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An evaluation of inter-organisational information systems development on business partnership relations

Elizabeth A. Williamson
Caledonian Business School, Glasgow Caledonian University
70 Cowcaddens Road, Glasgow, G4 0BA, UK
Tel: +44 (0) 141 331 3122
Fax: +44 (0) 141 331 3193
Email: e.williamson@gcal.ac.uk

Abstract

Inter-organisational information systems (IOS) are being used within SCM to improve businesses processes and to facilitate closer working relations with business partners. However, the technologies themselves impact on this relationship as they allow various levels of information flows, communications, function integration and partner integration.

The aim of this paper is to evaluate IOS development influencing partnership integration within Supply Chain Management (SCM) by investigating thirteen businesses that use a variety of IOS. IOS are classified into Elementary IOS, Intermediate IOS and Advanced IOS. Organisational variables such as information flows, partner co-ordination and integration, partner trust and confidence are measured against the level of IOS development. Variables such as management commitment, financial costs, system standards and partner resistance are investigated as forces or barriers, and related to different levels of IOS development.

This research concludes that IOS development results in increased information flows and coordination which supports the development of trust and confidence in business partners. However, the customer position in the supply chain, whether it be retailer, distributor or manufacturer can influence the use of IOS of its business partners. Also, although IOS allows businesses to source and contact a larger range of business partners, the tendency is for businesses to use a smaller number of partners. This work also shows that IOS development changes a business's relationship with its partners and moves it towards partnership integration.

However, a number of organisational factors impact on this integration. These factors vary with the level of IOS development. Management commitment and showing the requirement for IOS development can act as a positive force in developing IOS or as a barrier against IOS development. Other barriers include resistance from business partners, financial costs, lack of system standards and technical maturity of the companies. The effect of these barriers also is affected by the level of IOS development.

Keywords: inter-organisational information systems, supply chain management, business partnership relations

1 INTRODUCTION

An inter-organisational information system (IOS) is a collection of IT resources, including communications networks, hardware, IT applications, standards for data transmission, and human skills and experiences. It provides a framework for electronic cooperation between businesses by allowing the processing, sharing and communication of information (Haiwook, 2001). IOS are also known as extranets and allow electronic processing of business transactions and documents, as well as the transfer of information with minimal effort and makes it quickly available. The growth of IOS in SCM has allowed the flow of information throughout the supply chain by the integration of business processes (Stephens, Gustin & Ayers, in Ayers, 2002).

IOS can be used at both ends of the supply chain. They can be used with customers, to give visibility of data and interaction with company employees and with business partners, such as suppliers and logistic companies. Benefits are the same at both ends and include visibility of data and reduced purchasing costs (Ayers, 2002).

IOS can be categorised into four phases, in terms of historical IS development (Shore, 2001):
Phase One - Manual systems
Phase Two - EDI systems
Phase Three - ERP systems
Phase Four - Internet-enabled systems

Phase One: Manual Systems

This phase includes paper copies of documents such as purchase orders, bills and invoices. The information is processed manually and therefore information technology and telecommunications do not contribute to this system. The disadvantages of this phase are obvious – laborious procedures, inaccurate data, insufficient information and expensive maintenance of the system. This initial phase is still in use in some companies either on a wide scale across the company or in particular departments and in many Small to Medium sized Enterprises (SMEs), as shown in the empirical case studies. This IOS development may be curtailed due to a lack of expertise, financial resources or other organisational or environmental pressures (Papazoglou & Ribbers, 2006).

Phase Two: Electronic Data Interchange Systems

The next phase involved the development of EDI technology in the 1980's and this had a dramatic effect on the automation of heavy data flows and the elimination of many labour intensive key business processes. Paper documents such as purchase orders, invoices, bills of lading and shipping slips were replaced by electronic transmission of the information between computers (McKeown, 2003). EDI was the main technology used in electronic trading in many sectors, such as retail, manufacturing and financial services and has only been widely used since the early 1990's (Williams & Frolick in Ayers, 2002).

Early EDI systems used value added networks (VAN), which are special services on public networks available by subscription, and provide companies with data communication facilities. The company operating the VAN is totally responsible for managing the network, including providing any data conversion between different systems (McKeown, 2003). Therefore VANs were expensive to implement and therefore limited EDI use to the larger companies.

However, as there is no single agreed national or international standard, an EDI link tends to be set up for a specific supplier and buyer. Therefore it is difficult to switch the connection to another partner and a second EDI system may have to be created. Golden and Powell (1999) research showed that EDI limits flexibility of suppliers who are connected to more than one customer since they are required to support specific technologies for each. This resulted in an explosion of EDI software, VAN and EDI standards which made it difficult to integrate the technologies. Also, the full benefits of EDI can only be realized when EDI is fully integrated with other transaction processing systems, such as accounting and sales systems. The information sent via EDI is ordered as a transaction set and this transaction set has a fixed structure. These transaction sets for new products or services also have to be firstly agreed before they can be implemented. These data constraints also hamper EDI growth and implementation.

A second generation of EDI technology, Internet EDI, overcomes some of the disadvantages of the early EDI systems. Companies are able to use existing EDI systems and processes by installing Extensible Mark-up Language (XML) EDI translators on web-servers. Internet EDI lowers entry costs for businesses as data is transmitted over the Internet rather than using subscription to a VAN, and therefore telecommunication costs are minimized. It is also more useful in the global marketplace. Cost savings can be as much as 90% (EDI Data, 2003) and therefore can be implemented by smaller

companies. It uses the same EDI standards for documents. Data transaction sets are also more flexible within Internet EDI and allows easier and quicker development of applications (Papazoglou & Ribbers, 2006). Data is processed in real-time when using Internet EDI, as opposed to overnight batch data flows/processing and this is also an operational advantage. Therefore, due to these benefits over the older system, the volume of Internet EDI is increasing.

Phase Three: Enterprise Resource Planning Systems

This phase describes a more integrated information systems approach. This approach is being taken by companies who view the integration of systems and information flows as being essential in providing improved customer satisfaction and cut operational costs in an increasingly competitive market-place (Jenson & Johnson in Ayers, 2002).

Enterprise-wide systems and databases integrate and coordinate IT operations across the company. These systems, characterized by Enterprise Resource Planning (ERP) systems, have developed from Manufacturing Resource Planning (MRP II) applications. They generally include manufacturing, logistics, distribution, inventory, shipping, invoicing and accounting (Ayers, 2002). The integration of information from all departments in the company in the ERP system means that output or consequences from one system can be fed into other systems, so that there is total information coordination. An ERP system can also assist in controlling business activities such as sales, delivery, billing, production, inventory management and human resource management. Therefore it can cover all primary and support activities within the Value Chain. The implementation of ERP systems also results in organisational efficiencies as they automate processes, integrate functions and improve the quality of information flows (Papazoglou & Ribbers, 2006). The reach of ERP systems can be extended to include partners with the supply chain by the use of SCM software transferred onto the new integrated system. ERP systems, such as SAP's R/3, have been implemented across the globe. Worldwide sales of ERP packages, combined with implementation support, exceeded $15billion in 1999 with annual growth rates of over 30% (Akkerman et al, 2003).

Phase Four: Internet-enabled Systems

The Internet is a worldwide web of computer networks. The development of the protocol, Transmission Control Protocol/Internet Protocol (TCP/IP), allows separate networks of different architectures to work together through open network architecture. The integration of information resources has therefore been enabled by the use of web development technologies such as Extensible Mark-up Language (XML) and Java, which have allowed business partners to integrate their information resources. These systems also provide platforms for fast and reliable communications between trading partners, regardless of physical barriers (Bandyo-padhyay, 2002).

The use of the Internet requires integration of computer systems by examining existing legacy systems and software and developing integrated solutions. However, changing corporate information systems brings about a number of challenges for the business which need to be managed successfully (Krizner, 2001):

1. businesses have invested thousands if not millions of pounds in legacy systems which they will be keen to keep in place
2. the financial and time resources required to carry out systems integration
3. security and risk aspects of opening up internal systems to external parties
4. legacy systems require to be integrated to allow information flow between disparate systems and were not designed to 'talk' to other systems
5. businesses may define processes and data differently from their supply chain partners
6. legacy systems of partners may use different platforms
7. partners will belong to many different supply chains

There are a variety of information mechanisms available for use by managers in SCM, such as auctions, purchasing groups and electronic agents which provide this linkage. Recent developments also include trading exchanges or market places. These are online supply chains which allow the sharing of real-time synchronized information by using XML on features such as prices and delivery information. Examples include NonstopRX.com for the pharmaceutical industry and Retail.com for apparel manufacturers and buyers (Messmer, 2000). These mechanisms may be used to conduct a business transaction, to purchase something at a given price or to share information to coordinate the flow of the item after the purchase has taken place. These collaborative mechanisms come under the Collaborative Planning, Forecasting and Replenishment (CPFR) heading and aim to closely integrate business partners. In order to help companies come together within this system, the Voluntary Inter-

industry Commerce Standards Association (VICS) publishes guidelines to assist companies to achieve their objectives when using CPFR systems. However, the technology may require some business process change and also CPFR should be integrated into the e-business strategy. (Grossman, 2004). Managers are also required to choose the appropriate level of integration for particular relations in the supply chain and the appropriate degree of information sharing (Garcia-Dastugue & Lambert, 2002).

Therefore the Internet is now being used as one of the main networking platform in the upstream, downstream and internal supply chain by both large and relatively small companies.

Current IOS Development within Business

However, companies may be involved in ad-hoc development and use various operational and management information systems. For example, a company may use a legacy system for processing orders and stock control. Legacy systems may also be 'best of breed', bespoke, point or developed internally ERP systems. It may access a customer's web-enabled production system to calculate order quantities and it may implement a new invoicing and accounting system as required by head office which may be a SAP system. These systems may also be totally disjointed, totally integrated, using a web-enabled ERP integrated technology or use a few information systems with some integration of processes, some of which are web-enabled. Such companies may have the objective of full integration in the future. For example, a substantial proportion (82%) of companies surveyed during 2003 expect to be using the web for purchasing in the course of the next few years, while 75% plan to use online technology for order management and 71% for order status, with supplier management (69%) and selling (65%) proving equally popular. (Sweet, 2003). Therefore the actual configuration of IOS used by a company usually consists of a number of IOS, which may be partially or fully integrated internally or externally with business partners. This scenario is evident in the empirical case studies.

2 INTER-ORGANISATIONAL INFORMATION SYSTEMS DEVELOPMENT AFFECTING PARTNERSHIP RELATIONS

Previous research has focused on the how the use of information systems themselves have changed the business structure and influenced partner relationships (Venkatramen, 1991, 1994). Christopher & Juttner (1998) found that the quality of a relationship is strongly influenced by its interface structure. Premkumar in Ayers (2002) states that the nature of the IOS technology and partner linkages, including common partner objectives is important to IOS development and implementation.

Electronic Data Interchange Systems and Partnership Relations

Electronic Data Interchange (EDI) and point of sale (POS) systems have been used generally within SCM to facilitate information flows and therefore communication between businesses and their partners. Research carried out by Hill and Scudder (2002) on the use of EDI systems in the food industry found that the implementation of EDI facilitated inter-company coordination and that EDI users have more coordination with their suppliers than do non-users of EDI. These IOS bring about electronic cooperation by integrating stock holding, distribution, purchasing and other functions to improve customer responsiveness (Mische, 1992). POS systems have been a major influence in increasing information sharing among, for example, logistic managers and show that information exchanges can be beneficial to all parties involved (Lancioni, Smith & Oliva, 2000).

Haiwook (2001) found that EDI provides a better means of inter-organisational coordination than earlier applications of IT, but it is limited in its influence. Similarly, Santema (2003) found that although EDI improve communication between business partners, it doesn't 'add value' to the relationship. This supported previous findings by Clemons & Row (1993), who found that EDI-based checkout scanners significantly affect efficiency and information flow in distribution channels, but that automating the processes in this way, doesn't increase electronic cooperation. He concluded that only by sharing company information, such as in a two-way information flow, is a true partnership developed. EDI has also been accused of depersonalizing inter-organisational relationships due to its restricted information format (Morris, Tasliyan & Wood, 2003).

Crook & Kumar (1998) found that a number of organisational variables, including the partners' experience of EDI influenced the expansion of its use. Vlosky et al (1997) found that buyers, such as manufactures, initiate EDI and expect to and actual gain more benefits that their suppliers – their main objective is to improve customer satisfaction and cut costs. Significant disruption to the business relationship can occur if the implementation is not handled properly. Over time, relationship strength and satisfaction increases.

Internet Inter-organisational Information Systems and Partner Relations

The Internet can be used to provide a platform for partnerships in all areas of the supply chain, whether it is procurement, purchasing, negotiation, coordination or just information exchange. The Internet allows two-way communications, unlike EDI technology, and therefore has much more impact on partner relations and partnerships. Research by Lancioni, Smith & Oliva (2000) concluded that the use of Internet IOS, can improve supplier relations by improving communications and data flows between suppliers and businesses. Support for these conclusions is given by a number of researchers. Barua et al (2001) suggested that the Internet provides opportunities for companies to develop relations with all business partners, suppliers as well as customers. This research was further developed by Zank and Vokurka (2003) who surveyed manufacturers, distributors and industrial customers and found that overall, members of the supply chain believed that e-commerce had a slightly positive impact on their relations with other supply chain partners. Hayes (2002) has shown that the use of the latest IT systems can aid supplier relations. For example, commitment, trust and communications can be enhanced and solidified by allowing the supplier/s access to real-time data which can also be manipulated, as required.

The Internet better supports the business relationship by offering better information with little investment expense. (Papazoglou & Ribbers, 2006). Therefore is it the case that advances in technology are changing this relationship scenario and now it is not so much about the type of transaction but the technical development within companies and level of information interaction between companies.

Li & Williams (2001) concluded that implementing IOS could assist in strengthening partnerships and improving cooperation as

- it requires close working between companies which, in turn, helps them to build a closer relationship and encourage the sharing of information
- it removes many errors associated with manual systems
- changing partners can be costly and time consuming

However, some Japanese car manufacturers see e-procurement, in particular, as preventing the development of closer partnership-type relations, which is what they prefer, by automating partner relations and therefore limit e-purchases to nuts and bolts and basic office supplies (Harney, 2000).

3 RESEARCH

This paper further develops the above findings by investigating the influence of IOS development on business relationships with suppliers and customers. It also analysed forces for and against IOS development.

The research critically evaluates 13 case studies to provide rich, in depth information to develop a theoretical model, thereby extending existing theories and models. The case study approach was also chosen as an all-embracing method that allows a detailed investigation and understanding of situations within particular organisational settings (Walsham, 1995). Nineteen in-depth interviews were carried out with senior employees of these 13 companies to enable cross-case analysis. Companies in product supply chains were the focus of the research as the products, and supply chains would be clearly identifiable. Most of the companies were large multinational companies with locations in Scotland, although three were small Scottish Companies. Items produced by all companies included electronics, clothing, food and drink, packaging and fixing solutions. The companies were positioned at various points in the supply chains - suppliers, packaging distributors and manufacturers. Retailers were also included in the research in order to give an analysis of the full supply chains.

Initially, employees interviewed were managers responsible for part of the supply chain, such as purchasing managers and sales managers. Thereafter, the manager was usually asked to suggest partners, either suppliers or customers, as appropriate, who could be used for the development of dyadic case studies. Managers in these companies were interviewed by using the same structured questionnaire. Interview responses were confirmed and corroborated by managers within the same companies, partner companies and other companies using the same type of technologies. It was also substantiated by additional information from a number of secondary sources, such as company publications, company websites, published company case studies and the WWW. Data collected was made more robust by the supply chain network associations. For example, third-party systems, such as GXS TradeWeb, an Internet EDI global marketplace used by several companies included in the research.

As this research investigated the relationship between a company and its partner, partners of the companies chosen were also investigated where possible. Wilson, Stone & Woodcock (1996) suggested that researchers exploring buyer-supplier relationships in business-to-business markets should collect data from both ends of the dyad. They argued that the collected data would be richer and therefore would compensate for the smaller sample size involved. In fact, although some linkages between case studies were not known, during the research and analysis, it was clear that most companies had linkages with most of the others. These gave very strong basis for conclusions. The case studies can therefore be seen as a network of companies.

Data analysis was undertaken during and after the data collection. The analysis was conducted using principles of hermeneutics (Klien & Myers, 1999) as methods for identifying and extracting key themes from multiple case studies (Eisenhardt, 1989). Data analysis used coding, developing trends, summarizing, clustering and graphs.

After an initial analysis of data, IOS used by the companies were categorised into three types, Elementary IOS, Intermediate IOS and Advanced IOS, according to the level of internal information systems integration and external information systems integration with partners in their supply chain. This classification was subsequently used to determine the objectives of the research and is further explained in Figure 1.

Figure 1: Inter-organisational Information System Categories and Level of Information System Integration

Inter-organisational Information System	Level of Information System Integration
Elementary	Many different internal IS with manual data input between systems. No systems integration with external partners
Intermediate	More than one internal IS may be used but automatic data input between systems. No systems integration with external partners
Advanced	More than one internal IS may be used but automatic data input between systems. More than one external-facing IS may be used with partners but automatic data input between internal and external systems.

4 FINDINGS

The empirical study gave interesting findings on how IOS development affects not only the company itself, but also its relationship with its business partners, whether suppliers and customers. This is due to the fact that IOS cannot be deemed as a closed system on its own, but must be taken as a component of the organisation (Leavitt, 1965: Boddy, Boonstra & Kennedy, 2002).

Company Restructuring, IOS Development and Position in the Supply Chain

Findings here showed that companies restructure when developing IOS, to improve relationships with both suppliers and customers. All companies using Advanced IOS had restructured to some extent, while around 66% of companies using Intermediate IOS and only 33% of companies using Elementary IOS had undergone any restructuring. Therefore, companies with Advanced IOS are more likely to have restructured than companies using Intermediate or Elementary IOS. This supports previous findings that relationships within SCM are now increasingly being seen as partnerships and businesses within the supply chain generally consider themselves as partners, rather than taking on a more adversarial and segregated role (Grieco, 1989: Kanter, 1994: Bowersox, 1996: Heikkila, 2002).

Similarly, Venkatramen (1994) in Papazoglou & Ribbers (2006) determined that integration of advanced information systems require business transformation, which involve changing business structure and processes and establishing inter-organisational business processes. His work is supported by other writers such as Ayers (2002), Clark & Stoddard (1996) and Benjamin et al (1990) who propose that benefits from IOS can only be gained when basic organisational structures and work processes are redesigned.

This research also showed that companies are more likely to reorganise to improve relations with customers due to the position power of the customer in the supply chain. Research supports these findings (Ayers, 2002) in that where previously power resided with vendors/suppliers and they pushed technology onto their customers, the retailers, now the balance of power is with the retailer. This power balance was also shown here. For example, a retailer in this study was pushing the food manufacturer

to used newer advanced technologies, such as RFID. Another manufacturer was 'invited' to use the third party GlobalNetXchange marketplace by their retailing business partner.

Development of Trust and Confidence in Partners

The research found that the level of IOS development has a beneficial impact on communication/information flows. Of companies using Elementary IOS, 63% of respondents found no change on communications/information flows/interaction, with only 37% experiencing a Positive Effect. With regard to companies using Intermediate IOS, 82% replies experienced at least a Positive Effect with 28% experiencing a Significant Positive effect. All companies using Advanced IOS found that they had a positive effect (55%), or a significant positive effect (45%) on communications.

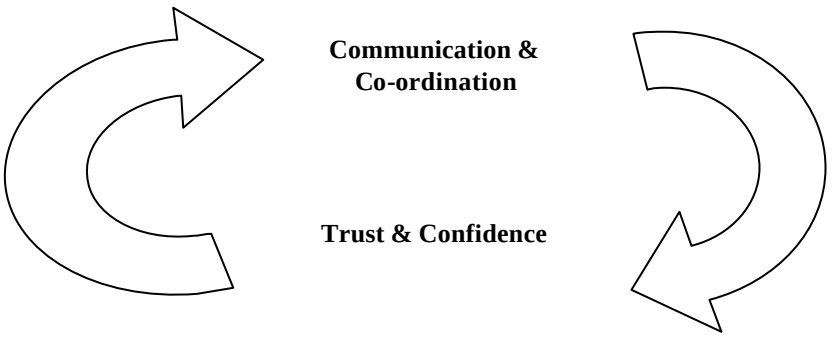
To illustrate, one manager commented that their legacy IOS brought about improvements in communications in purchasing, logistics and customer service and warehousing when they were implemented. Similarly, another employee commented that IOS development has not changed the number of meetings with suppliers, but has allowed more interaction with partners and therefore more important matters can be discussed at face to face meetings. A retail manager illustrated the beneficial impact of IOS on communications/ information flows to his role. Weekly information from Head Office is fed back to himself to give information on store targets such as revenue, stock levels and shelf space usage.

Information sharing and communication is necessary to build trust (Ballou, Gilbert & Mukherjee, 2000). Therefore given the previous findings that IOS development can improve information sharing and communication, it was of interest to determine if trust between partners was also developed when IOS development has taken place.

Findings showed that Elementary IOS can have a detrimental effect on trust levels between partners. For example, one manager regarded the lack of technology as hindering trust levels between partners as he felt that, as his company's IOS were not up web-based and in real-time, they hindered communication between business partners. Where companies used only Intermediate IOS then a positive effect on trust levels was reported by 54% respondents. For example, a Purchasing Manager reported that their web-enabled link with suppliers such as has enabled them to share more information and has led to an increase in trust between the companies. Most, 82%, of the replies from the companies with Advanced IOS reported a positive effect on the trust levels with partners. Therefore IOS development assists in development of trust levels between partners.

These findings can be shown as in Figure 2, as a virtuous partnership circle, supporting the partnership.

Figure 2: Virtuous Partnership Circle



Choi (1999) also found that there is a positive relationship between information volumes, amount of sales and joint decision-making, leading to better electronic cooperation. Grieco, (1989), Kanter (1994) and Kwon & Suh (2004) pointed to trust and communications/interaction as improving or even are necessary for effective working relationships with suppliers.

Barriers to and Forces for IOS development

Findings showed that other organizational factors also impact on the rate of this development. Some of these factors can encourage IOS development, whilst others act as barriers against it.

Seven organisational factors were shown to be barriers - benefits not demonstrated, financial costs, lack of system standards, resistance from other business partners, resistance from customers, technical maturity of the company, and technical maturity of the trading partner. These barriers were found to have different levels of impact, depending on the level of IOS development. The barriers had least effect in companies using Elementary IOS and most impact in companies with Advanced IOS. This is supported by Soliman & Janz (2003) who found that EDI and Internet-based IOS encountered a range of barriers which varied with the level of IOS development.

'Benefits not demonstrated' and 'Financial Costs' were not significant barriers for Advanced IOS but tended to be significant barriers for Intermediate and Elementary Systems. The remaining five factors were shown to be barriers, but at different levels and for different levels of IOS development:

'Business requirement' and 'Management commitment' can act as positive forces and encourage IOS development at all levels, thereby also enhancing partnership relations. In fact, management commitment can act as both a barrier, if it does not exist and have positive impact if it does exist.

A manager within one of the electronic companies endorsed this finding with his comment that the implementation of sophisticated IOS allows both their business and their customer to benefit, thereby keeping them in a leading position in the electronic market.

Significant Barriers for Advanced IOS

- Lack of System Standards
- Resistance from other business partner
- Resistance from customer

Small Barriers for Advanced IOS

- Technical maturity of company
- Technical maturity of trading partner

Small Barriers for Elementary and Intermediate IOS

- Financial Costs
- Lack of System Standards
- Resistance from other business partner
- Resistance from customer
- Technical maturity of company
- Technical maturity of trading partner

Therefore, in relating the strength of barriers to the type of IOS, then problems were generally regarded as 'Small Barrier' with Elementary and Intermediate IOS and more as 'Significant Barriers' with regard to Advanced IOS.

The above analysis also shows that partner resistance is more important to companies with Advanced IOS. This supports other findings in that variables within both partners can influence partner integration and that partner variables are more important in companies deploying Advanced IOS.

Therefore, it may be that due to the sophisticated nature of the systems and the integrative nature of their deployment in bringing companies together, a stronger, 'leader' or champion for technological change is required in order to push through the Advanced IOS, and to overcome technical and partner barriers.

5 MODEL DEVELOPMENT

In order to further progress the empirical and literature findings, a model has been developed from the above analysis. Firstly, this research has allowed the definitions of Elementary IOS, Intermediate IOS and Advanced IOS to be extended, to include other variables, such as Use of IOS, Partner Factors and Organisational Factors. Thereafter, the influence of organisational and technological factors at the three levels of IOS development on the organisation and its partners is compared. These are shown in the following Figures 3, 4, and 5.

Figure 3: Characteristics of Elementary Inter-organisational Information Systems

Characteristics of Elementary IOS			
Technology	**Use**	**Partner Factors**	**Organisational Factors**
Many different IS used, including EDI and third party networks. No/little internal systems integration. Technology seen as an operational tool, rather than as a key strategic component. Automation of processes gives effectiveness gains.	Transactions only. Partners enter information into their own systems. Limited information communication and co-ordination. Limited benefits from use of technology. Collaboration at operational level.	Companies may be working towards their own agenda and for their own benefit. Trust exists between partners but is limited by the nature of the IOS used. Partner collaboration is weak. Customers exert position power in the chain	*Significant barriers*: Benefits not demonstrated *Small barriers*: Financial costs Lack of system standards Resistance from other business partners Resistance from customers

Figure 3 shows that within Elementary IOS development, there is a low level of systems integration, information co-ordination, and partner collaboration and of benefits gained. Significant barriers are management commitment, benefits not demonstrated and resistance from customers. Smaller barriers include financial costs and resistance from other partners.

Figure 4: Characteristics of Intermediate Inter-organisational Information Systems

Characteristics of Intermediate IOS			
Technology	**Use**	**Partner Factors**	**Organisational Factors**
More that one IOS are used, but internal integration between information systems, gives integrated data flows. Role of technology is changing, from an operational tool to being a more strategic component. Technology is used for a larger range of tasks within all functions. Automation of processes gives effectiveness and efficiency gains. Information also used for business planning	Functional transactions and management reporting. Some integration of information systems to form links with parent company. Improved level of communications between functions. IOS replacing some face-to-face communications. IS supports communications with partners. Collaboration at operational and tactical levels	Companies may be working towards their own agenda and for their own benefit. However, some improvement in partner confidence due to increased communications and collaboration. Trust between partners is being enhanced. Integration of partnerships increasing Customers exert position power in the chain	*Significant barriers*: Benefits not demonstrated *Small barriers*: Financial costs Lack of system standards Resistance from other business partners Resistance from customers

Figure 4 shows that there is some systems integration, information co-ordination, partner collaboration and benefits gained within Intermediate IOS development. Significant barriers and insignificant barriers seem to be similar to those in the Elementary IOS.

Figure 5 shows the characteristics of Advanced IOS.

Figure 5: Characteristics of Advanced Inter-organisational Information Systems

Characteristics of Advanced IOS			
Technology	**Use**	**Partner Factors**	**Organisational Factors**
Technology viewed as a key strategic component with information as a key resource. Internal and external integration between information systems, using one of more Internet systems and portals Automation of processes gives efficiency and effectiveness gains.	IOS are used at all levels within the org, from strategic through to operational. Technology is used for an extensive range of tasks within all functions. Integration of communications, functions and processes is carried out by sophisticated technologies	Advanced IOS allow partners controlled access to extensive company information Company may review the status and number of partners. They may use tiered partners according to 'value' of partnership. Customers exert position power in the chain	*Significant barriers*: Business Requirement Management Commitment Lack of System Standards Resistance from other business partner Resistance from customer *Small barriers*: Financial costs Technical maturity of company Technical maturity of trading partners

At this level of IOS development, there is a high level of systems integration, information co-ordination, partner collaboration and benefits gained. Organisational barriers become different at this level of IOS development, with resistance from other business partners becoming more influential.

Combining these results into one graph, Figure 6 shows the influence of these organisational factors is the three levels of IOS development. The figure shows that IOS development impacts business partner relationship in a number of ways:

- Communication and coordination with the business partner increases
- Partner integration increases
- Confidence and trust in partners increase

However, this development also brings with it an increase in implementation barriers, such as lack of IOS standards and resistance from business partners. Management commitment and business requirement for IOS development can both as act as barriers against or drivers for IOS implementation.

Figure 6: The Impact of Organisational Factors at varying levels of Inter-organisational Information Systems Development

Factor	Elementary IOS	Intermediate IOS	Advanced IOS	Factor Impact
Partner Communication co-ordination, integration				IOS development increases communication and co-ordination between partners, as well as developing partner integration
Partner confidence and trust				IOS development, enhances confidence and trust in partners and therefore partnership integration
System Standards				Impact of lack of information system standards increase in effect with IOS development
Resistance from Business Partners and Customers				Impact of resistance from other business partners and customers increase in effect with IOS development
Management Commitment				Top management beliefs can act as a barrier or driver for IS development at all levels of IOS development. Strong management commitment is required for significant IOS development
Business Requirement/ Benefits not demonstrated				Business requirement can act as a driver towards IS integration at all levels of IOS development. If the benefits of IOS implementation cannot be demonstrated, then this may cause a significant barrier

Sherer (1995) developed a framework to describe three types of risk that affect IOS; technical risk such as security breaches, organisational risk which may arise due to restructuring of staff and their roles and environmental risk where partner and competitive forces exert influence over the company. Li & Williams (2001) also developed a similar three level model of barriers to the use of IOS, namely technical barriers or problems, organisational attitude to sharing information with business partners and suppliers and at the third level, an overall organisational cultural attitude towards inter-firm collaboration. However, this model relates such barriers to different levels of IOS development.

This model is supported by findings from Bensaou & Venkatramen (1995) who found that Inter-organisational Relationships varied with IOS development and that new IOS development will result in new business models and relationships. The pressure for these developments will come from the highly competitive marketplace.

6 CONCLUSION

This study is a comparative study on levels of IOS development within 13 case studies. It provides a better understanding of the impact of IOS across organizational boundaries. The findings show that the level of IOS development influences partner co-ordination and integration. IOS capabilities also assist in building trust and confidence in partners. However, a number of organisational factors influence IOS development and these factors such as management commitment, financial costs, resistance from other business partners can act as forces for or barriers to IOS development. The strength of these variables also varies with IOS capabilities.

The study has important implications for business. Organisations are increasing their use of IOS within SCM functions and therefore identification of the influencing factors is required and critical for emerging electronic business environments. Since partnership arrangements can be difficult and resource intensive and important to success in SCM, it would be valuable to businesses to evaluate the impact of technology, in particular, Internet IOS, on the required levels of partnership integration in

particular SCM functions. This will assist in improving SCM performance, enhancing business performance and ultimately leading to competitive advantage.

Ongoing work includes investigating and evaluating the impact of IOS on the supply chain of virtual products and services, as well as the impact of new technologies such as wireless applications.

The companies involved in this study were international or Scottish based companies and therefore the international cultural dimension was not investigated or noted. This research could be expanded to investigate any cultural aspects of the power aspect within business relationships, furthering the work of Hofstede (1983) who recognised cultural differences in the power variable.

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