



**ELECTRONIC DATA INTERCHANGE:
THE LONGER TERM EFFECTS ON
INTERNATIONAL TRADE**

**Survey of EDI users and service providers in the UK
What, Where, Why and Whither?**

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Introduction:

This series of working papers has been prepared as part of the early work in a new programme of research, based at the Cranfield School of Management. The topic for research is the "Longer term effects of Electronic Data Interchange" on business, in the United Kingdom, Europe, and elsewhere in the world.

Contents:

Seven working papers are available, as follows:

Topic	Date
Glossary of EDI terms and acronyms	18th July 1989
EDI: Technical Opportunity or Business necessity?	18th July 1989
Survey of EDI users and service providers in the UK	October 1989
An update report from the "EDI '89" conference in London	6th November 1990
EDI and advanced information processing - the way ahead	15th September 1989
EDI Standards and the Single European Market	11th September 1989
The effects of EDI on the financial sector	18th December 1989

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[Note to the reader: the figures referred to in the text are all provided at the back of this working paper]

Introduction

Project Scope

The objective of the project was agreed as:

"To examine the extent of take-up of EDI, to identify any perceived problems from the viewpoint of those involved, and to collate existing views of the future for EDI"

The project was limited to the United Kingdom market, and a short list of industry sectors was established.

Methodology

Information was gathered by:

- o desk research at Cranfield School of Management and the Department of Trade and Industry.
- o face-to-face and telephone interviews with representatives of EDI-active companies.
- o face-to-face interviews with Value Added Network suppliers.
- o telephone interviews with Standardisation Organisations

A contact list is at Annex B. The author wishes to thank all of those who gave their time to help him with this research.

What is EDI?

Introduction

Electronic Data Interchange is the transmission of formatted data from one computer system to another in such a way that the receiving system can understand its meaning as the same as that when transmitted. We can expect the introduction of EDI to bind customers and suppliers far closer together as they become mutually inter-dependant. Design information, product scheduling and easier import/export documentation can all be expected to become electronic in the near future. There will become far less of a need for outmoded concepts such as the invoice, since the ability to track orders through production, delivery and storage will enable self-invoicing and automatic funds transfer to clear debts. This paper will explain who this is coming about.

Technical Description

Traditionally orders, delivery notes, invoices and payments have been passed between trading partners on paper. As computer systems become commonplace it grew clear that it was inefficient for an order to be produced on a computer, printed out, posted to the supplier, re-keyed and then processed on the suppliers' computer [see figure 1]. There was obviously scope to reduce the time added by the post and errors introduced by the re-keying stages of this process. Major retailers such as Boots decreed that their suppliers should dispatch their invoices on magnetic tape in order to reduce the keying time into their order processing system. Boots itself estimates that its 50 major suppliers have saved between 1 and 4 people each, and reduced errors from 30% to less than 0.01% of the 1 million invoices that Boots receives electronically each year.

The next stage was to set up direct electronic links between customers and suppliers. A typical example of this was British Home Stores, who required their top 100 suppliers to have direct links to BHS's central computer. This increase the responsiveness of the suppliers to BHS's needs, but as these suppliers also supplied other customers the technical problems of co-ordinating an exponentially rising number of dedicated links was becoming more and more difficult to achieve [for example in the construction industry see figure 2]. One of the major problems was to schedule the times when the various computers were to intercommunicate. The way was therefore open for the development of Value Added Network Services (VANS) which provide a 'store and forward' electronic post office [see figure 3].

As it stands the introduction of EDI just appears to be a faster way of getting information around. However, it is likely to fundamentally change the way that companies do business. Remember back to the introduction of the telephone. People would say:

'What a wonderful invention. One day every town might have one! It allows someone to write a letter and read it out, so effectively arriving far sooner than it would do through the post.'

Obviously the telephone has fundamentally changed the way that we communication and do business; it does not just speed up the current *modus operandi*.

For a detailed description of the technical format of EDI messages the reader is referred to Bytheway [3,pp11-13].

Business Advantages

Efficiency

A survey by the Institute of Physical Distribution Management in 1984 gave average costs for some paper transactions as:

	Customer	Supplier
Order	£12	£8
Invoice	£4	£6

The percentage of Documentary Letters of Credit that are rejected on first presentation is between 50% and 90%. About 70% of information output from one computer ends up as input to another, and about 15 of these re-keyings will contain an error. One UK company found that about 30% of its invoices to its major customer were outstanding at any one time due to real or suspected inaccuracies. The introduction of EDI reduced this to less than 5% with the resulting better and more predictable cash-flow.

All of these unnecessary costs and errors, together with the time spent in transmission, can be reduced by the introduction of EDI. In addition better stock management brought about by better information flow can reduce inventory thus releasing working capital.

Market Compulsion

In many industry sectors EDI has been forced onto companies in order for them to remain in business. This can be imposed by a particularly dominant customer, says Marks and Spencer to one of its clothing suppliers, or a requirement to avoid competitive disadvantage, such as airline seat reservations. An example can be seen in the tool-making sector in the West Midlands. Here five companies operated in near equilibrium. Two of the companies started to receive orders by EDI and a third experienced a down-turn of 24% in its business. Now all five trade electronically. This shows both the opportunity (see below) that EDI can bring, as well as the compulsion to trade electronically to avoid competitive disadvantage.

Opportunity

This is where EDI can gain competitive advantage for its users. New business opportunities and closer links with existing customers can bring strategic benefits. Some of the efficiency savings made above can be passed on to others in the value chain. This can result in more orders due to a cost advantage. Alternatively customers can gain more benefits from trading with a particular supplier because they can provide more information to enhance their product offering, better and more reliable lead-times or faster response.

Much has been written about the Just-In-Time manufacturing systems employed in Japan, and increasingly in other parts of the world. In order to implement this successfully the flow of information between customer and supplier must be both accurate and timely. The introduction of EDI is likely to be the only way that this can be achieved. Once in a JIT environment there is a breakdown in the traditional power distribution between customer and supplier; both are mutually reliant on each other. This can be a very frightening environment for the management and it will be explored later.

A diagrammatic representation of benefits to be gained from EDI is a figure 4.

Where is EDI?

Introduction

In line with most 'products' EDI appears to have a life-cycle. This passes through Introduction, Early Growth and Primary Growth to Maturity. None of the industries examined below could be described as being in the Maturity stage, except, possibly, the banking sector with their use of BACS and SWIFT. An attempt has been made at figure 5 to place the industries on the curve. The stages can be described thus:

- o *Introduction:* The market leader promoted EDI to its major trading partners. Pilot schemes are set up. Typically the market leader perceives a long-term strategic advantage in adopting EDI.
- o *Early Growth:* EDI is adopted by other major players in the sector. However, these are much more reactive in their use of EDI. They tend to adopt because their customers require a quality of service that requires EDI or they wish to prevent loss in market share to existing or potential competitors.
- o *Primary Growth:* The necessary critical mass required for self-perpetuation is achieved as EDI becomes accepted by a wider range of customers. There may be a slackening of growth as standardisation becomes an issue.

EDI started in the USA and rapidly caught on in Manufacturing, Retail and Financial Services. The dominant message standard is the ANSIX12, with over 20 different network providers supplying VAN services. At present the UK has about 2/3rds the volume of the US but is ahead on a per-capita basis and is growing at a far faster rate. The UK is said to be about 2 to 3 years ahead of the remainder of Europe, but the gap seems to be closing. Figure 6 shows the relative sizes and growth rates of European countries taken from 'European EDI Market', INPUT 1988.

Industry Sectors

Construction

The Construction Industry is relatively new to the field of EDI, but the work of EDICON has enabled a clear view to be taken. The areas to be addressed are:

- Manufacturing, storage, sale and delivery of products
- Selection and specification of products
- Costing, ordering and payment for goods and services
- Technical direction and control of the building process

EDICON is committed to EDIFACT standards and has developed several industry specific messages to enable information to be passed effectively between interested parties. As was seen in figure 2, the number of information flows is large, and can be greatly simplified by use of a Van (figure 3). EDICON is not tied to a particular supplier and members have exchanged data over all three of the major networks during trials. The industry is particularly interested in the movement of design information, mentioned below. EDICON

is a particularly good example of how a standards-making body representing an industry can assist in the introduction of EDI.

One of the major problems faced by John Laing, one of the largest construction companies and a major force behind EDICON is the number of suppliers that it needs to deal with. At present this amounts to about 25,000 with many coming and going over time. Since many of these companies are very small this will mean that total adoption of EDI will take a very long time, although the increasing adoption of PC based EDI systems will help this process.

Retail

The major initiative by the Article Numbering Association (ANA) in bar-coding and cataloguing most retail products has provided the springboard for extensive use of EDI in the retail sector. In 1984 the ANA sponsored the Tradacom contract which was won by INS (see below). The system was accepted in March 1985 as Tradanet, and was given a five year exclusive endorsement in May 1985. This system now has over 1600 users, mostly in the retail sector. Driven by large companies such as Tesco, Marks and Spencer and B&Q the system grew very large very quickly, and is now well into the primary growth phase. For instance, Marks and Spencer now do 99.5% of their textile and furnishing business through Tradanet, to a value of £3 billion per annum. For a more complete case history of the adoption of EDI in the retail sector the reader is referred to the Tesco case [5].

Electronics

Major initiatives under the EDIFICE umbrella have been made. This has resulted in many large companies such as Texas Instruments, Phillips Components and Intel adopting EDI. TI have extensive networks world-wide to support their global manufacturing operations, but have had to support several networks because as suppliers they have limited power to impose standards. TI therefore support 5 different networks; INS, Istel, IBM, GEISCO and BACS, together with four message standards; Odette, X12, Edifact and BACS. TI claims a reduction in order processing time from 10 days to 2 because of EDI links. At present TI are exchanging Purchase orders and Invoices with customers, with six further messages this September and further messages in March 1990. They expect to be trading electronically for 90-95% of their transactions within 3 years.

Banking

The clearing banks have been amongst the first in implementing large scale EDI, in the form of the Bankers Automated Clearing Service (BACS) and the international systems, Society for World-wide International Financial Telecommunications (SWIFT), which processes about 1 million messages a day. The banks are slowly moving from defensive to offensive use of EDI and different services are beginning to emerge. An example is the Royal Bank of Scotland's ROYBOX system which enables customers to instruct the bank to buy and sell securities or currency. The banks are also involved in home banking projects, and electronic payment methods. Domestic payments are likely to be the first area to be fully converted to electronic messages. At present payment details do not include information that the recipient needs, such as which invoices the payment refers to and what credit notes and discounts are being taken. This sort of information must be included in any EDI message format. Once the domestic system is in place then International payments will surely follow (see example below).

Automotive

The automotive industry has embraced EDI in its move towards Just-In-Time production methods. JC Bamford for example now trades exclusively with 50 of its main suppliers electronically. In this way the suppliers can be kept informed of the production schedules and can meet the tight delivery schedules laid down by JCB. Nissan have moved from courier transmission of schedules and orders to EDI and are now able to give its suppliers such good production schedules that they can specify the time of day rather than the date for delivery. In this way Nissan can keep its inventory down to the absolute minimum. Ford decided to avoid being reliant on a third party VAN provider and set up its own FORDNET. It paid for the introduction of EDI links to its suppliers and forced adoption of standardised CAD/CAM systems. Because of this FORD has a highly efficient system that not only removes much of the financial paper transactions, but also enables design information to be easily exchanged. For an example of EDI in the Automotive industry refer to the LUCAS case [6].

International Trade

The Data Interchange for Shipping (DISH) project was set up between (*inter alia*) P & O Containers, Cunard Brocklebank, National Westminster Bank and SITPRO. P & O Containers used to process 12 miles of paper each week, and this is largely been removed by the DISH initiative. Electronic Bills of Lading are now in use, and Customers officials are beginning to accept "Period Entry" forms electronically. National Westminster Bank has been moving towards electronic documentary letters of credit. ICI have been using 7 EDIFACT standard International Transport Messages covering the commercial aspects of exporting goods. This arose from the frequent arrival of containers in the USA before the supporting documentation, slowing the delivery and providing bad service to ICI's customers.

Health

The National Health Service has introduced EDI links into Regional Health Authorities to speed up and control the costs of ordering pharmaceutical and other supplies. The NHS places 4.5 million orders per year, receives 12 million invoices and makes 6 million payments. About half the orders and invoices are for amounts below £100. In line with the governments move to open systems, the NHS has endorsed INS, Istel and IBM as network providers. In the short term this may cause problems since the suppliers may be forced to work on several networks until the proper interconnecting bridges are established.

In addition in the health area there is Pharmnet which links the pharmaceutical manufacturers to each other and their customers.

Insurance

The insurance market is changing dramatically due to EDI. The emergence of a 'second-hand' Insurance market has been made possible and other markets have become much more efficient. The Re-Insurance Network (RINET) and London Insurance Market Network (LIMNET) are both working examples of this.

Chemical

The European chemical industry has been exchanging data electronically for several years under the guidance of CEFIC. ICI has been a leading member of this, particularly under the chairmanship of Sir John Harvey-Jones, whose comments are elsewhere in this paper.

Oil

The oil industry has been brought into the EDI community through pressure from its customers. Having found that individual companies are trading electronically, it has become sensible to begin to examine the technology in a more strategic light. This is just beginning, for instance, as BP begins to trade electronically between its operating companies.

Suppliers

The VANS marketplace is dominated by three suppliers; Istel, INS and IBM. The market is growing at least 100% per annum. The official breakdown of the market by number of users is:

	INS	Istel	IBM	GEISCO
1988 UK	64%	30%	6%	
1989 UK	64%	27%	9%	
1989 Europe	38.5%	16%	8%	28%

These are shown graphically at figure 7. However, if transaction volumes are taken, the industry joke is Istel 60%, INS 60% and IBM 10%, which tries to show how fast the market is growing.

To give an idea of what the VAN suppliers are offering, INS have developed a 10 layer model which mirrors the ISO 7 layer model. It is reproduced at figure 8. The situation can be likened to that of the cellular telephone system where an oligopoly has emerged which will increasingly become transparent to the user.

Istel

The company was formed in 1979 as the software arm of the Rover Group. Its name was changed to Istel in 1984. In June 1987, a management-led employee buy-out resulted in the company being owned 50% by employees, 25% by the Rover Group and 25% by a group of major financial institutions. Today, Istel employs over 1650 staff, nearly 1000 of whom own shares in the company. Istel is one of the major IT services companies in Europe and has an annual turnover (1988) of over £85m.

Istel is committed to providing differentiated services in a number of key markets, including financial services, health-care, manufacturing, travel and leisure, retail, distribution and automotive.

Istel operate the largest private data network in Europe, called INFOTRAC. This offers local call access to about 98% of UK businesses. Over this network it runs its EDI offering, EDICT, together with other services such as travel bookings, life assurance quotation and electronic mail services. This service operates from 00.01 hrs Monday to 24.00 hrs Saturday, with the exception of UK Bank Holidays. The service offers a postbox and mailbox for each user [see figure 9]. As a message is received it is validated, and checked for legality, both as to content and to address. This ensures that the message can only be sent between

businesses that have established a trading relationship. In addition to the actual service, Istel offers support both pre- and post-implementation, and an on-going help desk and consultancy service.

Service levels are guaranteed as 98% within 15 minutes and 100% within 90 minutes. Messages are sent to the sender's mailbox when a message is received by the system, placed in the final recipients mailbox, and when it is collected. Thus the sender knows what stage his message has got to. The system relies on a single data centre running twinned computers for reliability and security.

Istel's background is that of a software house. It is predominantly in the business of selling software based systems. In pursuit of this aim it has two marketing philosophies. Firstly it is attempting to sell the interface packages for UK users of its EDICT system. Secondly it is franchising its technology to other countries in order to enlarge its world-wide sales.

In the internal market, Istel defines 'honeypot' customers. These tend to be large companies who have many suppliers. The marketing team targets these customers and persuades them of the benefits of adopting EDI techniques. These can be quantified in the terms outlined in the section on business advantages above. These 'honeypot' clients then decree to their suppliers that EDI is the only way that they will trade in future. However, with the help of Istel they sugar this pill with the advantages of EDI for the suppliers. The community then goes live over the course of 6 months to a year and then Istel target one or more of the new users to encourage them to become a 'honeypot'. If at the same time other communities are being built up then the secondary suppliers may be being encouraged to become EDI-based suppliers by several of their customers at once. A practical example of this is how Rover persuaded both Lucas and British Petroleum to trade electronically. These two in turn persuaded British Aerospace and the other oil companies respectively to also join the EDI community. In this way EDI is slowly being moved back up the value chain.

In this way Istel has built up a very strong community in the Automotive, Aerospace, Engineering and Manufacturing area (about 60% of its customers) and in the Health, Finance, International Trade and Retail areas (10% each).

The secondary method of increasing sales is through franchising. Currently the EDICT system is licensed to Cable and Wireless in Hong Kong, PAXUS ComNet (formerly Csironet) in Australia and An Post in Eire. Istel expect these to be joined shortly by other franchised operations.

INS

The International Network System Division of ICL Computers was hived off in February 1987 into a joint venture company with General Electric Information Systems Company (GEISCO). The new company, called INS is 60% owned by ICL and 40% by GEISCO. Ins has the mission statement of:

Profitable provision of paperless business communication services.

At the time of its formation INS was the market leader in the UK and GEISCO had a large world-wide network. The synergy of the two was considerable, and as can be seen in the overall market figures above INS in the UK or INS and GEISCO in Europe are the leading players. Turnover figures are not available as INS is a subsidiary of a subsidiary and therefore figures are concealed in group accounts. INS provides services for seat reservations, electronic mail, and the national bingo game in addition to its EDI services.

While still part of ICL, INS won a contract for a Value Added Network pilot scheme under the auspices of the Article Numbering Association (ANA). This system, known as Tradanet went live in March 1985 and has a 5 year exclusive endorsement from the ANA. The main focus are retail outlets and their suppliers. On formation Tradanet had 400 members. This has now risen to over 1500, with 40 to 50 new members each month. Interconnection to GEISCO's EDI*Express service has resulted in the largest world-wide open system with over 6000 companies in 85 countries. Tradanet, and its sister networks, Brokernet and Pharmnet, are available 365 days a year, 24 hours a day. Availability is said to be greater than 99%. In outline the network works in the same way as Istel's Edict, but instead of relying on a single data centre the network has multiple copies of messages on several twin machines. In this way INS claims to have the most reliable of the VANS. Message transmission is claimed to be 'instant', or at least within a minute or so, and full audit trails are maintained to enable messages to be tracked as in Edict.

Unlike Istel's software background, INS is fundamentally a pure service company. INS makes its money purely from the service that it provides, charging for connection, usage and consultancy. This gives it a rather different perspectives to Istel and IBM. INS follow a similar philosophy to Istel in market development. They refer to 'hub' companies who bring in 'spokes'. These 'spokes' are then developed into 'hubs' themselves. The three initial 'hubs' for Tradanet were Marks and Spencer, B&Q, and Tesco. A diagram of the build up of a community is at figure 10. Due to the initial certification by the ANA INS has a very strong hold of the retail sector, and a strong presence in pharmaceuticals and insurance.

IBM

International Business Machines requires very little introduction. With a turnover of £31.7 billion it is one of the largest companies in the world. Predominantly a hardware based company, IBM is really only interested in EDI and VANS provision as a way to sell extra hardware. This is reflected in its marketing stance.

IBM offers a wide range of services based on its world-wide Managed Network Service (MNS). These include the EDILINK service together with various electronic mail and data systems. Although the MNS and EDILINK are available on a variety of popular computer systems, the system has been designed and optimised for use on IBM machines. This means that it is more difficult to attach non-IBM sites to the service, and service levels are likely to be worse than on native IBM machines. The IBM network is available at almost all times, and has high levels of reliability and redundancy.

IBM has currently a very strange attitude to the marketing of EDI services. It appears to believe that it cannot make money out of selling VADS but must offer them to its customers as part of a total system offering. It is backing its Professional Office system product PROFS very strongly and is marketing EDILINK as a seamless part of such an office automation product, although they can be separated. There appears to be little direction to this campaign, and it is only being targeted at large IBM dedicated users. The company has obtained good footholds in strategic markets such as Electronics and Insurance. IBM itself has announced that it will be using its purchasing power to trade electronically with its 12,000 main suppliers by 1991, and is already doing so with 2,000 after the successful trial project Edinburgh with Texas Instruments. However, this internal success is not being marketed to the outside world, but it is always difficult to understand the workings of IBM and we may yet see a major thrust by the company. The major disadvantage for IBM would be the increasing international open standards being adopted; IBM seems to prefer to have proprietary technology to tie in its customers.

Discussion

There has been discussion that the introduction of EDI can be compared with the more general introduction of Information Technology. The phases of initiation, contagion, control, integration, data administration and maturity appear superficially as a good model for EDI adoption. However, closer study reveals that EDI is being used in all of the areas that formed separate eras of IT adoption. A large proportion are admittedly just automating current manual practices, but there are many examples where strategic advantage is being sought and gained in a very mature way.

What we appear to have is a "curate's egg" of adoption. Of the 2500 or so companies that are involved with EDI in the UK there are about 100 who are really looking at it from a strategic business perspective. They are the companies that are gaining real benefit from EDI. The remainder have been coerced into adopting EDI either by customer pressure or industry forces. They are gaining far less benefit than is possible. Some indeed are gaining no benefit and are adopting a necessary evil approach to the management of EDI. Because EDI can get to the very heart of the business, and may fundamentally change the way that a business works, it is essential to adopt a strategic view, a centrally planned management approach. Those who do not will not gain the full advantages on offer.

Why? - Obstacles for EDI adoption

Standards

Network

The UK market is dominated by three major suppliers providing incompatible systems. Although a bridge between the Istel and INS networks has recently been announced it is not a trivial exercise for a company to trade over more than one network. IBM announced recently that it was stopping collaborative work with INS and Istel on bridges to its MBS. The experience of TI in interfacing to so many networks suggests that this may not be a real issue. However, since resources must be devoted to solve the technical problems TI suggested that this may be a limiting factor in smaller companies. The Lucas case [6] also shows that multiple networks may not be a big problem, and a schematic of the Lucas system is at figure 11.

Messages

The current confusion over message standards led me to believe that it would be a major problem in the wider use of EDI. This appears not to be the case. The confusion is causing some companies to delay the adoption of electronic trading, but it appears that the translation of different message formats is a technical problem that can readily be overcome. All of the industry claims to be 'committed to EDIFACT' but the investment in alternatives such as Tradacoms in the UK and X12 in the USA will almost certainly mean that the message standards will co-exist for many years to come. See Annex A for a discussion of EDIFACT standards.

Looking further afield the IGES message set for the exchange of graphical information has some problems in the various implementations currently in use. This can lead to a drawing that has been converted from one system, transmitted in IGES format and read into a target system not being identical to the original. This is caused by different manufacturers interpreting the IGES standard and implementing it in different ways. This problem will eventually be solved as users complain to their system suppliers.

Security

Whilst the security of data within an EDI system is considered reasonable, it is unlikely to be sufficient for banking transactions. Therefore separate security facilities will be required for these transactions. At present there is no standard method agreed between the banks. This must be agreed otherwise customers will have to encrypt their data in different ways depending on the recipient. This would be almost as bad as, for instance, saying that a cheque to be cashed at a particular bank had to be written in a particular way. Whilst this is not currently a problem, as banks become more interested in electronic payment methods, it will become increasingly important.

Lack of Management Commitment

As mentioned above there are about 2500 companies trading electronically, of whom only about 100 have really done so from a strategic perspective. The next stage is to persuade the management of the coerced companies to grasp the opportunities that EDI can offer them.

In his keynote address to the EDI'88 conference, Sir John Harvey-Jones said that he was surprised that so little of the pressure for EDI had come from marketing men and top executives.

"...who all too often fail to see the real position they can achieve by using this technology faster, better and by getting there first".

He went on to say that most people running companies were

"... old people like me not familiar with the technological possibilities! We have great difficulty in making imaginative jumps to see the way in which the whole of our business can be reorganised, revitalised, set up in totally new ways, releasing energy and cost and putting us into the pole position. I can see abundant evidence that the full benefits of EDI will only be reaped by the companies where the Chief Executives is seized with enthusiasm for the potential prize he can grasp".

The areas that are particularly relevant to management are:

Competition versus Cooperation

Much of business revolves around gaining advantage over competitors. In the area of EDI it is frequently better to co-operate, at least initially, in order that all can win in the long term. This requires a different approach by management, which is sometimes hard to instil. It is difficult to imagine how successful the Tradanet initiative would have been if the main competitors in the retail sector had not agreed through a neutral body on what was required. The reason that EDIFACT messages have taken so long to be ratified is the process of ensuring that they match everyone's needs and not just one or two large users. In this way a standard can be achieved that enables all parties to minimise their set-up and running costs for EDI links, and maximising the benefits.

Organisational Change

The removal of large amounts of paper from the trading cycle is likely to remove jobs. This will cause upheaval in the organisation. In addition to this the jobs that remain will be of a controlling and checking nature rather than mundane clerical work. EDI should re-skill the work-force. Provided that the people are involved in the decision process then the disruption can be minimised.

Closeness of Trading Links

The use of EDI will bind customers and suppliers much closer together. There will be a reduction in the use of spot-price buying, and an increase in longer-term call-off contracts. All of this will change the balance of power between the supplier and the customer. Both will become mutually dependant on each other, which should enable both to feel 'in control' of the relationship. Negotiations will not be dominated by price considerations, but as the customer becomes much more important. The move is towards vertical integration without actually taking over companies in the value chain. Each company concentrates on its core competencies and contracts out everything else.

In addition EDI enables companies to cut out intermediates in the supply chain. A good example is how 'Big Bang' in the City of London removed middlemen in the trading of Stocks and Shares. The use of EDI enabled brokers to deal direct with market makers and

avoid jobbers. This may continue as market makers could get directly to the final customer by extending their use of EDI. This model can be used in many industries, and we can expect to see VANS taking the added value that used to be earned by middlemen.

Cost Justification

Although many EDI projects have attempted to justify their expenditure on cost savings, these calculations are almost always open to sceptical questioning. The main advantages are likely to be intangible and unquantified. Of course if the company feels that it must go with EDI or go to the wall, then cost justification is not that important. Like any other strategic system it is very difficult to pin down cost justification arguments for their adoption, and it is likely to end up being done as an act of faith. This is a hurdle that management must cross.

The introduction of EDI can call for the removal of large systems that have taken years to build up. The write-off of such investments is difficult to justify. As an example take the immense investment by the clearing banks in cheque clearing systems. The move to electronic payment will make all of these redundant.

Discussion

The adoption of any strategic information systems is likely to change the way that a company does business. For this reason it has always been argued that top-level management must be involved. A move to Just-In-Time production is similarly a radical change for an organisation. At its best EDI can be the equivalent of doing both of these changes at once. The change can be catastrophic and management must be involved. It has been said that EDI is 20% technology and 80% management. The experience of industry tends to bear this out. Unfortunately the zealots of EDI tend to be unable to 'sell' the benefits to management in most companies, and this is not helped by the way that many companies have been forced to trade electronically. Management tends to think that EDI is about computers, and because they think that computers are technical they abdicate responsibility with the cry of 'its all too difficult'. This must be wrong. It is up to those who understand EDI to learn how to talk to management, and it is up to management to understand that not only is EDI not about technology, but even if it was it is still their responsibility.

The Future of EDI

Internal Organisation

Since there are twice as many documents sent internally in an organisation than are sent externally it is likely that there will be increased use of EDI internally to enable companies to operate a more matrix oriented structure around marketing and production. Information will become more widely available and more reliable and up to date. People's jobs will change as they spend less time creating and storing documents and more time checking and controlling data as it passes through systems. All of this is likely to have profound effects on organisational structure, as will the increased move to home-working.

Most of the great changes in society have been based on changes in transportation; the horse, the ship, the train, the aeroplane, the space rocket. It can be argued that electronics is the next great change in transportation, in that it can remove the need to travel because face-to-face meetings and information gathering can be done without travelling. This will fundamentally change the way that organisations work.

Supplier Relationships

Middleman

The increased use of EDI will remove the need for middlemen in trading relationships. The value that they currently add to a process will be absorbed by the VAN. Organisations that currently provide information storage and collation services will find themselves under threat from electronic direct links. Brokers, freight forwarders, travel agents and teachers, amongst others, may all find that their services can be provided more conveniently over electronic links. In order to survive they will have to find something that adds value to the information.

Just-In-Time

The Japanese method of Just-In-Time production has been mentioned frequently in this paper and for a full description reference [7] may be of help. EDI links are almost a prerequisite for JIT because the optimal flow will be with very short information flow delays. In an electronic JIT system customers will call-off production from their suppliers giving the minimum required notice. In this way they are being at their most flexible to their customers. In turn the suppliers can be flexible because they have sight of the production schedule for the main manufacturer and can respond to his needs. As set-up times are reduced to allow for this flexibility then it becomes more economic to make in smaller batches, allowing variety and 'made-to-order' production. All of this gives greater customers satisfaction, lower inventory costs and therefore better profitability.

Design Information

The continued improvement of mechanisms to exchange Graphical Information will enable Computer Aided Design and Computer Aided Manufacturing (CAD/CAM) information to move swiftly between trading partners. This will reduce the response time of product design and eliminate the errors generated by the re-input of information from paper. This will tend to speed up the product development cycle. This is already happening in the

Automotive and Aerospace industries, and is well advanced in Electronics. A major area in the future will be construction, as architectural and design drawings are created, maintained and transmitted electronically. INS have recently introduced their Design*Expressed service to do just this sort of transmission.

The Death of the Invoice?

Once electronic links are in place for the whole of the purchasing cycle we can begin to fundamentally question the way in which we do business. Paper methods required that invoices were produced to inform the customer and the tax man that payment was due. As trading links become closer these become necessary. An electronic order can be linked directly into the manufacturer's production system. Expected delivery details can be sent to the customer and goods can be bar-coded to enable better receipt and tracking. As the goods arrive at their destination the goods inward system informs the accounts payable system and a self-billed payment can be sent electronically. 'Attached' to the payment advice will be the reference number of the order, information about any defects and information on discounts taken. The tax office can be informed if required, or the details summed for electronic dispatch with payment at some later date.

This of course is only the first step. If we can get rid of one of the most basic of business forms, then there will almost certainly be scope for getting rid of many others, and changing the way that business work.

International Trade

The amount of paper that flows during the import/export cycle is incredible. Much of it contains duplicate information, and much of it is rejected at first presentation. EDI can help to solve this problem. An example of the future might be:

"The importer, aware that a purchase is required, interrogates his database of suppliers and chooses you. He sends an EDI message ordering goods and at the same time a message to his bankers to open a letter of credit. This passes through the banking system and is advised electronically to you, noting that electronic messages will be accepted for presentation. Those stipulated are an invoice, a waybill and an insurance message.

"You manufacture the goods and at the same time arrange transport again by exchange of electronic message with your freight forwarder and shipper. Once complete, the messages are sent to the paying bank, who transfer the funds on day of receipt and advise you, electronically of course, that the transfer has been made. Oh yes, and the goods pass through customs with electronic declaration and clearance, with a message going to the importer advising anticipated arrival time."

(from "EDI - A Solution to the Exporter's Nightmare?" by Ken Edwards, National Westminster Bank).

Almost all of this is possible now, but is not yet fully adopted. As it becomes so international trade will become much easier, cheaper and faster.

Homeworking

The use of EDI and on-line databases will enable far larger numbers of people to work from home. Those with information gathering, collating and assimilating jobs will be the leaders in this move. This will enable workers such as women with small children to become much more useful in the overall work-force. This is particularly relevant in a time of declining employable population levels.

Globalisation

TI are currently using EDI links to manufacture components on a world-wide basis. Caterpillar have EDI links to 500 suppliers in 750 locations in 8 countries world-wide. Toshiba has a 7 country VAN. Electronics companies can send a CAD design to California for fabrication and receive it back in the UK by the next morning. There could even be the continuous processing of designs by passing them around the world in the same way that the financial markets are now 24 hour 'follow-the-sun' markets. All of this adds up to an increase in globalisation. For some companies this will be a strategic opportunity. For others electronically mediated global markets will eliminate marginal national suppliers.

Conclusion

EDI will enable us to concentrate on the things that matter and thus be better at them. It can also change the way that companies do business. As Sir John Harvey-Jones said at EDI'88 "In future it's the company that's closest to its trading partners, that's inside the head of its customer that is going to survive."

Annex A - EDIFACT Standards

In the early days of EDI in the USA the rail and trucking industries were looking at ways of reducing the basic overheads of trading. This was achieved by standardising documents and looking to electronic methods of exchanging information. These industries formed the Transportation Data Co-ordinating Committee (TDCC). Standards were set for orders, invoices, waybills and so on. Several other industries picked up these standards and produced derivatives. These included Retail (UCS) and Automotive (AIAG).

The American National Standards Institute produced the ANSI X12 by the United Nations Economic Commission for Europe (UNECE) in their Trade Data Interchange (TDI) standards. Also in the UK the Article Numbering Association (ANA) Tradacoms committee played a crucial role in implementing these rules.

Since the UNTDI and X12 standards only differed at the vocabulary and syntax levels a panel of US and European experts got together to harmonise them under the auspices of the United Nations Joint EDI working party (UNJEDI). The result was the Electronic Data Interchange for Administration, Commerce and Transport (EDIFACT). This is now an international standard (ISO-9735).

Almost all of the standards making bodies in the world are now committed to migrate to EDIFACT. However, due to investment in current systems this may take a long time. New bodies, such as EDICON, are designing their messages to be EDIFACT compliant from the start. Others will change as new messages are designed. What is likely to happen is that international trade will go to EDIFACT while national US trade remains X12 and UK trade remains UNTDI, at least in the short to medium term.

(Adapted from "EDICT Interchange" Winter 87/88)

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Annex D - Figures

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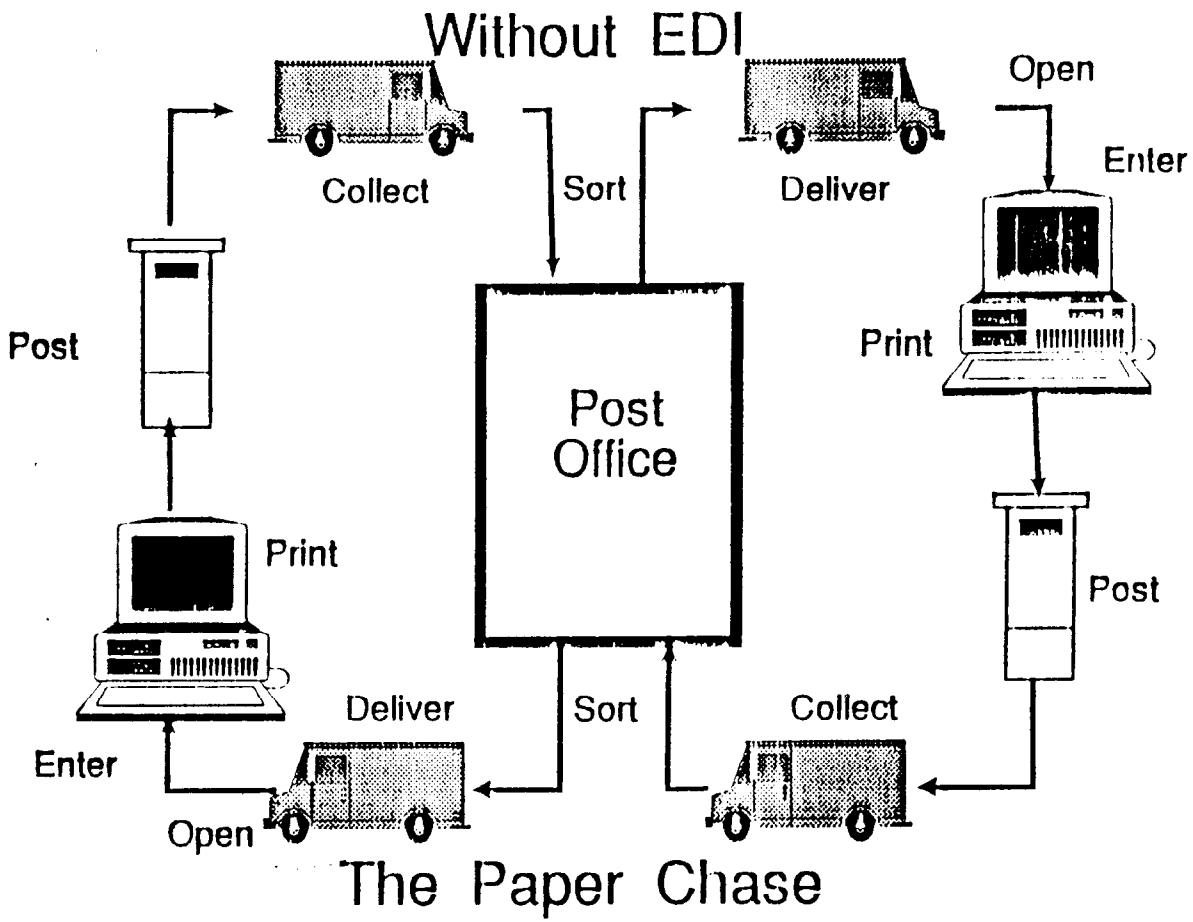
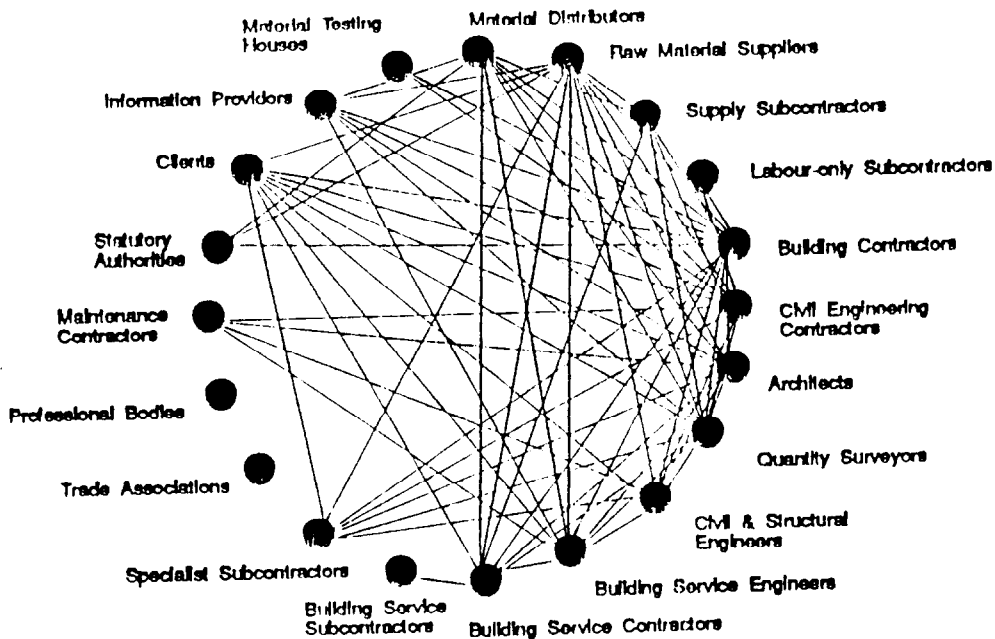


Figure 1 - EDI Outline
 (adapted from EDICT Handbook)

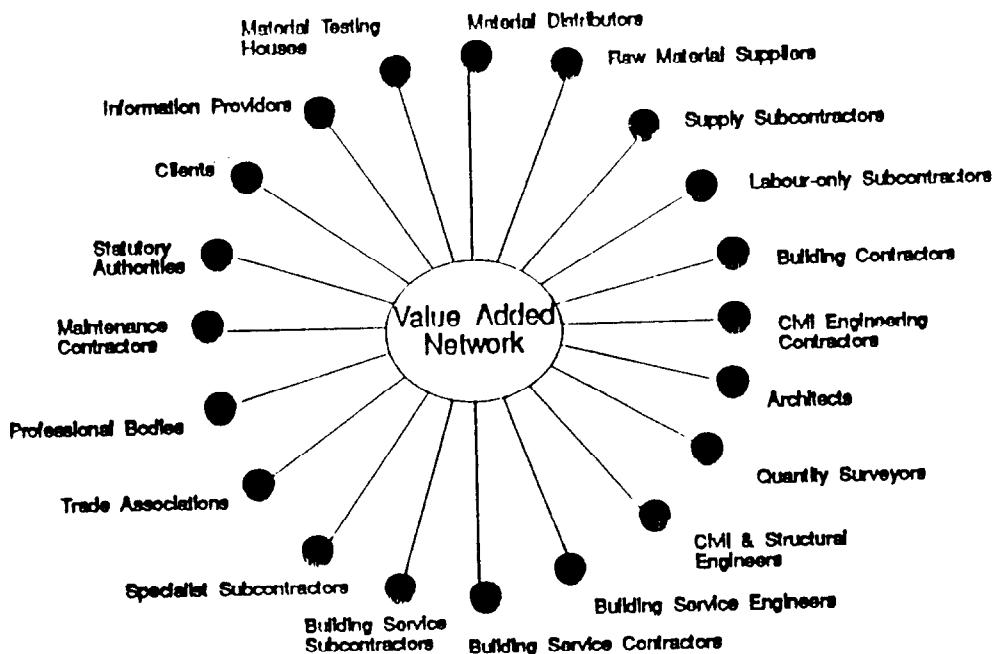
Construction Industry



Main Data Flows

Figure 2 - Information Flows
(adapted from reference [10])

Construction Industry



EDI Data Flows

Figure 3 - Information Flows with EDI

Typical Benefits of Trade Data Interchange

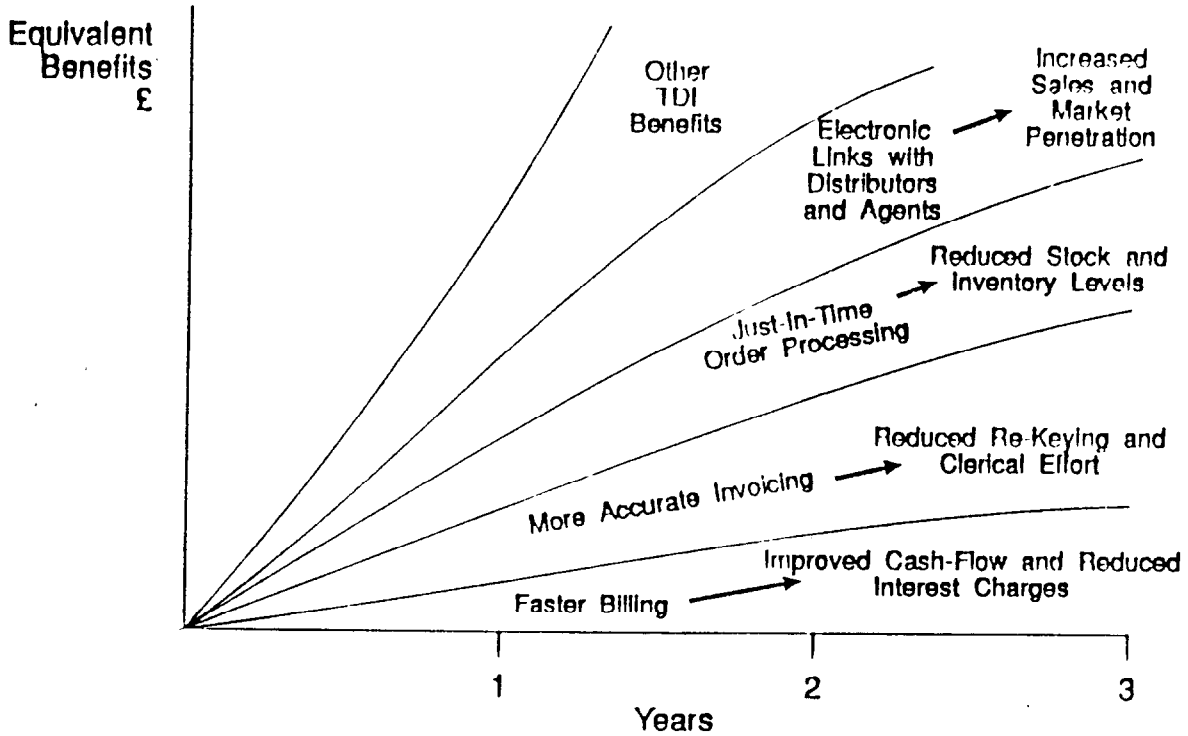
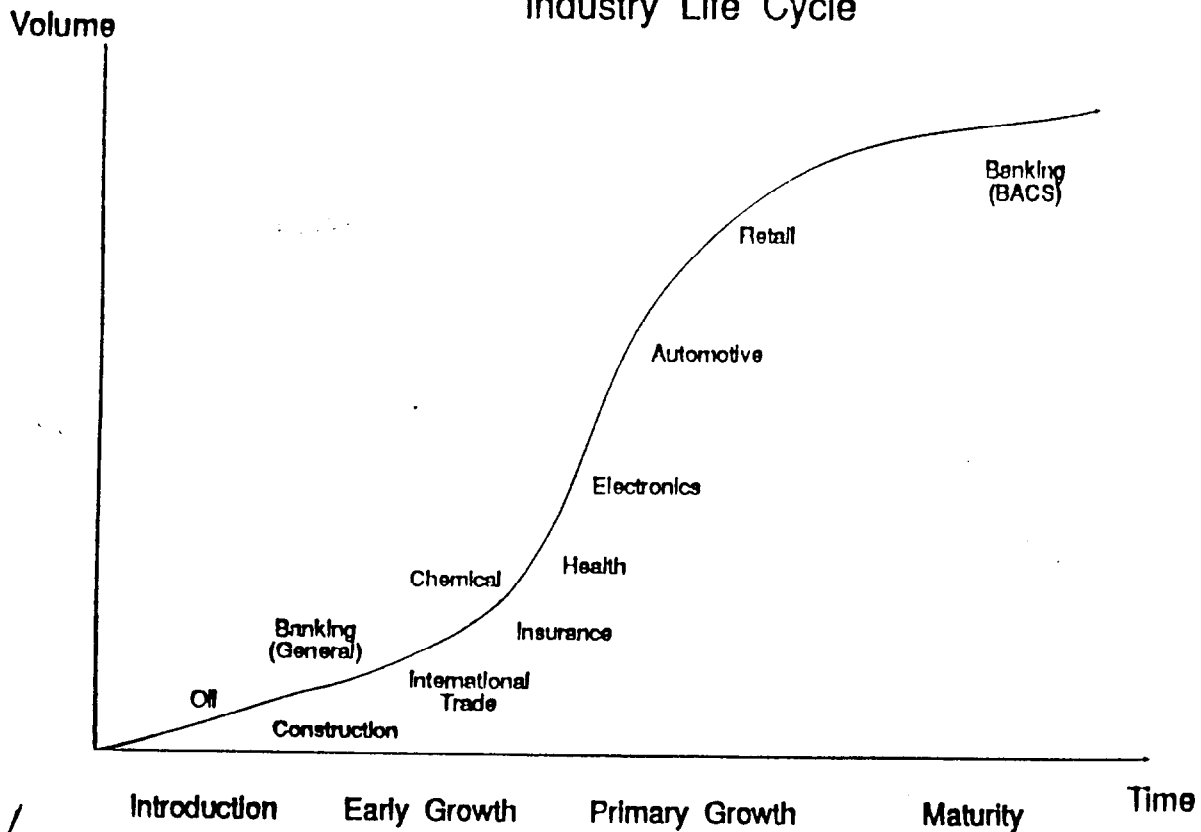


Figure 4 - TDI Benefits
(adapted from Vanguard News Winter 1986)

Industry Life Cycle



FDI Service Market 1986-1991

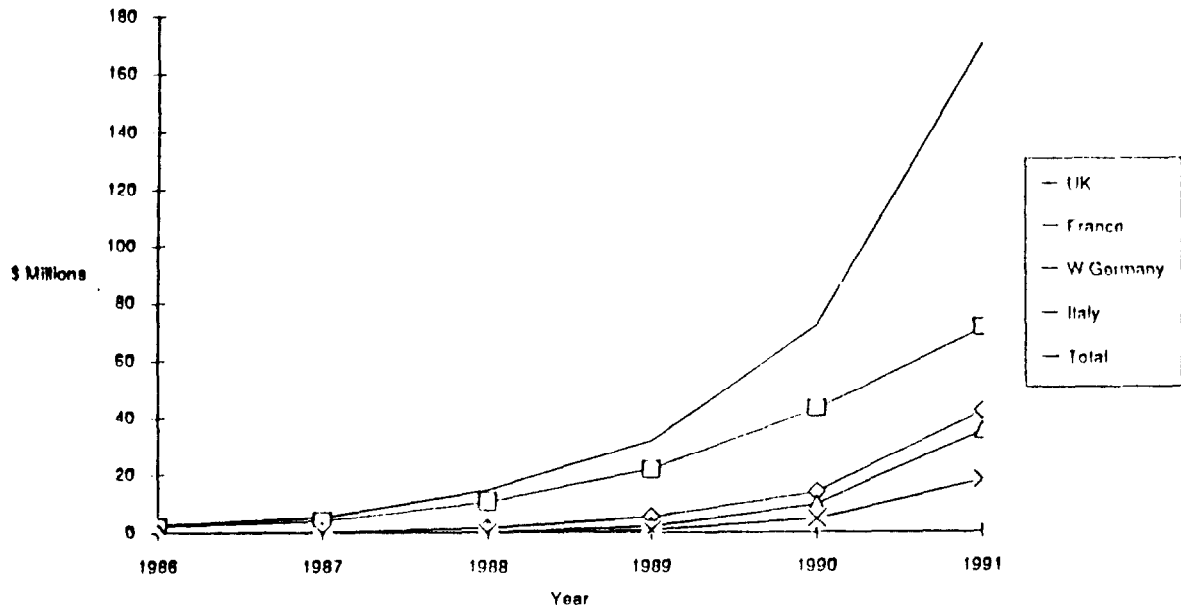
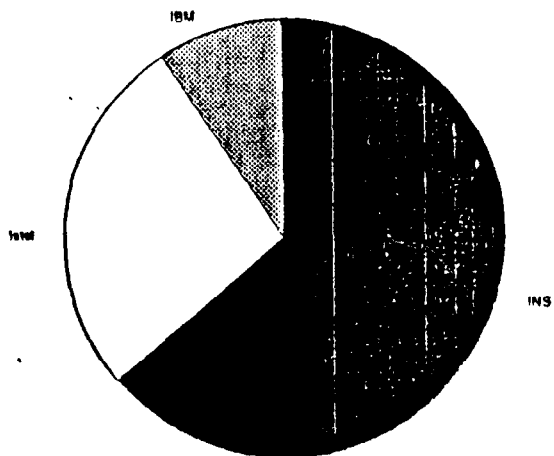
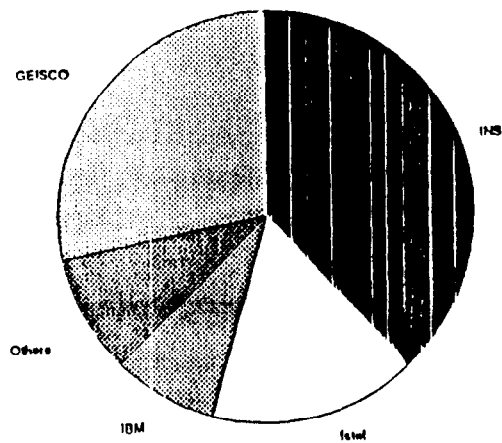


Figure 6

UK Market 1989



European Market 1989

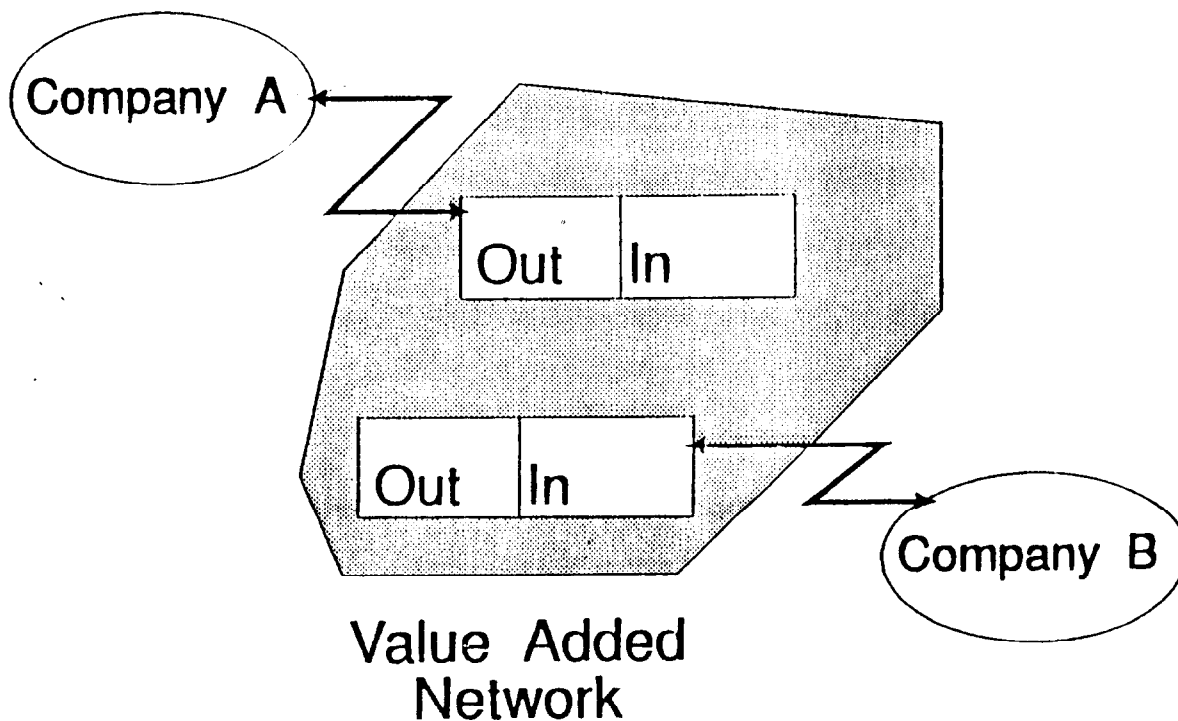


10	Gateways	E-mail, Augmentation
9	Community Development	Help hubs develop spokes
8	Support Facilities	Help desk, Training, Consultancy
7	Enabling Services	Tradastart (MVS, DEC, Unix)
6	User Functionality	Security, Audit, Relationships
5	Postbox/Mailbox Facilities	24 hr, 365 day
4	Envelope Standards	Tradacomms, Edifact, Odette
3	Data Standards	
2	Protocol Conversion	Async, CO3, SNA, X25
1	Network - National/International	X25, GEIS etc

The INS 10 Layer Model

Figure 8

Schematic VANS Operation



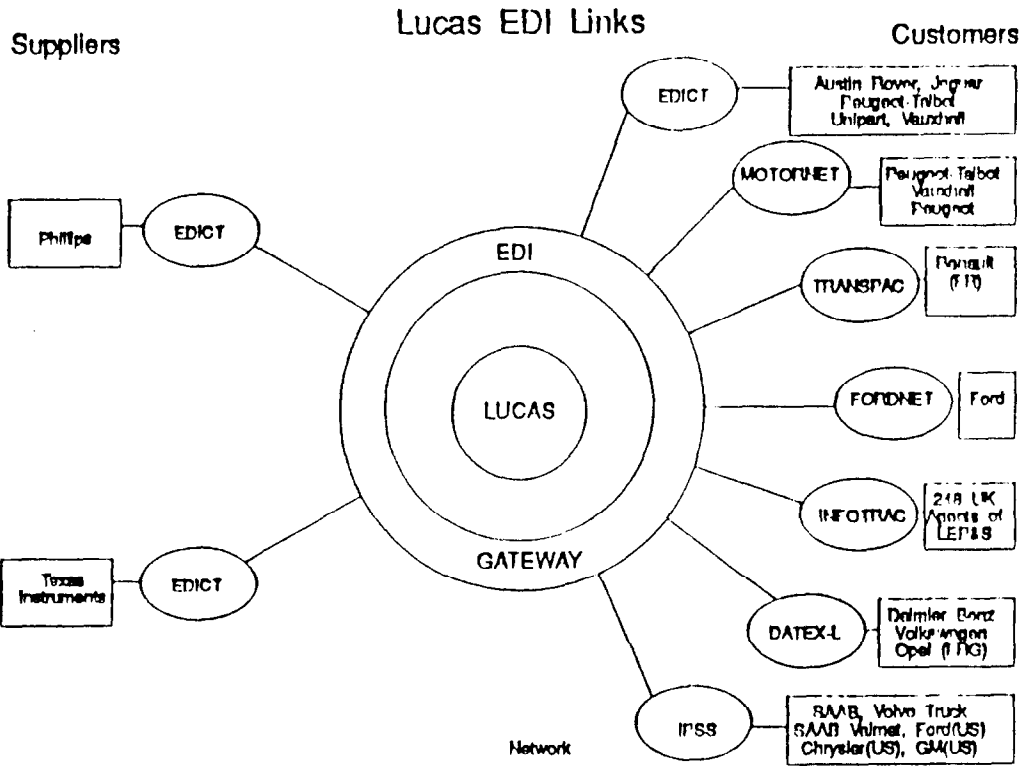
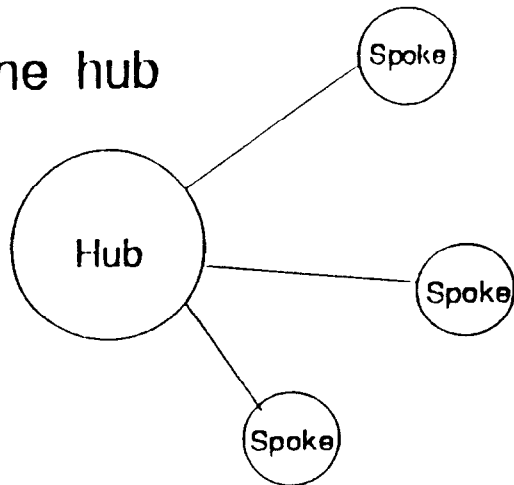


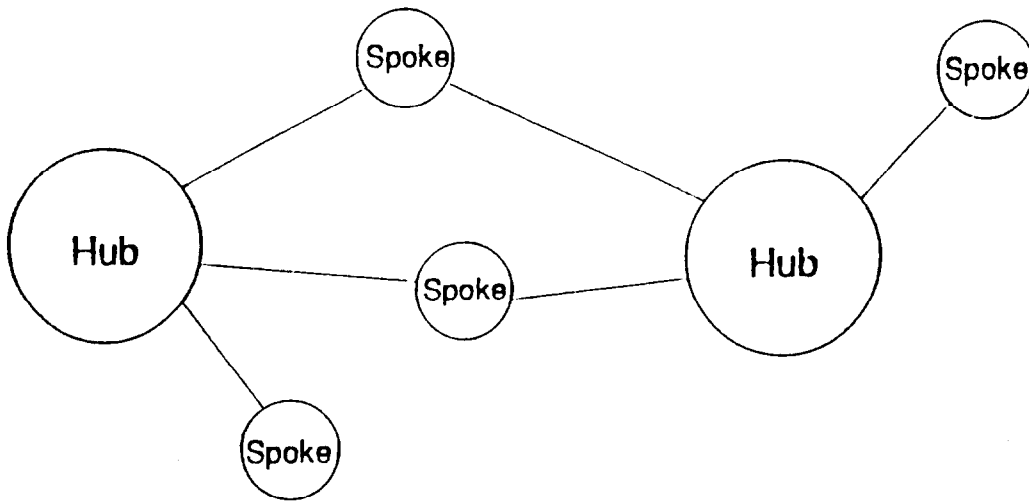
Figure 11

The Development of a Community

Phase 1 - One hub



Phase 2 - Second hub



Phase 3 -
Spoke becomes hub

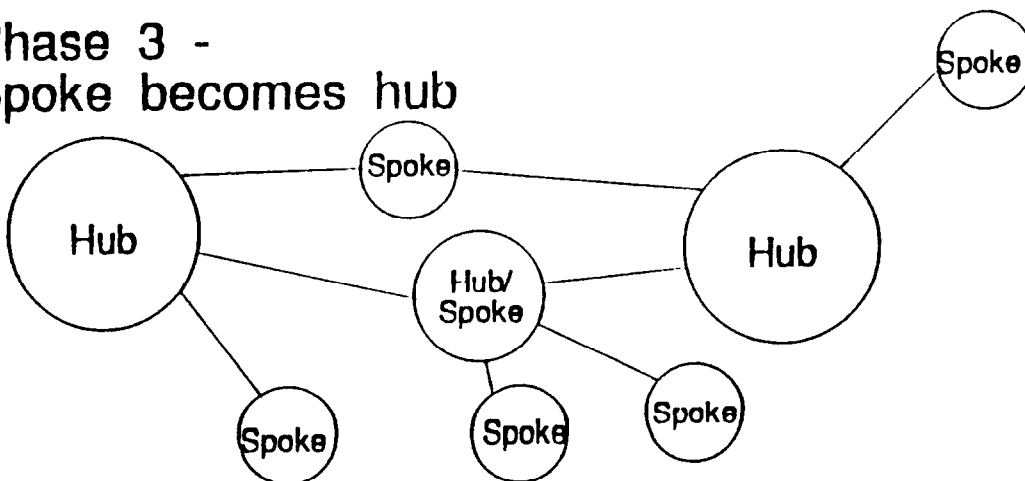


Figure 10