

The impact of electronic data interchange (EDI) on competitiveness in retail supply chains

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ABSTRACT

The Economic Intelligence Unit (1988) has grouped the benefits of electronic data interchange (EDI) accruing to business into 3 categories: 1. strategic, 2. operational, and 3. opportunity. A detailed examination of current retail logistical practices was initially carried out with the twin objectives of identifying suitable host participants, while at the same time tracking logistical problems that were specific to Ireland, given its insular and peripheral location relative to mainland Europe. Barriers encountered in the adoption and diffusion of EDI implementations and solutions have been extensively documented. Any strategy to promote the uptake of EDI must focus on negating the impact of certain barriers, such as trading partner negotiations or lack of central warehousing, while simultaneously emphasizing the considerable benefits to users of such a service. Nelson (1990) has suggested a model whereby organizations migrate through a series of evolutionary stages in the course of EDI implementation. Carter and Ragartz (1991) also suggest a 4-stage evolutionary progress as the most typical pattern of EDI adoption.

FULL TEXT

Increasingly, management attention is focusing on the issue of how the flows of material and information passing along the supply chain can be managed more effectively. Over the past number of years, developments have taken place in the information technology area which have helped companies to seek improvements not only in the management of such flows internally but also in the way in which they can communicate with other organisations.

This paper focuses on one such development--Electronic Data Interchange (EDI) and presents findings relating to a pilot EDI experiment carried out in the retail sector, in the Republic of Ireland.

ELECTRONIC DATA INTERCHANGE IN CONTEXT

The need to exchange data lies at the centre of the interaction process between buyers and sellers. In the typical business environment such data would include delivery notes, sales invoices, stock information, purchase order forms and other trading documents. With an ever-growing volume of business transactions, many companies are beginning to explore the possibility of moving towards "paperless trade" procedures in the leaner supply chains of the nineties. Benjamin et al. (1990) have documented the confusion that prevails in defining EDI in the context of inter organisational systems. For instance, Stock and Lambert (1989) describe EDI as simply a process where one computer communicates with another. However this definition is too simplistic in that it fails to identify the distinguishing characteristics of EDI. Cunningham and Tynan (1990) have criticised such loose definitions and suggest a more generic approach under the heading of electronic trading. This encapsulates three types of system, viz. person to person, computer to computer and person to computer. Ody (1990) observed that there are many ways of exchanging data electronically ranging from a magnetic tape sent by courier to permanent linking line systems. In an environment however where a company needs to establish links with many suppliers, it is not feasible to have a number of dedicated PCs, each communicating with a different customer via a fixed line. This is especially so in the retail sector where a large multiple such as Tesco, may have many branches, linking with hundreds of suppliers.

The distinctive feature of the EDI approach is that in order to transfer data to a remote location, the document must initially be converted into an agreed EDI syntax (grammar) and relayed in such a manner that it is error free and cannot be repudiated. Conversion of data to a specific syntax (e.g. the United Nations EDIFACT standard), takes place at the

originator's premises. The resulting data in syntax is then transmitted via a third party value-added network (VAN) provider to be relayed to the intended destination. The service provider acts as an electronic "mailbox" and performs a number of functions:

- * It will take in data on a 24-hour basis and hold it until the intended destination is ready for reception. This is convenient in cases of destination system failure or maintenance downtime and where there are different time zones between the trading partners.
- * It records all transactions made and relays reports of data successfully or otherwise transmitted or received to the communicating parties. This nonrepudiation feature is important for audit purposes.
- * It provides protection against accidentally lost information. Messages will be kept on the system until they are erased by others.

The data is received by the destination user by downloading the necessary information from the service provider. The data is still in its syntax format and is converted into a form understood by the destination location, i.e. for integration into their computer accounts and order processing system. In this context, electronic data interchange can be defined as the interchange of trading documents within internationally agreed formats and standards using value added services. This approach acknowledges the need for computers to identify data with each other in the same way using a series of protocols. Thus whilst the operating systems used can be different, they still need to translate commands and instructions into an understood format.

THE RATIONALE OF EDI ADOPTION

Stalk (1988) has argued that time-based competition will become the dominant issue in the business environment of the nineties. He points to the necessity of formulating time-based strategies in innovation, manufacturing, sales and distribution. EDI offers considerable scope for improved performance in each of these areas. The Economic Intelligence Unit (1988) has grouped the benefits accruing to business into three categories: strategic, operational and opportunity.

STRATEGIC BENEFITS

Such benefits can be of crucial long term significance to the functioning of the corporate entity and include:

- * Faster trading cycle
- * Just-in-time manufacturing
- * Inventory management
- * Competitive advantage via win-win partnership

OPERATIONAL BENEFITS

These are of major importance to the daily operation of the company but usually only have an impact on individual departments within the organisation.

- * Reduction in working capital requirements
- * Improved cash flow
- * Security and error reduction
- * Acknowledged receipt of order and delivery

OPPORTUNITY BENEFITS

These benefits include enhanced image and competitive edge, while perceived as beneficial, are difficult to quantify. As more companies begin insisting on EDI as a modus operandi for interaction, suppliers already using the approach are more likely to secure a wider choice of trading relationships.

RESEARCH OBJECTIVES AND APPROACH

The overall objectives of the pilot study were:

- * to examine a pilot implementation of EDI,
- * to assess the benefits that would accrue to the pilot participants,
- * to evaluate the barriers to adoption of EDI,
- * to suggest a suitable strategy to counteract any such barriers.

The methodology adopted comprised four distinct stages:

- * a series of exploratory depth interviews to establish current developments in advanced telecommunications, supply chain

practices and logistical strategies across a number of distinct trading sectors,

- * detailed logistics and IT audits of selected pilot participants,
- * technical implementation of pilot project,
- * evaluation and prognosis.

This combination of research approaches was considered to be the most appropriate given the nature of the study. Indeed Benjamin et al. (1990) have indicated that most companies are first exposed to EDI technology through pilot projects, the exceptions being those firms driven by dominant buyers to establish electronic linkages.

CURRENT ISSUES IN RETAIL LOGISTICS

A detailed examination of current logistical practices was initially carried out, with the twin objectives of identifying suitable host participants, while at the same time tracking logistical problems that were specific to Ireland, given its insular and peripheral location relative to mainland Europe. In-depth interviews were held with management personnel from fifty companies in such diverse sectors as food and drink, pharmaceuticals, brewing, milling, hardware and cosmetics. It became clear during the interviews that certain key discriminating variables were present across this range of sectors. These included:

- * The number of product/service lines offered by the company. Multiplicity of product lines tended to be greatest in companies involved purely in distribution, as might be expected, and in those manufacturing companies producing for consumer markets.
- * Whereas industrial suppliers often had limited client lists, many of the companies involved in fast moving consumer goods (FMCG) manufacturing and/or distribution tended to have from 1,000 individual accounts upwards. A proliferation of small, independently managed accounts coupled with a lack of centralised purchasing in retail groups are noticeable features of retail distribution in Ireland.
- * The information required to effectively manage the logistics function is not clearly defined within many companies.
- * There appears to be a marked reluctance on the part of grocery multiples to recognise the benefits of sharing information with suppliers.
- * The structure of retailing in Ireland poses considerable logistical problems which impact adversely on costs. The lack of centralised warehousing by the multiples groups further accentuates this problem.
- * The completion of the Single Market poses threats for indigenous manufacturers, particularly those in the food, confectionery and soft drinks trades. They may well face stiffer competition on the home market from cost efficient European manufacturers and distributors.

The initial fifty companies surveyed were reduced to a short-list based on those companies which comprehensively mirrored the discriminating features outlined in the exploratory interviews. The final selection composed of three companies: a multiple group (Sigma) and two suppliers--one manufacturing and selling a commodity type product (Alpha) the other a distributor involved in the FMCG category (Beta). It was felt that this combination would present an accurate simulation of what would be encountered in the adoption of EDI in the retail sector.

LOGISTICS AND IT AUDITS OF PILOT PARTICIPANTS

The multi-site nature of the multiple groups and their relationship with suppliers highlighted the critical need for the speedy dispersal of both information and product between a number of different locations widely spread from a geographical perspective. Failure or delays in the communication of essential information can decouple the system and lead to a reduction in customer service and operational efficiency.

Both the logistics and IT audits were carried out over a period of three months with the objectives of understanding the nature of the supply chains and the existing hardware/software configurations of each of the project participants. A general representation of the typical flows of information between the manufacturer-wholesaler-retailer that prevailed is illustrated in Figure 1. (Figure 1 omitted). The link between the distributor (Beta) and retailer (Sigma) was a one-to-one operation--where orders go from H.Q. to H.Q. and deliveries from central warehouse to central warehouse. However, a more complex relationship existed between the manufacturer (Alpha) and the retailer, where orders emanated from the various retail outlets to the depots (via manufacturer sales representatives) and deliveries were made from the depots to the outlets. This scenario is very representative of the mixes of order/delivery mechanisms found in the FMCG sector in Ireland. It also

represents a representative model from the point of view of establishing an EDI system for installation and subsequent evaluation.

TECHNICAL IMPLEMENTATION

At the pilot implementation stage it was necessary to run existing "paper" procedures to ensure business continued as normal. This is standard practice with any EDI introduction (see Benjamin et al. 1990) as test and debugging can take some time. Introducing EDI as a commercial tool was to remain as a business issue that would involve a restructuring of the existing set of trading relationships. For this reason, the pilot study had to be non-invasive while simultaneously providing insights into the viability or otherwise of EDI. Pilot involvement demanded a high level of commitment from all participants with scheduling being of critical importance.

The main steps involved were as follows:

- * Increasing the awareness of participants
- * Building a schedule for the pilot.
- * Configuring the EDI network for the trading pairs.
- * Training on system usage.
- * Translation packages to allow the interpretation of received EDI documents.
- * Installation and test.

The pilot participants were equipped to generate and receive all of the necessary trading documentation. The hardware and software configurations used by the three participants included IBM, ICL and DEC. All of these systems were capable of being interfaced with EDI, although the system diversity presented an added challenge in technical implementation.

Eirtrade provided the EDI service for the purpose of the experiment.

The EDIFACT syntax standard was applied, using the appropriate United Nations Standard Messages (UNSM) subsets as defined by the Article Numbering Association (ANA). It was decided to employ a front-end communications processor that would communicate with the EDI service for the transmission and reception of EDI messages. The mainframes at the host sites were linked to the PCs for the necessary uploading and downloading of data. This approach had a number of advantages:

- * it was relatively inexpensive,
- * it did not necessitate any major central mainframe modification,
- * it did not require the operation of the mainframe to test the mainframe functionality,
- * it did not compromise central computer security,
- * software was immediately available to link the PCs to the EDI service and to the mainframes. The translation and transmission/reception software used was a combination of the proprietary Interbridge/Intercept module.

EVALUATION

The trials with EDI transmission and reception were carried out over a period of four months. By limiting the parameters of the study to just three participants, it was possible to monitor the experiment by way of weekly project meetings with financial, marketing and data processing personnel at each company. In addition at the conclusion of the experiment, a round table workshop comprised of the project team, pilot participants and service providers provided an appropriate forum for the elaboration of respective experiences during the study.

In the context of pilot evaluation, Bytheway and Dyer (1991) have documented the difficulties that generally prevail--the costs are uncertain (because it is a first-time experience and the benefits unclear (the emphasis should be on exploring the concept rather than saving money)). Such problems were further compounded in our research as it was difficult to quantify "hard" benefits because the critical mass of transactions needed to obtain such benefits could not be realised in just four months. A concomitant problem experienced was the need to maintain the parallel running of the paper system to ensure the continual smooth pattern of trade between the participants, if and when problems arose at the installation and testing stage. Nevertheless there was unanimous consensus among the participants with regard to the following outcomes.

COST SAVINGS

Sigma (the multiple chain) and Beta (the FMCG distributor) identified that management time had previously been absorbed by the dual requirements of extracting a relevant product line set from the price list order form (PLOF) and the

identification of products on special promotion or price terms. Both participants indicated that full scale implementation of EDI would improve management value-added productivity significantly. In addition Sigma predicted that about five clerical personnel could be redeployed in other job roles.

CUSTOMER SERVICE BENEFITS

Beta indicated that the pilot programme clearly showed that EDI could provide them with a solution to the problem of improving customer service in a relatively low-margin business whilst not incurring significant additional costs. Flexibility and responsiveness in information provision on the part of Beta were acknowledged by Sigma. This amounted to an anticipated saving of two days as compared to the industry average previously experienced by the participants. In addition, Alpha reported that the pilot experience had provided preliminary pointers as to how inter-site communication could be fully rationalised in order to use information reaching headquarters with a zero-time lag. As a result, the lead time required to supply Sigma could be reduced by as much as three to four days.

INVENTORY CONTROL

Given the power of multiple groups to dictate inventory levels and location in a retail environment, it was not surprising to find that Sigma was the primary beneficiary in relation to inventory control. They reported that EDI eliminated unapproved goods as a result of a supplier's sales representative artificially inflating the agreed order (on the assumption that extra goods are seldom refused).

REDUCING TIME LAGS AND LEAD TIMES

All three participants agreed that EDI had the potential to significantly reduce time lags although a degree of adjustment in internal systems would be necessary in each case if the benefit was to flow through fully to dispatch and distribution. Thus in the case of Alpha, inter-site communication would require to be fully rationalised in order to use information reaching H.Q. with zero time lag to improve overall lead-times of up to ten days on delivery from the time of raising an order in-store.

BARRIERS TO ADOPTION

Barriers encountered in the adoption and diffusion of EDI implementations and solutions have been extensively documented. Janssens and Cuyvers (1991) have highlighted legal and contractual issues, the use of "just to be sure" paper back-up procedures, time lost in the mailbox and delays due to measurement difficulties in cost/benefit analysis as the primary obstacles to adoption. In addition, the pilot participants indicated the following obstacles which are in some instances specific to the Irish retail environment.

TRADING PARTNER NEGOTIATIONS

Both Alpha and Beta (the two suppliers) indicated that EDI would not be used on a widespread basis unless the adoption process is demanded as a *modus-operandi* for trading by the multiple groups. This reflects the position in the United Kingdom where the major multiple groups such as Sainsburys, Marks and Spencer, ASDA and Tesco have been prime movers in compelling their suppliers to use EDI. Indeed it is likely that the UK. experience, which has added to the power of the multiple groups, will be reflected in Ireland, thereby raising the issue as to whether or not EDI would disproportionately favour a small number of relatively larger retailers rather than SMEs in the manufacturing/distribution sector.

LACK OF CENTRAL WAREHOUSING

The pilot implementation highlighted that EDI was easier to introduce in the case of the linkage between Sigma (the retailer) and Beta (the FMCG distributor). This was primarily due to the less complicated delivery position as a result of the central warehousing of Beta's product lines. However, central warehousing is not a key feature in the logistics system design of the major multiple retailing groups in Ireland. The predominance of multi-site/multi-drop delivery patterns and independent purchase decision at store level does not reflect the UK. position and indeed would not encourage a suitable framework for EDI adoption.

COMPETING TECHNOLOGIES

Although four major multiples account for over fifty per cent of retail market share in Ireland, the remaining outlets are of considerable importance to suppliers also. Such outlets tend to be smaller and more geographically dispersed than the multiple groups. Both Alpha and Beta were in the process of evaluating portable hand-held solutions for this sector, and in the light of a perceived possible incompatibility with EDI implementation, had not discounted this type of technology for order transmission in its entirety. Thus one of the major barriers to EDI adoption in Ireland is the availability of a perceived

competitive solution in the form of portable hand-held terminals. Such a solution was articulated by the sales personnel of both Alpha and Beta, who felt that the easier and less costly implementation of a hand-held solution coupled with supplier control of order transmission were major benefits that could not be realised quickly (or at all) in an EDI implementation.

COMPATIBILITY OF AVAILABLE VALUE-ADDED NETWORKS

Reservations about the incompatibility of commercially available VANS were voiced by both suppliers. Concern was expressed about having to subscribe to two or more EDI services. This highlights the need for an internationally agreed network that is operational across national boundaries.

LACK OF TRADING PARTNERS

All parties in the pilot programme indicated that it would be difficult to appraise the future of EDI because of the limited dimensions of the trial in terms of the number of participating parties. It was felt that a critical mass in terms of numbers of users would be necessary before adoption would become more widespread.

EDUCATION AND TRAINING

The preliminary interviews with over fifty companies highlighted a considerable amount of disparity in the application and comprehension of logistics system-design in supply chains and the possible benefits that could be derived from implementing integrated information systems. Comprehension and awareness would need to be addressed to further the process of EDI diffusion.

INFORMATION TECHNOLOGY PRIORITIES IN THE RETAIL SECTOR

Lower rates of adoption of electronic point of sale (EPOS) and scanning technology in the Irish retail environment and the limited usage of sales information indicated significant scope for the application of new information technologies. However the process of diffusion has been more prolonged than one might have expected. It can therefore be expected that this process will probably be reflected in relation to the spread of EDI.

A STRATEGY FOR DIFFUSION

Any strategy to promote the uptake of EDI must focus on negating the impact of such barriers while simultaneously emphasising the considerable benefits to users of such a service. Nelson (1990) has suggested a model whereby organisations migrate through a series of evolutionary stages in the course of EDI implementation. This model is illustrated in Figure 2. (Figure 2 omitted).

Nelson argues that organisations can move initially from a position of "passive EDI" to one of "active EDI" but that the greatest benefits accrue at the last stage, i.e. performing processes in a better business by using EDI to offer completely new products and services. Carter and Ragartz (1991) also suggest a four-stage evolutionary progress as the most typical pattern of EDI adoption. In this regard, a number of factors in the Irish retail environment could be influential in either hindering the adoption of EDI or of convincing potential users of the urgent need to participate:

* As already outlined, suppliers have been adopting hand-held terminals as a sales force tool which eliminates much paper and provides for remote data entry. The rate of adoption has been accelerating. These terminals present "an Irish solution to an Irish problem" where approximately fifty per cent of retail FMCG sales are by way of a fragmented network of geographically dispersed independents. Because of the commitment of resources and staff training on the one hand and the apparent hard benefits arising on the other, companies that have adopted hand-helds may well postpone any consideration of further change particularly when such change may require radical revaluation of business practices.

* It is widely anticipated that the completion of the Single European Market will precipitate radical change in the Irish distribution sector though the exact shape of that change has yet to be determined. At stake is the control of supply chain relationships. Distributors who fail to gain competitive efficiency through the use of technology could be vulnerable. Paradoxically the adoption of EDI by manufacturers may encourage them to bypass distributors in any event and seek direct relationships with retail customers. This dual threat poses a difficult dilemma for distributors, a dilemma that will not be resolved by adoption of hand-held terminals with their limited impact upon the pattern of trading. Distributors may well be led to adopt EDI eventually through retailer pressure. Careful consideration needs to be given therefore to the option of early adoption.

* Power is concentrated in the hands of a small number of multiple retailers. EDI may deliver the greatest competitive advantage to large multiples while simultaneously damaging smaller competitors and independent retailers. Policy aimed

at the diffusion of EDI could however be focused towards widening the uptake pattern in order to further disperse the benefits.

PROGNOSIS

Focusing initially on the negative impact of barriers to adoption in the Irish context, it is suggested that a strategy for implementation must incorporate the following measures:

- * The retail sector must arrive at a consensus as to which service or combination of services is most appropriate for their requirements. While subscription to a number of services may not present a financial burden to the retail sector (as suggested by Sigma), the issue of incompatibility of different services was one that was voiced by both Alpha and Beta, both of whom expressed concerns not primarily about extra subscription costs, but more so in relation to perceived duplicated investment in hardware and software requirements. As this decision is likely to be retailer-led, it is important for the retail groups to understand the reservations expressed by the suppliers concerning this issue.
- * As a proactive step in this direction it is suggested that if a variety of network services are proposed by the retailers, that inter-network gateways be aggressively promoted to increase awareness amongst the supplier user base. Cullen (1992) has argued that while progress has been made in interconnecting different networks, that it is still disputed within the network industry as to whether or not the same level of service is available across interconnections. On the other hand, Benjamin and Blunt (1992) contend that standards for interconnection and interoperability will be comprehensively developed by the end of the decade. One way or the other, supplier reservations must be diminished while simultaneously avoiding a monopolistic situation in relation to network availability.
- * The manufacturing/wholesale distribution sector must adequately distinguish between the likely application sectors for EDI and hand-helds. While an EDI solution is likely to be prompted by the multiples, the adoption of hand-helds is an alternative technology that can be pushed by manufacturers/distributors in the independent/symbol group stores, where the distribution of trade and geographical dispersion suggest they are more appropriate.
- * Pilot participants expressed the view that the dangers of a monopolistic service provider emerging coupled with a possible deterioration in cost structures could be met either by competition or by regulation. If a monopoly emerges, the early adoption of a national regulatory framework may encourage uptake among potential users.
- * It appears that whatever the technology (EDI or hand-held), there will to be a considerable impact on the traditional role of the sales force, emphasising the merchandising rather than order-taking function to a far greater extent. Such changes in responsibility and job definition need to be handled with due care.

An implementation strategy must also focus on promoting the positive aspect of EDI in relation to a possible user base.

Suggested measures in terms of a "push" strategy include:

- * A comprehensive marketing/education programme emphasising the strategic, opportunity and operational benefits of EDI to both retailer and supplier groups.
- * Active agents to promulgate change must be introduced to the marketplace arguing for the kinds of change in logistics systems that will be necessary for full-scale EDI adoption. Key retailers and a number of key suppliers must be encouraged to lead. Indeed in the course of our exploratory research, one retailer commented that the retail trade in Ireland only adopted scanning when the technology had stabilised and that this phenomenon may well be repeated with EDI.
- * Intending service providers must create a pricing structure that will facilitate rapid initial uptake. The scale of Irish firms is relatively small and it is important for the future of EDI that suppliers are not deflected towards exclusive adoption of hand-helds that provide many of the immediate hard benefits in dealing with their total customer base.

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DETAILS

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