER COX FOUNDATION

Butler Cox

Butler Cox is an independent management consultancy and research organisation, specialising in the application of information technology within commerce, government and industry. The company offers a wide range of services both to suppliers and users of this technology. The Butler Cox Foundation is a service operated by Butler Cox on behalf of subscribing members.

Objectives of the Foundation

The Butler Cox Foundation sets out to study on behalf of subscribing members the opportunities and possible threats arising from developments in the field of information systems.

The Foundation not only provides access to an extensive and coherent programme of continuous research, it also provides an opportunity for widespread exchange of experience and views between its members.

Membership of the Foundation

The majority of organisations participating in the Butler Cox Foundation are large organisations seeking to exploit to the full the most recent developments in information systems technology. An important minority of the membership is formed by suppliers of the technology. The membership is international, with participants from Australia, Belgium, France, Italy, the Netherlands, Sweden, Switzerland, the United Kingdom and elsewhere.

The Foundation research programme

The research programme is planned jointly by Butler Cox and by the member organisations. Half of the research topics are selected by Butler Cox and half by preferences expressed by the membership. Each year a shortlist of topics is circulated for consideration by the members. Member organisations rank the topics according to their own requirements and as a result of this process, members' preferences are determined.

Before each research project starts there is a further opportunity for members to influence the direction of the research. A detailed description of the project defining its scope and the issues to be addressed is sent to all members for comment.

The report series

The Foundation publishes six reports each year. The reports are intended to be read primarily by senior and middle managers who are concerned with the planning of information systems. They are, however, written in a style that makes them suitable to be read both by line managers and functional managers. The reports concentrate on defining key management issues and on offering advice and guidance on how and when to address those issues.

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17 Electronic Mail
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20 The Interface Between People and Equipment
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Availability of reports

Members of the Butler Cox Foundation receive three copies of each report upon publication; additional copies and copies of earlier reports may be purchased by members from Butler Cox.

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