

# Developing an XML/EDI trading system for business-to-business electronic commerce: An Exploratory Study

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## Abstract

*Recent times have seen the rate of adoption of EDI systems decrease significantly. In an attempt to develop widely accessible EDI systems companies are looking to the Internet and emerging standards for data transportation. An XML-based electronic trading system is an example of a system that facilitates Internet-based EDI transactions. The purpose of this research is to investigate the issues associated with developing an XML-based electronic trading system. The findings indicate that while there are difficult issues to overcome when developing an XML-based electronic trading system, these issues must be considered and resolved prior to developing the system*

## Keywords

Inter-Organisational Systems (IOS), Electronic Data Interchange (EDI), E-Commerce, Extensible Markup Language (XML)

## **1. INTRODUCTION**

In the past organisations have looked on information systems' (IS) as support functions for the essential business of the organisation (Swatman and Swatman 1992). Information Systems (IS) have tended to be used for decision-support activities, as an aid in resolving organisational issues within the context of the individual organisation and operational issues. Over the last-two decades the nature and impact of IS on the organisation has changed. Organisations have begun to realise the potential of IS to provide strategic benefits either as weapons of competitive advantage or as strategic resources to provide long-term comparative advantage (Benjamin, et al. 1983).

The role of IS has now moved out of the back-room support function and started to affect the competitive positions of business. The strategic advantage gained through IS is possible because of the continuous advancements in Information Technology (IT). The most prominent use of strategic information systems is in the area of systems which cross organisational boundaries, namely inter-organisational systems (IOS) (Mahadevan & Lucknow, 1997).

This paper examines the issues encountered with developing an XML/EDI trading system. It focuses on the organisational, technical and inter-organisational issues encountered by an organisation when developing this system. Previous literature has looked at these two technologies in isolation. It has neglected to study the issues associated with merging these technologies to provide a total solution for business-to-business electronic commerce. However, with the current market for EDI saturated (McKendrick, 2000), it is critical that research now focuses on the evolution of EDI to allow the transfer of data over the Internet. XML/EDI offers the greatest potential for meeting the needs of a changing marketplace.

## **2. INTER-ORGANISATIONAL SYSTEMS (IOS)**

Kaufmann (1966) identified the concept of data systems that cross organisational boundaries. The two most commonly used terms to describe IS that connect separate organisations together are electronic data interchange (EDI) (Cunningham, 1990; Benjamin et al, 1988) and IOS (Ives & Learmonth, 1984; Cash & Konsynski, 1985 and Konsynski and McFarlan, 1990). Inter-organisational systems (IOS) have widely been regarded as important strategic systems which help develop competitive advantages for those organisations that use them. IOS are essentially systems that cross organisational boundaries and connect the organisation with its customers and/or suppliers. The most accepted and simple definition is that provided by Cash and Konsynski (1985) who state that IOS consist of a computer and communication infrastructure that permits the sharing of an application. The distinguishing feature of IOS is the fact that they link a company to its suppliers, distributors, or customers (Johnston and Vitale, 1988).

Studies undertaken by Barrett and Konsynski (1982), Cash (1985), and Cash and Konsynski (1985) set out that the reason for the rapid growth of IOS is their ability to provide fast, reliable information exchanges in response to rapidly changing markets, products, and services. Furthermore, IOS are also appropriate where there are industry guidelines, standards, and protocols. These standards force consistency of message content, making it easier for organisations to establish and participate in inter-organisational systems.

IOS benefit organisations by allowing better management and control over their value systems (Thompson and Strickland, 1996). Cunningham and Tynan (1993) argue that electronic trading can increase the competitive position of an organisation by tightening its grip on the logistics of the supply chain. It can also enable closer relationships with fewer more comprehensive suppliers. The effects of this relationship building include new levels of competition between supply chains rather than individual organisational units as well as vertical integration (Holland, 1995). IOS can also shift the balance of power between the buyer and supplier, making for a possible dependence on either side (Cash and Konsynski, 1985). Feeny (1988) argues that the providers cannot demand or instruct a user to accept the system, instead they can only persuade. However, pressure from trading partners who are IOS initiators play a critical role in IOS adoption, particularly by smaller firms (Swatman and Swatman, 1991; Webster, 1994). Furthermore Cash and Konsynski (1985) stated that inter-organisational systems could be used to minimise the effect of Porter's five forces (Porter 1980; Porter and Millar 1985) on the organisation. The reasons for adopting IOS may not be the same for both organisations (Golden, 1997) and indeed Johnston and Vitale (1988) have shown differences in impact of IOS on the sponsor compared with that of the participant.

### **2.1 Electronic Data Interchange**

The relationships between firms and their business partners are changing. Partnerships have become a major theme of business, and increasingly, firms are aligning themselves with suppliers in order to stay ahead of the competition

(Palmer and Johnston, 1996). Electronic data interchange (EDI) systems can be used for exchanging data such as purchase orders, advice of delivery notes and invoices or more complex transactions such as integrated cash management systems or shared technical databases (Holland, 1995). The most essential features of EDI include the direct computer-to-computer communication between two or more business entities, of business documents and information in a machine readable and structured format that permits data to be transferred and used without re-keying (Prekumar and Ramumarthy, 1995).

There is a tendency to confuse EDI with other forms of data communication and electronic messaging such as facsimile and electronic mail (Hansen and Hill, 1989; Cunningham and Tynan, 1993). The salient difference is that EDI involves the transfer of structured data (Webster, 1995; Raymond and Bergeron, 1996). Messaging standards form a vital component of EDI. Agreeing the specific messaging standard to be used between two organisations enables them to communicate via computer-to-computer integration without human intervention. The purpose of such messaging standards is to facilitate the automatic transfer of data (Golden 1997). As inter-organisational communication systems interconnect, in many cases incompatibility problems arise between the hardware and software of many suppliers (Emmelhainz, 1992), which can be overcome by mutual agreements on protocols and formats (Palmer, 1990). In reality a variety of standards have been developed, such as, ANSI X12, which predominated in the US, and EDIFACT which was used in Europe (Janssens and Cuyvers, 1991). However, EDI standards have evolved greatly over the past few years, with the result that those originally developed for a particular business community or a particular country are now merging toward a common worldwide standard known as UN/EDIFACT (Pickot *et al.*, 1993; EDI Association of Ireland, 1994).

The perceived benefits of EDI are the main motivation for its adoption (Swatman and Swatman, 1992; Iacovou *et al.*, 1995). EDI's direct impacts include labour savings in the areas of data transcription, controls and error investigation and correction as well as fewer delays in data handling (Swatman & Swatman, 1992). According to Emmelhainz (1990) EDI leads to improved internal operations, better responsiveness to customers, improved trading partner relationships and an increased ability to compete both domestically and internationally while Swatman and Clarke (1990) believe that significant benefits are to be gained through the integration of related functions across organisational boundaries. Many companies experience problems when implementing EDI. The two most frequently cited problems are the cost of running and maintaining EDI systems (Palmer, 1988, Raymond *et al.* 1996, McKendrick, 2000) and the lack of flexibility (Marchal, *et al.* 1995). Therefore, companies are being forced to look at alternative means of exchanging data with their trading partners. The use of the Internet to conduct EDI transactions offers the most promise for building a system which is accessible to small and large companies alike.

## **2.2 Electronic Commerce**

Electronic commerce is a new way of conducting, managing and executing business transactions using computer and telecommunications networks. Electronic commerce is expected to improve the productivity and competitiveness of participating businesses by providing unprecedented access to an on-line global marketplace with millions of customers and thousands of products and services. In addition it provides participating companies with a new, more cost and time efficient means for working with customers, suppliers and development partners (Kalakota and Whinston 1996). Electronic Commerce as a general concept covers any form of business transaction that is conducted electronically, using telecommunications networks. Such transactions occur between companies; between companies and their customers; or between companies and public administrations (European Commission Electronic commerce report, 1999). The Internet is the largest and most far-flung network system, connecting users worldwide. Inexpensive Internet access allows small and large companies access to expertise, information and resources worldwide, at low cost. It lowers information and entry barriers across various industries, allowing smaller companies to better leverage resources and compete on a global scale (Kambil, 1997; Hammond, 1996).

A widely cited problem with on-line systems is security, although many specialists consider it to be a matter of perception rather than reality (Kline 1995). Nevertheless, perceptions are really what matter in terms of new technology adoption (Bloch *et al.*, 1996). Parties wishing to transact business on the World Wide Web will do so only if they can be sure that data transferred is secure. Whilst the technology for achieving this exists, there is still a perception that credit card numbers can be accessed by non-authorised parties and that electronic payments can be diverted. Powerful encryption mechanisms are critical to the development of electronic commerce (Handol, 1999).

Business-to-business electronic commerce is said to be like God, both everywhere and invisible (Witty, 2000). One of the major technologies supporting business-to-business interactions is EDI (Peat & Webber, 1998). However, due to the cost and complex nature of setting up EDI systems, companies have been slow to adopt such systems.

Companies, especially SME's have looked to more inexpensive ways to perform business-to-business electronic commerce (McKendrick, 2000). It is not surprising that people have turned to the ubiquitous Internet and its related technologies to help reduce the expense of connecting to as many trading partners as possible. One of those related technologies is XML (Sutor, 2000). Internet EDI will bring down some of the barriers that have prevented companies from taking advantage of sophisticated data interchange in the past.

### **2.3 Extensible Markup Language (XML)**

In July 1996 the World Wide Web consortium (W3C) set up a working group to study how the standard general markup language (SGML) could be simplified to allow for its efficient use over the Internet. The result was the development of an Extensible Markup Language (XML) that combined the expressive power of SGML with the Internet-aware functionality of HTML (Marchal *et al.*, 1999). The primary benefit of XML is that it allows the exchange of data between trading partners to evolve to a level that is more affordable and flexible by opening up EDI trading capabilities to firms of all sizes, not just those companies which can afford to set up VANs (Value added Networks) (McKendrick, 2000). Data moves with ease since it flows within a format that's independent of the application and particular application semantics (Linthicum, 2000). However, XML adoption has been limited because of concerns with reliability, security, and bandwidth (McKendrick, 2000). Furthermore, more than 300,000 of the largest companies worldwide already exchange trade documents electronically everyday. XML-based Internet commerce can't simply ignore this realm, which is why a viable XML/EDI solution is critical to the success of XML-based electronic commerce (Ricker, 2000).

The vision for XML/EDI is to develop a trading system which will allow organisations to deploy smarter, cheaper and more maintainable systems to a global audience via the Internet, without the addition of complex and expensive embedded programs (Driscoll, 1997). XML/EDI is thus equally accessible to companies of all sizes (Webber, 1998). EDI has traditionally used unique segment identifiers like tokens to separate and identify data items within messages. Replacing those same segments with Web tokens allows XML to express and carry EDI via Web delivery methods (Webber 1998). This moves EDI away from the costly VAN infrastructure (that had an adoption rate of less than 3% of companies), to the Internet, which is accessible to millions of computers worldwide (McKendrick, 2000). In addition, XML/EDI provides 100% backward compatibility to existing EDI transactions, hence, companies do not have to discard the investment in existing systems and knowledge (Peat & Webber, 1997).

The concept of electronic commerce is not a new one. Companies have been buying and selling goods electronically for the last 20 to 30 years. They were not using the Internet, but rather EDI (Sutor, 2000). Fortune 1000 companies which could afford to buy and maintain EDI systems have primarily used EDI. However, the cost associated with EDI has prevented it from becoming the standard form of business-business electronic commerce (Witty, 2000). With a potential market of over 1.8 trillion dollars by 2004, companies are looking to expand their EDI capabilities to allow them to trade with companies of all sizes, not just the companies who can afford EDI (Witty, 2000). The Internet and XML open up EDI trading capabilities to firms of all sizes (McKendrick, 2000).

## **3. RESEARCH OBJECTIVE AND METHOD**

This study investigates the organisational, technical and inter-organisational issues associated with developing an XML/EDI model for business-to-business electronic commerce, from the multi-national company perspective.

Corbitt (2000) advocates the need for interpretative methods in studying IS issues, especially in electronic business environments. Interpretative studies focus on developing a greater understanding of social aspects of the research environment (Walsham, 1993), and are thus considered useful in the context of this study. Case studies are regarded as the most commonly used qualitative research method in IS, and are especially useful for studying organisational aspects of IS (Benbaset *et al.*, 1987). Cases are most appropriate when the objective involves studying contemporary events, without the need to control variables or subject behaviour (Yin, 1994). The single case study method is considered to be a potentially rich and valuable source of data, while suited to exploring relationships between variables in their given context (Yin, 1994; Benbaset *et al.*, 1987) and is appropriate where it represents a critical case. Given the exploratory nature of this research and the need to obtain rich data in a complex organisational context, a case study approach was adopted. 'A case study examined the phenomenon in its natural setting, employing multiple data collection methods to gather information from a few entities. The boundaries of the phenomenon are not clearly evident at the outset of the research and no experimental control or manipulation is used' (Benbaset *et al.*, 1987). A single organisation was selected for this research study. Selection was not based on best practice, but rather on the ability to investigate thoroughly the issues associated with the development of an

EDI/XML trading system. The researchers first examined all relevant documentation concerning the proposed system and, as a result of this preliminary analysis, prepared a case study protocol as defined by Yin (1994) and sent it to the contact person at the organisation. Based on this protocol, interviews were arranged with key personnel at the organisation. A semi-structured interview format was used to encourage interviewees to discuss openly the issues they considered important to the development of the trading system which it was hoped would lead to richer findings. In addition to the interviews which took place during a site visit, the researchers were also given access to relevant documentation. The site visit was followed by several conference calls with the contact person in order to clarify issues and confirm the accuracy of the data collected. While objectivity in personal interviews is unachievable (Birnberg *et al*, 1990), and bias in any social sciences fields, including Information Systems (IS) is inevitable (Vitalari, 1985), the intention of the researchers was that the above approach would give a more in-depth understanding of the phenomenon under investigation.

### **3.1 Intel: E-Business Group (EBG)**

Intel was founded on July 18, 1968 and is the largest manufacturer of computer devices in the world. Intel employs approximately 80,000 people in 48 countries worldwide and is committed to developing innovative technology. The objective of the E-Business Group (EBG) at Intel is to use the *'unique power of the Internet to create significant value for Intel, its brands and its customers'*. EBG has the responsibility to provide an architecture that seamlessly ties various technologies together into a heterogeneous environment. This architecture provides the core capabilities that enable web applications to exchange data between Intel and its trading partners. EBG's focus has been on automating the supply chain and developing a solution to allow Intel to conduct electronic transactions with all its suppliers, not just those who can afford to develop EDI systems. This has driven Intel and EBG to look to the Internet as a means of providing a total solution to business-to-business electronic commerce. While EDI standards present a formidable foundation for electronic transactions, the cost of setting up an EDI system and maintaining a VAN greatly restricts the number of companies willing to trade in this way. In fact, in 1999 Intel performed less than 10% of their transactions with suppliers via EDI. Therefore, it is not surprising that Intel was looking for a better solution to business-to-business electronic commerce.

Intel had two main reasons for looking beyond EDI. Firstly, Intel's mission was to become a 100% E-corporation. Intel could not achieve this goal by simply using EDI. This spurred Intel to look at ways of developing Internet-based EDI capabilities. Secondly, Intel needed to find a way of transacting electronically with a greater number of its trading partners than was possible with EDI. According to the E-commerce project manager, *"while EDI was an effective system for trading electronically with our larger suppliers, we needed to find a way to extend our e-commerce capability so as to achieve the efficiencies that can be gained through the increased use of electronic commerce"*. As a result EBG began to develop an XML-based system for business-to-business electronic commerce. The goal of the project was to give Intel the ability to trade electronically with all of its trading partners and ultimately to make it the only system for business-to-business electronic commerce within the company.

## **4. FINDINGS**

A detailed analysis of the EBG case study highlights some key organisational, technical, and inter-organisational issues that need to be addressed when developing an XML/EDI model for business-to-business electronic commerce. The main considerations are discussed below and Table 1 presents the findings as a checklist for organisations to address prior to system development.

### **4.1 Organisational Issues**

The gathering of business requirements is fundamental to undertaking any project in the information systems world and the development of an XML-based trading system is no different. According to the E-commerce manager for EBG *"the most important thing to understand before developing this system, was what exactly we wanted it to do"*. However, the gathering of business requirements was a more difficult task in this project because the system being developed crossed organisational boundaries. Hence, it was necessary not only to collect the internal requirements of the company, but also, to collect the requirements of external companies who would also be using the system. The project lead for E-Invoicing stated that *"not only was working with suppliers difficult to organise, it was extremely time consuming"*.

Developing the XML-based trading system has provided Intel with the capability of transacting electronically with many more of their suppliers than was the case with EDI. In fact, when using EDI only, Intel conducted electronic transactions with less than 10% of their suppliers. With the new systems in place, Intel now has the capability of conducting electronic transactions with over 40% of their supplier and this figure is increasing rapidly. While this is very beneficial to Intel, it also requires a large supplier support team. This team needs to have the expertise and resources to deal with these suppliers appropriately. Supporting any information system is a very important and expensive process. However, this system presents some unique difficulties. Not only does this system have to be supported in its own right, it has nearly doubled the need for support of their suppliers. Forming these support teams is something that is time-consuming and hence needs to be thought out well in advance of developing the system.

Legacy systems are back-end databases used by companies to store data. A company as large as Intel requires multiple legacy systems in order to support the corporation. According to the E-business manager *“the biggest challenge with doing business-to-business electronic commerce is the ability to map transactions sent by your suppliers directly to your legacy systems”*. Intel uses a translator (DMZ) to receive documents sent by suppliers and to map these documents to the correct location. Intel did not face this issue when only using EDI because *“EDI was typically a one-way system used to send an invoice, without really expecting anything in return. XML on the other hand allows a two-way system where companies can transact with each other in real-time”*. In order to facilitate this functionality a lot of changes were required to the back-end systems. These changes allowed Intel to automatically transport data into their legacy systems in the correct format. Interfacing with legacy systems is certainly not an insurmountable obstacle, but it is something a company should examine before developing the system.

Although an XML-based trading system is far less expensive to develop and maintain than EDI, the cost of developing it is still a prohibiting factor for many of Intel’s suppliers. According to the E-business manager *“50 – 60 percent of Intel’s suppliers are incapable of doing XML”*. He goes on to say that *“it is an expensive proposition for a small company. The company has to have programmers who not only know XML, but also know a language that can translate XML. Most companies don’t have the resources to support this”*. Any company undertaking the development of an XML-based trading system should be fully aware of the costs associated with developing such a system. For a company as large as Intel, this was not an issue. However, for many of Intel’s suppliers, the cost of developing and maintaining the system was the main issue determining its development.

## 4.2 Technical Issues

Every manager interviewed stated that *‘defining standards for XML transactions was the biggest obstacle to developing the XML-based trading system’*. XML is an extremely flexible programming language and it provides the flexibility to define tags and the structural relationships that exist between them. While this makes XML infinitely extendable, it presents a big problem for companies trying to transact with it. For companies to be able to transact effectively and efficiently using XML a standard set of tags with predefined structural relationships is required. In an attempt to achieve this Intel joined an initiative known as RosettaNet.

Within Intel, while security was seen as an issue that needed to be addressed early in the development of the system, it was easily overcome by using the technology available. According to the EC Project Manager, *“Security technologies have improved significantly over the last three years, almost to the point where security is no longer an issue for E-Commerce”*. The EC Supplier Coordinator was not quite so positive and said *“while there are ways to overcome the security risks associated with E-Commerce, it is an issue that should be resolved prior to developing a system that transports data over the Internet”*. Intel secures the files it transports over the Internet in two different ways, either by using encryption techniques or digital certificates. Encryption ensures that only the recipient can decipher the document. Digital certificates verify the person sending the document and ensure the document has not been changed without the necessary authorisation.

XML is a relatively new technology. It has only recently received recognition from the W3C as being an effective tool for transporting data over the Internet. Outside the US and especially in Asia, very few companies have knowledge of what XML is and how it can be used. According to the E-Business manager, *“knowledge of XML and what it can do, especially outside of the US, has made it extremely difficult to push XML out to as many of our suppliers as we would have liked. As you can imagine, trying to explain how XML can be used to a Chinese technologist who speaks little or no English becomes extremely difficult”*. In order to overcome this issue, Intel needs to invest a large amount of time and resources into expanding the knowledge of XML to its more regional suppliers.

Reliably in transporting data between companies is fundamental to any electronic trading system. With EDI, information is transported over VANs. This ensures that the data gets to the desired location. A VAN also keeps a

log of what data was sent and where it came from, so that in the event of a problem companies can decipher where the process failed. The Internet, being a public network, makes it more difficult to transport reliable data and to track whether that data arrives at the desired location. According to the EC Supplier Coordinator, *“the ability to define a way to make it easy to swap data in a reliable fashion was imperative to the success of this project”*. In order to overcome this obstacle, Intel began by examining the different file transport protocols available over the Internet. According to the E-Business Manager, *“stability was the most important characteristic for us when deciding which of the protocols to use. We have the ability to secure the files ourselves by using keys and certificates”*.

### 4.3 Inter-organisational issues

In terms of supplier resources, it was important for Intel to ensure the majority of its trading partners could support the system before they decided to invest and develop it. In an attempt to understand the ability of external companies to support the system, Intel performed a supplier capability assessment. The purpose of the document was to assess the capability of suppliers to engage in E-Business activities with Intel using XML document exchange. A supplier’s capability was gauged on the sophistication of their computing environment and the software components they had installed at their site. Depending upon the assessment, an estimate was given for the efforts required by the supplier to engage in XML document exchange. At the time of the research only 40% (approx) of their trading partners had the capability to perform XML transactions.

As a multi-national company Intel transacts with many companies in non-English speaking countries. According to the E-business manager, *“probably the biggest issue with dealing with companies outside of the US is the language barrier”*. When using EDI this was not an issue because EDI uses a series of numbers to define where to transport data. XML on the other hand uses a series of tags with words defining where to store the data. This presents an issue when transacting with non-English speaking countries because XML standards are written for the English language, hence, it is extremely difficult to perform XML-based transactions with any company not using English as their working language. To overcome this issue, Intel is currently translating their XML documents into Chinese, Japanese and Taiwanese. This is a costly and time-consuming process and one that a company should not overlook when considering the development of an XML-based trading system.

The ability to transact electronically with another company requires a defined process so as to ensure that the document being transported gets to the desired location. When using EDI, this process was relatively simple to define because Intel was conducting electronic transactions with less than 10% of their trading partners. With the development of the XML-based trading system, this figure has increased to over 40% of their trading partners, hence, making the process far more complex. According to the Project Lead for E-Invoicing, *“it is important to hire commodity managers who can build relationships with suppliers if we want to learn what the optimal trading partner locations are to both send and receive information”*. Forming a team with the skills to perform this role is not a trivial matter and should be considered before undertaking the development of the system.

Any system development requires a significant amount of testing. When developing internal systems this is usually not an issue but with systems that cross organisational boundaries this process becomes infinitely more complex. According to the E-Business Manager *“organising testing of the system, especially with companies outside of the US, was not only a difficult task, but an extremely time-consuming one”*. As a multi-national company Intel faced difficulties in organizing suitable times to test the system and difficulties in persuading suppliers to provide adequate resources to ensure that the testing process succeeded. The process requires a significant amount of resources to be provided by both the supplier and Intel, and is extremely time-consuming. Table 1 presents a list of pre-requisites that must be considered prior to developing an XML-based Trading System.

<b>Organisational Issues</b>	<b>Summary</b>
1. Requirements gathering	The need to gather an adequate set of requirements so as to fulfil all the needs of the users.
2. Supporting the system	The ability to support the system adequately and to form a team with the necessary expertise to resolve any issues that might arise.
3. Inter-facing with legacy systems	The ability to integrate data received with existing legacy systems seamlessly.
4. The cost of developing the system	The development costs of the XML-based trading system. The cost may be a deterrent to many smaller suppliers hoping to build a similar system.
<b>Technical Issues</b>	<b>Summary</b>

1. Defining standards	The need to define a standard for transporting data over the Internet using XML. RosettaNet is an initiative which attempts to do this.
2. Security	The ability to transport data over the Internet securely.
3. XML Knowledge	The limited knowledge that many other companies possess regarding what XML is and how it can be used to perform electronic transactions.
4. Reliability	The ability to transport data over the Internet in a reliable fashion.
<b>Inter-organisational issues</b>	<b>Summary</b>
1. Supplier Resources	The systems infrastructure necessary for suppliers to conduct E-Business activities with Intel.
2. Translating XML into multiple languages	The need to translate XML into foreign languages so as to facilitate electronic transactions with companies in Non-English speaking countries.
3. Building relationships with suppliers	The need to build close relationships with suppliers so as to learn where the best locations to buy from are
4. Testing Coordination	The ability to coordinate the testing of the system with external companies, especially those residing outside of the US.

**Table 1: Checklist of Issues Associated with Developing an XML-based Trading System.**

## 5. FINAL THOUGHTS

XML is increasingly being used by organisations to conduct electronic transactions and to improve operational efficiency. The two main motivating factors driving organisations to develop an XML-based trading system are that it is inexpensive to develop and maintain and that it allows a greater number of trading partners to conduct electronic transactions with each other, hence, streamlining the supply chain. Intel's main motivation for developing the system was to become a 100% E-Corporation. They could not achieve this by using EDI only.

This research was intended as a starting point to understanding the issues associated with developing an XML-based trading system. As XML becomes more widespread it will become more important to understand the benefits that XML affords an organisation. However, while XML is still an immature technology, it is important to focus on understanding the issues associated with developing these systems and how best to resolve them.

## 6. REFERENCES

Barret, S. and Konsynski, B. (1982) "Inter-organisational information sharing systems" *MIS Quarterly* 93 – 105.

Benbasat, I., Goldstein, D.K. and Mead, M. "The Case Research Strategy in Studies of Information Systems," *MIS Quarterly* (11:3) 1987, pp. 369-386.

Benjamin, R.I. and Rockart, J.F., Scott Morton, M.C. and Wyman, J., (1983), *Information Technology: A Strategic Opportunity*, Sloan Management Review.

Birnberg, J.G. and Young, S.M. (1990) "The case for multiple methods in empirical management accounting research", *Journal of Management Research*, Fall.

Bloch, M., Pigneur, Y., Segev, A., (Mar. 1996), *On the Road Of Electronic Commerce, a Business Value Framework, Gaining Competitive Advantage and some Research Issues*.

Cash, J.I. Jr. & Konsynski, B.R., (1985), *IS Redraws Competitive Boundaries*, Harvard Business Review Mar April, pp. 134 to 142.

Cash, J.I. Jr., (1985), *Inter-Organisational Systems: An Information Society Opportunity or Threat*, The Information Society, Vol. 3, Number 3.

Corbitt, B. J. (2000) *Developing intraorganisational electronic commerce strategy: An ethnographic study*, Journal of Information technology, vol. 15, no. 2, pp. 199-130

Cunningham, C. & Tynan, C., (1993), *Electronic Trading, Inter-organisational systems and the nature of buyer-seller relationships: The need for a network perspective*, International Journal of Information Management 13, pp. 3-28.

- Cunningham, M.T., (1990), Survival and Growth Strategies in New Technology Markets: A Study of the Electronic Data Interchange Industry, In R. Fiocca & I. Snehota, (Eds.), Research Developments in International Industrial Marketing and Purchasing. Proceeding of the 6th I.M.P. Conference, 346 – 372.
- Driscoll, Chris, 'XML Touted as a Cure for EDI Ills', EDI News, August 1997.
- EDIAI, (1994), A report on the usage and trends in the Republic of Ireland, EDI Association of Ireland, pp. 1 – 34.
- Emmelhainz, M. A. (1990), Electronic Data Interchange: A Total Management Guide, New York: Van Nostrand Reinhold.
- European Commission Electronic Commerce Research Report (1999), What is Electronic Commerce.  
[www.ispo.cec.be/ecommerce/introduc.htm](http://www.ispo.cec.be/ecommerce/introduc.htm)
- Feeny, D., (1988), Creating and Sustaining Competitive Advantage with IT, in Earl, M.J. (ed.), Information Management, pp.98-117.
- Golden, W. & Powell, P. Inter-Organisational Information Systems and the Gains from Organisational Flexibility, 1997.
- Hammond, (1996), Digital Business: Surviving and Thriving in an on-line world, Hodder & Stoughton,  
[www.Hammond.co.uk/digitalbusiness.html](http://www.Hammond.co.uk/digitalbusiness.html)
- Handol, J., (1999), The legal framework for electronic commerce, William Fry Solicitors, [www.williamfry.ie](http://www.williamfry.ie)
- Hansen, J., and Hill, N., (1989), Control and Audit of Electronic Data Interchange, MIS Quarterly, pp. 403 – 413.
- Holland, C.P. (1995) "Cooperative supply chain management: the impact of interorganizational information systems" Journal of Strategic Information Systems 4(2): 117-133
- Iacovou, C., Benbasat, I., and Dexter, A., (1995) Electronic Data Interchange and Small Organisations: Adoption and Impact of Technology, MIS Quarterly, pp. 465 – 485.
- Ives, B., and Learmonth, G.P. (1984). The Information System as a Competitive Weapon, Communications of the ACM, December.
- Janssens, G.K. and Cuyvers, L. (1991) "EDI - A Strategic Weapon in International Trade" Long Range Planning, 24(2): 46 – 53.
- Johnston, R.H. and Vitale, M.R. (1988) "Creating Competitive Advantage with Inter-organizational Information Systems" MIS Quarterly, 12(1): 153 – 165.
- Kalakota, R and Whinston, A.B., Frontiers of Electronic Commerce, Addison-Wesley Publishing, 1996.
- Kambil, A., (1997), Doing Business in the Wired World, IEEE Computer May, pp56-61.
- Kaufman, F., (1966), Data Systems that Cross Company Boundaries. Harvard Business Review, Jan-Feb, 141 – 155.
- Kline, D., (1995), False Alarm: Credit Card Security, Market Focus, Oct. 23rd, Hotwired.
- Konsynski, B.R. and McFarlan, F.W. (1990), Information Partnerships-Shared Data, Shared Scale, Harvard Business Review, Sep – Oct 1990.
- Linthicum, David S, (2000), 'Say Goodbye, EDI', Enterprise development Magazine, Feb. [www.enterprisedev.com](http://www.enterprisedev.com)
- Mahadevan, N., and Lucknow, IIM., (Mar. 1997), Information Systems as a Strategic Weapon.  
[www.iiml.ac.in/htmldocs/str\\_mis.html](http://www.iiml.ac.in/htmldocs/str_mis.html)
- Marchal, B, Mikula, Norbert H, Peat, Bruce, Webber, David RR, 'Guidelines for using Electronic Data Interchange' 25<sup>th</sup> January 1995.
- Marchal, Benoit, 1999, 'XML by Example', 1<sup>st</sup> edition, Chap 1, pp. 18.
- McKendrick, Joseph, 'Will the Internet Engulf EDI?' Electronic Commerce World, April 2000, vol. 10, no. 4
- Palmer, D., (1990), EDI – The Nuts and Bolts. In: M. Grifkins, Ed. EDI Technology, pp. 3 – 14, Pinner, Middlesex: Blenheim On-line Publications.

Palmer, J.W., and Johnston, J.S., (1996), Business to Business Connectivity on the Internet: EDI, Intermediaries, and Interorganizational Dimensions. [www.electronicmarkets.org](http://www.electronicmarkets.org)

Peat, B, Webber, D, 'Introducing XML/EDI...the e-Business Framework', 1997, XML/EDI Group. [www.geocities.com/Wallstreet/Floor/5815/start.htm](http://www.geocities.com/Wallstreet/Floor/5815/start.htm)

Pickot A., Neubuger, R. and Niggel, J. (1993) "Management Perspectives of Electronic Data Interchange Systems" International Journal of Information Management, 13: 243 – 248.

Porter, M.E. and Millar, V.E. (1985) "How information gives you competitive advantage" Harvard Business Review, 63(4): 149 - 160

Porter, M.E., Competitive Strategy: Techniques for analyzing industries and competitors, Free Press, 1980

Premkumar, G., and Ramamurthy, K., (1995), The Role of Inter-Organisational and Organisational Factors on the Decision mode for Adoption of Inter-Organisational System, decision Sciences, 26(3), pp. 303 – 336.

Raymond, L., and Bergeron, F., (1996), EDI Success in Small and Medium-Sized Enterprises: A Field Study, Journal of Organisational Computing and Electronic Commerce, 6(2), pp. 161 – 172.

Raymond, L., Renaud, K., Blili, Samir, July (1996), Evaluating the Potential for EDI in a Network Enterprise, ECIS Vol. 2.

Ricker, J, Munro, D, Hopeman, D, 'XML Representation of X12 EDI', 2000.

Sutor, Bob, 'Introducing ebXML', XML Journal, Vol. 1 issue 2, May 2000.

Swatman, P. M. C. & Swatman P. A. EDI System Integration: A Definition and Literature Survey. 1992: The Information Society, Vol 8 pp 169-205, Taylor and Francis.

Swatman, P.M. and Swatman, P.A., (1991), EDI and its Implications for Industry. Managing Information Technology's Organisational Impact, Ed. Clarke R. and Cameron, J., Elsevier Science Publishers B.V. (North Holland) pp. 105 – 115.

Swatman, P.M.C., and Clarke, R., (1990), Organisational, Sectoral and International Implications of Electronic Data Interchange, Proc. IFIP Conf. HCC4 (4th International Conference on Human choice and Computers), Dublin, Ireland, July.

Thompson, A.A. Jnr and Strickland, A.J. Strategic Management: Concepts & Cases, Richard D. Irwin, Chicago 1996.

Vitalari, N.P. (1985) "The need for Longitudinal Designs in the Study of Computing Environments" in *Information Systems Research - A Dubious Science, Proceedings of the IFIP TC8/WG 8.2 Colloquium*, Manchester Business School, September, 1984, Mumford, E. (ed.), Amsterdam, North Holland, 1985.

Walsham, G. (1993) *Interpreting Information Systems in Organizations*, Wiley, Chichester.

Webber, R., (1998) Chablis-Market analysis of digital payment systems, [medoc.informatik.tu-muenchen.de/Chablis.mstudy/x-a-marketpay.html](http://medoc.informatik.tu-muenchen.de/Chablis.mstudy/x-a-marketpay.html)

Webster J. (1994), EDI standard setters: Processes, Politics and Power. *Technologie de l'Information et societe* (special issue on "standardisation"), Dunod Edit, Paris 6(2), pp. 10 –21.

Witty, J, Bloomberg Business-to-business issue, June 2000, Pg. 54. [www.geocities.com/Wallstreet/Floor/5815/edinews.htm](http://www.geocities.com/Wallstreet/Floor/5815/edinews.htm)

Yin, R. (1994). *Case study research: Design and methods* (2nd ed.). Beverly Hills, CA: Sage Publishing.

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