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How the Use of Interorganizational Systems by Participants of a Retail Supply Chain Supports Competitive Advantage

CAPSTONE REPORT

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Use of Interorganizational Systems to Support Competitive Advantage

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Running Head: Use of Interorganizational Systems to Support Competitive Advantage

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Abstract

This review examines how interorganizational systems (IOS) are used to provide a competitive advantage to both individual firms and the supply chain as an aggregate. Selected literature published between 2002 and 2009 is analyzed to provide IT managers an understanding of how IOSs are being used in support of competitive advantage. Focus is on the evolution of IOS, from electronic data interchange (EDI) and electronic markets (EMs), to extensible markup language (XML).

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Introduction

The introduction is designed to "state the purpose of the review and give brief background information on the subject of the review" (Hewitt, 2002, p. 22). This is accomplished by providing an overview of the topic, an explanation of the research problem, a statement of purpose, a set of research delimitations and preview of the data analysis and writing plan.

Problem Area

An Interorganizational System (IOS) is an information system (IS) that facilitates the exchange of products, services and information between firms (Han, Kauffman & Nault, 2008). An IOS is an umbrella term that encompasses several technologies that are relevant to the retail supply chain (Yao, Dresner & Palmer, 2009). These include electronic data interchange (EDI), electronic markets (EMs) and supply chain management systems (SCMS) (Yao, Dresner & Palmer, 2009; Subramani, 2004). Through the use of these technologies, the relationship between the various participants in the retail supply chain can be both exposed and strengthened (Madlberger, 2008). This strengthening of the relationship can be used to enable tighter coordination between trading partners, resulting in a considerable “reduction of the bullwhip effect, a distortion in the supply chain that increases with growing distance from the final consumer” (Madlberger, 2008, p. 1).

As noted by Madlberger (2008) and others, efforts to increase collaboration between firms in the retail supply chain have been on the increase since at least the 1980s (Lai & Long, 2007). EDI, which Yao, Dresner and Palmer (2009) define as the “bilateral linkages enabled by industry standard protocols” (p. 844), account for the vast majority of IOS activity prior to the Internet revolution of the 1990s (Narayanan, Marucheck & Handfield, 2009; Lai & Long, 2007). By 2001, EDI-based transactions enabled more than $2 trillion of trade, with as much as of 55%

mid-sized and larger North American companies utilizing some form of EDI networks (Kanakamedala, King & Ramsdell, 2003). Since that time, EDI usage has continued to grow. International Data Corporation (IDC) estimates that in 2007 the total size of EDI transactions grew to $2.68 trillion (IDC, 2004). During this time however there was a move from traditional EDI, which does not utilize the Internet, to Internet based EDI (I-EDI) (Huang, Janz & Frolick, 2008; Narayanan, Marucheck & Handfield, 2009). This movement towards I-EDI has both given new life to EDI as well as enabled the growth of the next generation of retail supply chain IOS technologies – the EMs (Yao, Dresner & Palmer, 2009).

Electronic markets are defined by Yao, Dresner and Palmer (2009) as "transaction systems featuring multilateral relationships enabled by the Internet open protocol and standards." (p. 844). Whereas EDI establishes "individual electronic links with each of a select set of trading partners" (Choudhury, 1997, p. 3), electronic markets feature the electronic broker effect (Malone, Yates & Benjamin, 1987). This lets EMs "facilitate the comparisons among multiple sellers with respect to prices, product quality, product availability, or any number of other factors" (Yao, Dresner & Palmer, 2009, p. 844).

An additional distinguishing point between EDI and EMs is the ability of EMs to participate in both informational discovery as well as transaction processing – whereas EDI is limited to transaction processing (Mukhopadhyay & Kekre, 2002). Information discovery refers to the process in which buyers can search for product alternatives, compare offerings and then choose the desired products from among suppliers (Yao, Dresner & Palmer, 2009).

Purpose

For an IOS to be effective, "communication at all levels must be effective and timely, therefore the integration of information systems becomes a necessary component of a successful supply network design" (Nagy, 2006). For the past two decades, IOSs have "been one of the

primary enabling technologies for conducting business-to-business (B2B) transaction" (Narayanan, Marucheck & Handfield, 2009, p. 121). While IOSs are not a new technology, the introduction of the Internet has both changed the dynamics as well as expanded their reach (Narayanan, Marucheck & Handfield, 2009).

Since an IOS ties together the various components of diverse supply chains, it places a demand on databases, networks, web sites and middleware. The challenge of designing a modern IOS is to utilize these components in a way that will anticipate business needs while driving down costs by providing increased supply chain visibility (Wei & Wang, 2007). Kauffman and Mohtadi (2004) state, "… it is highly surprising that despite the overwhelming evidence of the advantages of e-procurement systems, proprietary systems such as [traditional] EDI continue to exist" (p. 138).

As noted by Yao, Dresner & Palmer (2009), the lack of movement towards newer technologies may be partially due to the uncertainties of potential benefits derived from Internet-based systems. In order to address this perspective, the purpose of this study is to identify these benefits, for presentation to the target audience. The focus is on Internet enabled technologies and how they can be leveraged in environments that demand full integration and collaboration (Reary, 2002). Included in this focus are Internet Electronic Markets, Internet EDI and extensible Markup Language (XML) based e-business technologies. The goal is to identify and describe IOS technologies that are being used by retail supply chains to create and sustain competitive advantages.

This study is designed as a literature review, which is defined as a "self contained piece of written work that gives a concise summary of previous findings in an area of the research literature" (Hewitt, 1997, p. 1). Literature published between 2002 and 2009 is examined in four

areas, including IOS (Madleberger, 2008), EDI (Huang, Janz & Frolick, 2008), EMs (Yao, Dresner & Palmer, 2009), and SCMSs (Han, Kauffman & Nault, 2008).

Significance/Audience

The study is targeted towards those individuals who are responsible for designing and implementing IOSs as they relate to EDI, EMs and the various iterations of these technologies. As stated by Reary (2002), "the new supply chain is based on connected processes, collective decision making, information transparency, common metrics and lowered barriers of entry for new partners". Competition has moved away from the individual companies and has emerged across supply chains (Woerner, 2001). As such, companies are focusing on enabling collaborative processes with trusted supply chain partners to gain that competitive advantage (Woerner, 2001).

As network leaders continue to both implement and force new forms of IOS on supplier networks, the resulting impact on suppliers is often asymmetrical (Subramani, 2004). As quoted by Riggens and Mukhopadhyay (1994), benefits from these information technologies are distributed unevenly and often in favor of the network leader. The challenge IOS professionals face is in negotiating the demands of the network leader with the needs of their own companies (Subramani, 2004). This study incorporates this challenge by analyzing how companies use IOS to create a collaborative supply chain environment, which according to Reary (2002) results in lower cost of ownership, increased return on relationships, and increased revenue and market share.

Outcome

The outcome of this study is designed as a set of potential benefits derived from Internet-based systems, in relation to full integration and collaboration (Reary, 2002). As noted by Reary (2002), "The Internet optimizes the existing supply chain to maximize the return on relationship

with both suppliers and customers, which helps maintain a competitive edge" (p. xx). Benefits are described for participation in desirable supply chains, ease of entry into complementary supply chains and painless exit and enhanced supply chain visibility.

It is expected that the outcome of this study will show that firms that choose to engage in supply chain management strategies through the use of IOS technologies benefit in transactional cost economics as well as greater ownership and control of the supply chain. Controlling the supply chain reduces external turbulence and the bullwhip effect (Wei & Wang, 2007). Supply chains in which an aggregate decision is made by all participants to increase visibility produces a net benefit to all through reduced uncertainty and enhanced performance (Wei & Wang, 2007).

Delimitations

Time frame. IOSs have been studied intensively for many years (Huang, Janz & Frolick, 2008). The emergence of the Internet in the late 1990s has drastically changed the IOS environment however (Huang, Janz & Frolick, 2008). Most literature prior to 2002 does not fully take into account the magnitude of change the Internet has brought into this field. Vollmer (2001) states the Internet will "determine the future of EDI" (p. 23). As such, literature published between 2002 - 2009 is selected for use in this study.

Types of sources. Literature is selected primarily from journal articles due to the abundance of current and peered reviewed literature in this format. There was little available literature in books that was published in the time frame desired. Additional literature is obtained from professional web sites and white pages.

Selection criteria. Literature selections are chosen from the University of Oregon Library network, to include IEEE, Academic Search Premier and Worldcat. Additional selections are obtained from targeted searches on Google Scholar, JSTOR and general purpose web searches. Selections are obtained by following the guidelines presented in Looking for Articles in Journals

and Magazines (2009). Once selections are obtained, the methods described in Critical Evaluation of Information Sources (2009) are applied. Most specifically, selection criteria include examination of these questions: "who is the publisher", "when was it published" and "What is the author's reputation among his/her peers?"

Choice of audience. The audience is brokers of the retail supply chain engaged in IOS activities. This includes network leaders as well as supplier and 3PL firms (Subramani, 2004).

Choice of focus. This study is focused on how IOS practices can serve to create and enhance relationships between members of the supply chain. Specifically, focus is the analysis of EDI, EMs and SCMSs to facilitate these relationships. An IOS is not fully defined by these three components, but this study limits the scope to provide a more comprehensive overview of these vital components.

Data Analysis Plan Preview

This study makes use of the conceptual analysis research methodology as the approach selected for data analysis. Conceptual analysis is a technique in which a concept is chosen for examination and the number of occurrences within the text is recorded (Busch, et. al, 2009). Content analysis enables the researcher "to sift through large volumes of data with relative ease in a systematic fashion" (Stemler, 2001). Based on the extensive literature base for the chosen topic, this methodology allowed for a systematic and replicable approach.

The conceptual research methodology starts with the identification of key words to be used during the data analysis coding process. For this study, the following words are used for this function: EDI, EMs, SCMSs, IOS, private networks, vertical integration and Internet EDI. During the course of preliminary research, it became clear that there is not a standard vocabulary

to describe these concepts. By expanding on the level of generalization, phrases such as private networks, internet EDI, and vertical integration are allowed when the context supported the overall purpose of this study (Busch, et. al, 2009).

Writing Plan Preview

The intent of this study is to identify the benefits that an IOS system can bring to a supply chain. There are several aspects however to an IOS and how they are used in the modern supply chain. Through the course of analyzing the literature, it is apparent that there is both an historical aspect as well as a modern component to the IOS environment. To properly account for these various components, this report has been formatted in the thematic approach. This approach organizes literature around a central concept while allowing for the discussion of historical context (Literature Reviews, 2007).

Definitions

Definitions help to establish the perspective of the study. They are used to help evaluate and select literature as well as structure the search strategy. The following definitions offer an insight into the direction the study takes and are meant to establish a common reference point.

3PL: Third party logistics. As defined by Selviaridis & Spring (2007), 3PL is "usually associated with the offering of multiple, bundled services, rather than just isolated transport or warehousing functions" (p. 125). In the context of this study, 3PL is defined as a member of the supply chain that facilitates the interaction between the other members of that supply chain.

Competitive Advantage: According to Porter (1985), competitive advantage is defined in an industry by an aggregate of five factors:

1. Supplier bargaining power
2. Buyer bargaining power
3. Barriers to entry
4. Available substitutes
5. Intensity of rivalry

This literature review uses Porter's elements to further define competitive advantage as a factor relating to switching costs of suppliers, capital requirements as a barrier to entry, relationship between price and quality, and access to distributors (Porter, 1985)

Electronic Data Interchange (EDI): Bilateral linkages enabled by industry standard protocols (Yao, Dresner & Palmer, 2009).

Electronic Market (EM): Transaction systems featuring multilateral relationships enabled by the Internet open protocol and standards (Yao, Dresner & Palmer, 2009).

Interorganizational Systems (IOS): Information System (IS) that facilitates the exchange of products, services and information between firms (Han, Kauffman & Nault, 2008).

Retail Supply Chain: The network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services delivered to the ultimate consumer (Christopher, 1992).

Specificity of Investment: "The loss in the value of a participants IOS-related investments when the IOS asset is used outside of the current IOS relationship" (Han, Kauffman & Nault, 2008, p. 182).

Supply Chain Management Systems (SCMS): Instances of information technologies employed in interorganizational contexts to mediate buyer-supplier transactions (Subramani, 2004).

Transaction Cost Economics (TCE): TCE focuses on the trade-off between transaction costs and alternative governance structures. By selecting appropriate governance mechanisms, firms can minimize their transactions costs (Patnayakuni, Rai & Seth, 2006).

Research Parameters

The following section defines the way the study is framed and how the literature review is conducted. In it are five key components; research questions, search strategy report, evaluation criteria, data analysis plan and writing plan.

Research Question and Sub Questions

Main question. What types of benefits can be gained by each participant of the retail supply chain when using IOS technologies?

Sub-questions.

1. How is traditional EDI being impacted by the Internet (Huang, Z., Janz, B., & Frolick, M. 2008)?
2. What is the relationship between EDI and XML (Yao, Dresner & Palmer, 2009)?
3. How is this relationship between EDIs and XML combining to allow companies to create new solutions (Christiaanse, 2005)?
4. What factors enable and inhibit both the adaption of EDI/XML as well as movement towards a higher level of sophistication (Yao, Dresner & Palmer, 2009; Christiaanse, 2005)?

Search Strategy Report

Literature is identified by the search terms noted below. These terms are chosen based on several factors, including a careful analysis of existing work and the terms identified in preliminary searches. The majority of literature for study is published between 2002 and 2009.

Some work outside of this time frame is incorporated if it references terms and environments that in the researcher's opinion are not affected by the passage of time.

Searches began with the term "EDI" and the phrase "Supply Chain Technology". In researching these topics, the concept of IOS was first approached. Once this concept of an IOS is incorporated into the analysis, it became clear that EDI was a subset of IOS and that the overall goal of modern IOSs was not to simply exchange preformatted data but rather to increase overall visibility in the supply chain (Kauffman & Han, 2008). Through this visibility, a more competitive supply chain is created, which in turn creates a more competitive environment (Wei & Wang, 2007). Search terms include:

- EDI
- Electronic Data Interchange
- supply chain technology
- supply chain xml
- supply chain & EDI
- EDI & B2B
- outsource & supply chain & technology
- Supply chain management system (SCMS)
- Interorganizational Information Systems
- "Interorganizational Systems" "Information Systems"
- Interorganizational Systems & Supply Chain

Searches were limited to IEEE, Worldcat and Academic Search Premier – as provided by the University of Oregon online databases. Based on the quality of results found, this researcher determined that these three search databases yield an appropriate and representative amount of literature. The search results report is located in Appendix A.

Evaluation Criteria

Once selections were obtained, the methods described in Critical Evaluation of Information Sources (Bell and Smith, 2009) are applied. This work suggests five different areas to consider in judging the credibility of the information source. Below these five criterions are listed as well as how they are used in this study:

1. Authority: Literature cited is either listed in Annual Reviews (2009) or noted as not being included.
2. Objectivity: Literature cited must be cited by other works to the extent that obvious bias and subjectivity is limited.
3. Quality: Literature must show signs of being properly reviewed, such as being filtered for proper grammar, cogent flow and proper citation.
4. Coverage: Literature must be properly framed and substantiated by other works.
5. Currency: Literature is generally published after 2002.

Data Analysis Plan

This study makes use of the conceptual analysis research methodology as the approach selected for data analysis. Conceptual analysis is a technique in which a concept is chosen for examination and the number of occurrences within the text is recorded (Busch, et. al, 2009). Content analysis enables the researcher "to sift through large volumes of data with relative ease in a systematic fashion" (Stemler, 2001). Based on the extensive literature base for the chosen topic, this methodology allowed for an efficient and replicable approach.

The conceptual research methodology starts with the level of analysis. This dictates whether words or phrases will be used for coding. Due to the technical nature of this study, it is observed that single words and acronyms are most suitable for coding. Exceptions are made for expanding acronyms and for specifics concepts as described below. For this study, the following words are used for this function: EDI, EMs, SCMSs, IOS, vertical integration, private networks and Internet EDI.

During the course of preliminary coding, it became clear that there is not a standard vocabulary to describe these concepts. By expanding on the level of generalization, phrases such as private networks, internet EDI, and vertical integration are allowed when the context supported the overall purpose of this study (Busch, et. al, 2009).

The two phrases that exist in most of the relevant literature are EDI and IOS. These two terms are coded for frequency during preliminary coding, which disallowed a large amount of literature that merely mentioned these phrases in passing. Then, during the final data coding process, the additional phrases EMs, SCMS, private networks, Internet EDI and vertical integration are coded for existence.

To keep the conceptual analysis process focused; a technique known as translation rules is used in which only topics in which the focus was on IOS and EDI are identified (Busch, et. al, 2009). Irrelevant information is not considered.

The coding process made use of automated coding for text. In other words, data relevant to the pre-determined set of coding terms was automatically highlighted during the search process and returned to the researcher in an ordered format (Busch, et. al, 2009). These results are further scrutinized by manually examining the specific context of the use of coded words.

Writing Plan

The presentation of the Review of the Literature section of the paper is divided into three themes as described below. Through an examination of the results of the data analysis process, these themes indicate that while EDI is traditionally a legacy technology it is being adapted to the modern IOS (Huang, Janz & Frolick, 2008; Narayanan, Marucheck & Handfield, 2009). Despite this adaption, there are several inherent limitations that have enabled a new generation of IOS technologies to come forth (Huang, Janz & Frolick, 2008). These new technologies are identified and discussed in section three below. Themes are then reframed in order to produce the outcome of this study, designed as a set of potential benefits derived from Internet-based systems, in relation to full integration and collaboration (Reary, 2002). The preliminary set of themes is as follows:

Theme One: How IOS systems complement and interact with supply chains

- History of information technology in the supply chain.
- Evolution of the competitive environment from individual companies to the supply chain in its entirety.

Theme Two: How EDI is being adapted to the modern IOS environment

- History of EDI in the supply chain.
- How EDI has migrated from a legacy technology to a relevant piece of the modern IOS environment.
- Limitations of EDI

Theme Three: How is XML innovating IOS technologies

- What are EMs and how does XML enable them
- Uses and impact in the IOS environment

Annotated Bibliography

The following selections of literature are chosen based on the direct applicability they have to the topic of this study. The author has attempted to identify the most relevant existing pieces of literature and provide both bibliographic data as well as an abstract. Comments are included to indicate how the reference is used in support of this study, and how evaluation criteria are applied to ensure that each reference is credible.

Christiaanse, E. (2005). Performance benefits through integration hubs. *Communications of the ACM, 48,* 95-100.

Abstract. Firms have increasingly begun to realize their performance depends on the competitiveness of the supply chain configurations in which they participate. Vertical industry-oriented B2B marketplaces and hubs, like Elemica in the chemical industry, Covisint in the automotive parts industry, or Transora and CPG market in the consumer packaged goods industry, can be seen as such collaborative efforts. The improvement of efficiencies is the main source of value created by these B2B marketplaces. The coordination of business processes is highly dependent on the ability of firms to coordinate flows of goods and information. Interorganizational systems, like electronic data-interchange devices (EDI), have permitted firms to exchange information on a more timely and frequent basis. Investment in EDI systems requires close coordination to achieve a certain degree of electronic integration.

This paper discusses the general details of electronic markets and provides some case studies specific to supply chain markets. It proceeds to discuss the value that information technology can bring to the supply chain by not only providing a dyadic relationship but

extending that to the entire supply chain. Tasks like pricing, inventory management and product design can all be facilitated through EDI and IOS technologies.

***Comments*:** Study discusses the cost savings that communication and integration hubs provide. Since coordination between members of the supply chain is highly dependant on the ability of firms to coordinate flows of goods and information, it is essential that businesses learn to control both of these factors. Information flow helps develop and solidify relationships, which help develop competitive advantages. The article is part of the data set for coding, and information supports the development of the Review of Literature section of this paper. The publisher, The Communications of the ACM, is a peered reviewed journal and the author is an associate professor from the Amstradam Graduate Business School in the Netherlands. She has been a visting scholar at MIT has been published in at least nine separate journals.

Dedrick, J., Xu, S. & Zhu, K. (2008). How does information technology shape supply chain structure? *Journal of Management Information Systems*, *25*(2), 41-72.

Abstract. This research investigates the relationship between a manufacturer's use of information technology (IT) and the number of suppliers in its supply chain. Will a manufacturer use more or fewer suppliers due to the increasing use of IT? Based on data from a sample of 150 U.S. manufacturers, we find no direct relationship between procurement and number of suppliers at the aggregate level. However, when we distinguish the type of goods purchased, we find that the use of electronic procurement is associated with buying from more suppliers for custom goods but from fewer suppliers for standard (or commodity) goods. It is possible that for commodity goods, an efficiently functioning transparent market ensures that a few suppliers are sufficient, whereas for custom goods the need for protection from opportunistic vendor holdup leads to the use

of more suppliers. Further, the positive relationship between number of suppliers and electronic procurement for custom goods is negatively moderated by deeper buyer–supplier system integration. This implies that such integration can help buyers obtain better "fit" for their customized requirements. This research investigates the relationship between a manufacturer's use of information technology (IT) (particularly electronic procurement) and the number of suppliers in its supply chain. Will a manufacturer use more or fewer suppliers due to the increasing use of IT?

Comments. Investigates how e-procurement affects the number of suppliers in the supply chain. While this topic is not directly related to the topic of this study, it does address various related items, one of which is how the level of sophistication of the EDI/IOS system impacts the ability of a company to manage a large supply base. While the study found no relationship between the level of sophistication and the supply base, it does find secondary benefits of IOS, including assisting companies in identifying low cost suppliers. The article is part of the data set for coding, and information supports the development of the Review of Literature section of this paper. The Journal of Management Information Systems is a highly regarded and peer reviewed journal that has been in publication since 1984. Jason Dedrick is an Associate Professor at Syracuse University and previously was a Senior Research Fellow at the Center for Research on Information Technology and Organizations (CRITO). Sean Xin Xu is an Assistant Professor at the University of California, Irvine. Kevin Zhu is a professor at the University of California, San Diego and has authored nine articles on various aspects of IT diffusion.

Dia, Q., & Kauffman, R. (2006). To be or not b2b: Evaluating managerial choices for e-procurement channel adaption. *Information Technology and Management, 7,* 109-130.

Abstract. E-procurement systems are computer systems and communication networks through which firms buy and sell products. We identify two types of e-procurement systems: extranets and e-markets. Extranets connect the buyer and its suppliers with a closed network, while e-markets create open networks for buyer and supplier interactions. The differences between them lie in system implementation costs, marketplace benefits, and the extent of supplier competitive advantage that develops due to information sharing. The authors develop a new theoretical model to analyze the adoption of e-procurement systems from the buyer's perspective, to explore the set of conditions under which the buyer will prefer to procure via an electronic market instead of using proprietary extranet connections. The primary finding is that a buyer will adopt an e-market approach when the supplier's competitive advantage derived from access to strategic information is modest compared with the marketplace benefits less the channel costs. In addition, we find that the buyer is likely to have a bigger trading network with an e-market than with an extranet in order to capture the greatest available benefits. Overall, this study offers guidelines for managers to design and select e-procurement channels to fit different procurement needs.

Comments. This study is one of the more useful studies in regards specifically to emarkets. Provides additional references and addresses how emarkets are used and what advantages they provide. This information is used in the Introduction of this study to provide a history and current context of emarket applications. Robert J. Kauffman is the current director of the MIS Research Center at the University of Minnesota and has published a variety of articles in peer reviewed journals. Qizhi Dai is an Assistant Professor at Drexel University and has published six articles in the last several years focusing on ecommerce.

Furst, K., Schmidt, T. (2001) Turbulent markets need flexible supply chain communication. *Production and Planning Control, 12*(5). 525-533.

Abstract. This paper consists of three main sections. The section discusses market turbulence and the transition from mass production to mass customization as driving forces for organizational change and optimization, which leads to IT-support and virtual enterprises. The second section describes the key-elements of supply chain management as one building block for virtual enterprises. Low-cost Electronic Data Interchange (EDI) is the key-enabler to automate the interactions between companies and their partners. In the third section, a complete concept and a prototype realization for Internet EDIÐ using XML (extensible markup language) is proposed. This approach is based on Internet and XML, because the implementation of traditional EDI (e.g. EDIFACT, ANSI X.12) is mostly too costly for small and medium sized enterprises, which has to be integrated as suppliers and customers in a supply chain. XML will be the international standard for Internet communication in the near future.

Comments. An excellent study on the reasons companies use EDI and how, in doing so, gain advantages in the market place. One of the few studies that includes SCM software in the same discussion as both EDI and competitiveness. Provides several case studies showing internet EDI as assisting companies in gaining a competitive advantage. The article is part of the data set for coding, and information supports the development of the Review of Literature section of this paper. The publication, Production and Planning Control, is a peer reviewed journal. Karl Furst is PhD teaching assistant and head of the working group ‘Intelligent Production Design’ at the Vienna Institute of Technology. Thomas Schmidt is a research assistant at the Institute for Flexible Automation at the Vienna Institute of Technology.

Gosain,S., Malhotra, A., & Sawy,O. (2004). Coordinating for flexibility in e-business supply chains. *Journal of Management Information Systems, 23*, 7-45.

Abstract. The widespread use of information technology (IT) to create electronic linkages among supply chain partners with the objective of reducing transaction costs may have unintended adverse effects on supply chain flexibility. Increasing business dynamics, changing customer preferences, and disruptive technological shifts pose the need for two kinds of flexibility that inter-enterprise information systems must address--the ability of inter-enterprise linkages to support changes in offering characteristics (offering flexibility) and the ability to alter linkages to partner with different supply chain players (partnering flexibility). This study explores how enterprises in supply chains may forge supply chain linkages that enable both types of flexibility jointly, and allow them to deal with ubiquitous change. Drawing on March and Simon's coordination theory, we propose two design principles: (1) advance structuring of interorganizational processes and information exchange that allows partnering organizations to be loosely coupled, and (2) IT-supported dynamic adjustment that allows enterprises to quickly sense change and adapt their supply chain linkages. This study reports on a survey of 41 supply chain relationships in the IT industry. For design principle, our empirical investigation of factors shows (1) that modular design of interconnected processes and structured data connectivity are associated with higher supply chain flexibility, and (2) that deep coordination-related knowledge is critical for supply chain flexibility. Also, sharing a broad range of information with partners is detrimental to supply chain flexibility, and organizations should instead focus on improving the quality of information shared. For industry managers, the study provides clear insights for information infrastructure design. To manage their interdependencies, enterprises need to encapsulate their interconnected

processes in modular chunks, and support these with IT platforms for information exchange in structured formats. Enterprises also need to nurture their execution capabilities by putting in place the information systems to process information exchanged with partners, augmenting their understanding of factors such as how partner actions need to trigger adaptive responses. For researchers, the study initiates a new stream of theorizing that focuses on the role of the information infrastructure in managing the tension between competing goals of offering flexibility and partnering flexibility.

Comments. This study identifies two advantages that flexible ecommerce systems provide; flexibility in modification and flexibility in exiting. Modification means that the supply chain can adapt quickly. Exit means that the supply chain can rearrange to include better suited members. This is a unique perspective in that it identifies two broad and otherwise unmentioned competitive advantages. The article is part of the data set for coding, and information supports the development of the Review of Literature section of this paper. The Journal of Management Information Systems is a highly regarded and peer reviewed journal that has been in publication since 1984. According to Google Scholar, this article has been referenced 80 times. Sanjay Gosain is an assistant professor at the University of Maryland and is one of the orignal members of the RosettaNet Consortium. Arvind Malhotra is an assistant professor at the University of North Carolina and has published articles in leading industry journals, two of which earned the Best Paper Award from the Society of Information Managers. Omar Sawy is a professor at the University of Southern California and has published a book, Redesigning Enterprise Processes for e-Business, and serves on six journal editorial boards.

Han, K., Kauffman, R., & Nault, B. (2008). Relative importance, specific investment and ownership in interorganizational systems. *Information Technology Management, 9, 181-200.*

Abstract. Implementation and maintenance of interorganizational systems (IOS) require investments by all the participating firms. Compared with intraorganizational systems, however, there are additional uncertainties and risks. This is because the benefits of IOS investment depend not only on a firm's own decisions, but also on those of its business partners. Without appropriate levels of investment by all the firms participating in an IOS, they cannot reap the full benefits. Drawing upon the literature in institutional economics, this literature examines IOS ownership as a means to induce value-maximizing noncontractible investments. The authors model the impact of two factors derived from the theory of incomplete contracts and transaction cost economics: relative importance of investments and specificity of investments. The authors apply the model to a vendor-managed inventory system (VMI) in a supply chain setting. The literature also shows that when the specificity of investments is high, this is a more critical determinant of optimal ownership structure than the relative importance of investments. As technologies used in IOS become increasingly redeployable and reusable, and less specific, the relative importance of investments becomes a dominant factor.

Comments. This study investigates who owns the supply chain process when it consists of numerous separate entities. Without clear ownership, investments rarely are made. Discusses additional concepts such as asset specificity, essentiality, complementaries and indespensibility as they relate to IOS's. This article details many essential concepts, to include EDI, IOS, and TCE. The article is part of the data set for coding, and information supports the development of the Review of Literature section of this paper. Kunsoo Han

works for McGill University in Montreal, Quebec and has been published in the Journal of Management Information Systems and major IS conference proceedings. Robert Kauffman is the chair in Information Systems at Arizona State University and has published approximately 50 journal articles since 2000. Barrie Nault is The David B. Robson Professor in Management (MIS), and director of the Informatics Research Centre (iRC) at the University of Calgary. Barrie has published approximately 15 articles since 2000. Dr. Kunsoo Han joined McGill University in 2006. He received his PhD from University of Minnesota and previously worked in the IT consulting field in Korea.

Huang, Z., Janz, B., & Frolick, M. (2008). A comprehensive examination of Internet-EDI adoption. *Information Systems Management*, *25*, 273-286.

Abstract. By taking advantage of the Internet, a new generation of Interorganizational Information Systems, i.e., Internet electronic data interchange (I-EDI) provides great efficiency for performing business-to-business transactions and is much more affordable than other network alternatives. Few empirical studies have been conducted to examine the adoption of I-EDI and little guidance has been given to the practitioners in the field. To fill this void, this research investigates the adoption of I-EDI by U.S. enterprises based on a comprehensive framework. Results from an online survey of 219 organizational respondents indicate that the proposed framework is able to help explain organizational adoption of I-EDI. This study provides insights and interesting findings toward technology adoption in Internet era. While some new factors are found to play important roles in IOS adoption, several conventional factors, such as technology compatibility and organization size, are no longer significant in explaining the adoption of I-EDI. Different effects of interorganizational factors such as power, trust, and

relationship commitment on I-EDI adoption have been revealed. Implications for researchers and practitioners are provided.

Comments. This is a core piece of literature to this study and discusses the history of EDI and IOS, as described in the Problem Area. Topics include the lead up to Internet EDI. Identifies the factors that lead organizations to adapt IOS's and what advantages it can provide. There are four groups of variables that effect this decisions; technology, environmental, organizational, and interorganizational. This journal is well respected and peer reviewed. Dr. Zhenyu Huang is an assistant professor at Central Michigan University. Dr. Brian D. Janz is a Professor of Management Information Systems at the Fogelman College of Business as well as the Associate Director of the FedEx Center for Supply Chain Management at the University of Memphis's FedEx Institute of Technology. Dr. Mark N. Frolick is a Professor of MIS in the Williams College of Business at Xavier University and the holder of the Western & Southern Chair in Management Information Systems.

Lai, I., & Long, A. (2007). The strategic changes by adopting Internet based interorganizational systems. *Management Research News, 30*, 7.

Abstract. The Internet, with its unprecedented growth, is a promising platform to exchange information along the business channels. The purpose of this study was to determine the factors that are critical to organizations in their adoption decision of Internet-based interorganizational information systems (IBIS). Using a field-based survey, the researchers obtained findings that suggested that the factors that significantly affect the adoption decision of IBIS are pressures felt from trading partners, pressure felt from competitors, establishing costs, network reliability, data security, scalability, complexity, support from top management, and trust between trading partners. This

research highlights the similarities as well as the differences between IBIS and Electronic data interchange (EDI). The study showed that IBIS and EDI are similar in terms of the significant effect of factors such as pressure from trading partner, pressure from competition, establishing cost, top management support, and trust on the adoption decision. However, the results show that there are differences between IBIS and EDI in terms of establishing costs, scalability, and complexity.

Comments. As organizations continue to face economic pressures to become more efficient, electronic commerce is often looked at to provide cost savings. The organizations can no longer be satisfied with internal efficiencies alone. Discusses the advantages of IOS's, such as the reduction in labor and material costs as well as increased competitiveness. The article is part of the data set for coding, and information supports the development of the Review of Literature section of this paper. Khalid S. Soliman is Assistant Professor of Business Computer Information Systems at Hofstra University. Dr. Soliman has published more than 27 articles in peer reviewed journals as well as national and international conference proceedings. Brian D. Janz is Associate Professor of MIS at the Fogelman College of Business and Economics at The University of Memphis. Prior to receiving his PhD in Management Information Systems from the Carlson School of Management at The University of Minnesota, Dr. Janz spent 12 years in the information systems field working for Fortune 100 companies.

Madlberger, M. (2008*). Interorganizational collaboration in supply chain management: What drives firms to share information with their trading partners?* Paper presented at the Proceedings of the 41st Hawaii Annual International Conference on Systems Sciences.

Abstract. With growing use of interorganizational systems the scope of inter-firm collaboration has increased considerably, particularly in the supply chain context. An important prerequisite of inter-firm collaboration is information sharing. Extant research suggests clear advantages of information sharing. The research presented in this paper addresses antecedents of interorganizational information sharing. Based on findings from interorganizational systems adoption and inter-firm collaboration research, a structural model is developed and validated by a quantitative survey among Austrian retailers and manufacturers in the fast moving consumer goods sector. The proposed model explains the effect of internal factors (commitment, information policy, and readiness), inter-organizational factors (relationship, trust, power, and trading partners' readiness), and economic factors (perceived benefits and costs) on information sharing behavior. The results show the relevance of internal factors and perceived benefits. The study reveals particularities of information sharing behavior and can help practitioners to understand what motivates their trading partners to share information.

Comments. Discusses the reasons, advantages and methodologies for information sharing. Analyzes the resulting competitive advantage that these actions provide. The article is part of the data set for coding, and information supports the development of the Review of Literature section of this paper. This study proposes a hypothesis and works to prove it, which is outside the domain of this literature review. Dr. Maria Madlberger is a Senior Research professor at Webster University Vienna. Dr. Madlberger has authored almost 60 publications in academic journals, conference proceedings, book chapters, and books.

Malone, T.W., Yates, R., & Benjamin, R.I. (1987). Electronic markets and electronic hierarchies. *Communications of the ACM, 30,* 484-497.

Abstract. This paper analyzes the fundamental changes in market structures that may result from the increasing use of information technology. First, an analytic framework is presented and its usefulness is demonstrated in explaining several major historical changes in American business structures. Then, the framework is used to help explain how electronic markets and electronic hierarchies will allow closer integration of adjacent steps in the value added chains of our economy. The most surprising prediction is that information technology will lead to an overall shift toward proportionately more coordination by markets rather than by internal decisions within firms. Finally, several examples of companies where these changes are already occurring are used to illustrate the likely paths by which new market structures will evolve and the ways in which individual companies can take advantage of these changes.

Comments. This is one of two articles that serve as a foundation for electronic markets. The finding in this article is that the benefits of an electronic market are so intense that it will allow companies to allow the market to fulfill previously internal tasks. The case studies that are referenced should provide a grounded framework to explore this concept in more detail. The article is part of the data set for coding, and information supports the development of the Review of Literature section of this paper. Thomas W. Malone is the Patrick J. McGovern Professor of Management at the MIT Sloan School of Management. Dr. Malone has also published over 75 articles, research papers, and book chapters; he is an inventor with 11 patents; and he is the co-editor of three books. Dr. JoAnne Yates is Sloan Distinguished Professor of Management at the MIT Sloan School of Management and has authored a wide variety of articles.

Nagi, A. (2006). *Collaboration and conflict in the electronic integration of supply networks.* Paper presented at the Proceedings of the 39th Hawaii Annual International Conference on Systems Sciences.

Abstract. The integration of supply networks to ensure timely and high quality information sharing between trading partners is an essential component in supply chain performance development. Electronic data interchange (EDI) and other interorganizational systems (IOS) are able to support these goals, however the diffusion of these systems throughout the supply chain is by no means guaranteed. Integration very often fails due to conflicting interests of the supply chain members and because of the lack of commonly accepted IT and process standards. The authors apply the Adoption Position model in a form of comparative case studies to explain the reasons of success and failure of recent IOS adoptions. They analyze several tiers of an international supply chain and derive the conclusion that the intention to adopt a specific IOS and the relative power relationship between trading partners together determine the adoption decision and the degree of collaboration within the supply network.

Comments. This article provides a framework around the historical and future implementations of IOS systems. The author goes into detail on why companies establish IOS's and what the cost/benefit is for that decision. This information is used to help this study identify the competitative advantage that IOS's bring to firms that chose to engage in them. The article is part of the data set for coding, and information supports the development of the Review of Literature section of this paper. Dr. Nagi is on the facility of Tilburg University in the Nethelands. He has produced several conference reports.

Narayanan, S., Marucheck, A., & Handfield, R. (2009). Electronic data interchange: Research review and future directions. *Decision Sciences, 40,* 121-163.

Abstract. For nearly two decades, electronic data interchange (EDI) has been widely viewed as a technology pivotal to supply chain management that has also provided benefits to firms on multiple levels. Despite a substantial body of literature, there are a number of conflicting and inconclusive research results in this field. In this study, the authors synthesize the diverse body of research in EDI by organizing the literature into an initial theoretical framework. Based on a meta-analysis of results from the empirical literature, they seek to clarify conflicting results from the literature in order to develop a more unified theoretical framework of contextual variables associated with EDI adoption factors and outcomes. From a managerial standpoint, the literature-based framework offers a set of guidelines for making successful EDI adoption and implementation decisions.

Comments. This article is used to support the Problem Area of this study. It helps provides the historical context as well as provides substantial information on the qualitative benefits of using EDI/IOS systems. This article appears in the Decision Sciences journal, which is a professional journal that is circulated to over 1000 libraries worldwide. Dr. Sriram Narayanan is an Assistant Professor with the Department of Supply Chain Management. Dr. Narayanan has published five articles since 2008. Dr. Marucheck is a department editor for the IEEE Transactions on Engineering Management and associate editor for the Journal of Operations Management as well as a number of editorial review boards. Dr. Rob Handfield is the Bank of America University Distinguished Professor of Supply Chain Management at North Carolina State University, and director of the Supply Chain Resource Cooperative. He also serves as an

Adjunct Professor with the Supply Chain Management Research Group at the Manchester Business School.

Patnayakuni, R., Rai, A., & Seth N. (2006). Relational antecedents of information flow integration for supply chain coordination. *Journal of Management Information Systems, 23*, 13-49.

Abstract. A new model of competition, where competition is among supply chain networks rather than individual firms, is transforming traditional market-based buyer supplier relations to one of competition among cooperative sets. In order to integrate and realize performance gains from participating in cooperative supply networks, the importance of information sharing across the supply chain has been emphasized in different literature streams. In this study, the authors examine the relational antecedents of this critical aspect of supply chain integration--that is, information flow integration. Our objective is to investigate the relationship between relational orientations of the focal firm, as characterized by (1) long-term orientation of its supply chain relationships. (2) asset specificity, and (3) interaction routines and the information flow integration between a firm and its supply chain partners. A research model was developed and data were collected from 110 supply chain and logistics managers in manufacturing and retail organizations. The results suggest that tangible and intangible resources invested in supply chain relationships enable the integration of information flows with supply chain partners. Specifically, formal and informal interaction routines that take time and effort to develop enable integration of informational flows across a firm's supply chain. Investments in relation specific assets and long-term orientation in relationships enable the development of these interaction routines.

Comments. This article was primarily used to support the concept of competitition occuring on the supply chain rather then within individual companies. By analyzing the IOS based factors that lead to increased efficiencies, the authors were able to identify how to lower TCE. The article is part of the data set for coding, and information supports the development of the Review of Literature section of this paper. This study is cited by 56 sources. Ravi Patnayakuni is a professor at the University of Alabama and has published nine articles since 1996. Arun Rai is a professor at Georgia State University and has published 33 articles since 1990. Nainika Seth is an assistant professor at University of Alabama and has published two articles since 2001.

Selviaridis, K., Spring, M. (2007). Third party logistics: A literature review and research agenda. *The International Journal of Logistics Management*, *18*(1), 125-150.

Abstract. The review reveals that 3PL research is empirical-descriptive in nature and that it generally lacks a theoretical foundation. Survey research is the dominant method employed, reflecting the positivist research tradition within logistics. It identifies certain knowledge gaps and develops five propositions for future research. It suggests that focus should be directed towards more normative, theory-driven and qualitative method-based studies. It also argues that further empirical research in relation to 3PL design/implementation and fourth party logistics services is needed.

Comments. Third party logistics (3PL) is a primary user of IOS systems. This is due to their role as facilitator in the retail supply chain. This article explores the unique ways in which 3PL benefits from open IOS systems and how they can be used to provide seamless integration between partners. The article is part of the data set for coding, and information supports the development of the Review of Literature section of this paper.

The International Journal of Logistics Management is a peer reviewed publication. Dr. Kostas Selviaridis works at the Lancaster University Management School with Dr. Spring.

Son, J., Narasimhan, S. & Riggens, F. (2005). Effects of relational factors and channel climate on EDI usage in the customer-supplier relationship. *Journal of Management Information Systems, 22*(1), 321-353.

Abstract. Managing electronic trading partner relationships is a key to successful development of an interorganizational systems (IOS) network. Firms often exercise their power and offer reciprocal investments to their trading partners in developing an IOS network. However, limited effort has been made to empirically validate their effects on increasing IOS usage between trading partners. This paper gauges the effects of these two relational factors—power and reciprocal investments—within the context of an electronic data interchange (EDI) network development. Moreover, the role of channel climate in increasing EDI usage is explicated with a particular focus on its determinants and impacts. With insights obtained from social exchange and transaction cost theories, a research model is developed and tested with data collected from 233 suppliers with electronic linkages via EDI with a nationally recognized retailer of home improvement supplies and materials in the United States. The customer's reciprocal investments in the form of EDI-related support are proven to be effective in increasing EDI volume and diversity. However, power exercised is found to be not effective. Suppliers' cooperation with the customer, which is influenced by perceived uncertainty, trust, and transaction-specific investments, is found to have strong effects on EDI volume and diversity.

Finally, the reciprocal investments are found to be an even more effective strategy when suppliers desire to keep a more cooperative relationship with the customer.

Comments. Firms that implement IOS systems often do so under the direction of network leaders. This has the consequence of tilting the benefit of such implementations towards these network leaders. This article was used to support the idea that there are varying degrees of advantages to IOS systems depending on where in the supply chain the firm lies. The article is part of the data set for coding, and information supports the development of the Review of Literature section of this paper. This article has been cited by 45 sources according to Google Scholar. Dr. Jai-Yeol Son is an Assistant Professor of Management Information Systems and has authored six articles on various aspects of IOS's. Dr. Sridhar Narasimhan is the Senior Associate Dean and Georgia Tech and is also a Professor of Information Technology Management. Frederick J. Riggins is the Clinical Associate Professor of Information Systems at Arizona State University.

Subramani, M. (2004). How do suppliers benefit from information technology use in supply chain relationships? *Mis Quarterly*, *28*(1), 45-73.

Abstract. Supply chain management systems (SCMS) championed by network leaders in their supplier networks are now ubiquitous. While prior studies have examined the benefits to network leaders from these systems, little attention has been paid to the benefits to supplier firms. This study draws from organizational theories of learning and action and transaction cost theory to propose a model relating suppliers' use of SCMS to benefits. It proposed that there are two patterns of SCMS use by suppliers -- exploitation and exploration. These, in turn, enable suppliers to both create value and retain a portion of the value created by the use of these systems in interface relationships. Data from 131

suppliers using an SCMS implemented by one large retailer support hypotheses that relationship-specific intangible investments play a mediating role linking SCMS use to benefits. Evidence that patterns of information technology use are significant determinants of relationship-specific investments in business processes and domain expertise provides a finer-grained explanation of the logic of IT-enabled electronic integration. The results support the vendor-to-partners thesis that IT deployments in supply chains lead to closer buyer-supplier relationships (Bakos and Brynjyolfsson 1993). The results also suggest the complementarily of the transaction-cost and resource-based views, elaborating the logic by which specialized assets can also be strategic assets.

Comments. This article was used to support the Problem Area of this study as well as to further expand upon the idea of uneven benefits of IOS implementation depending on where the firm lies on the supply chain. Mani Subramani is an associate professor in the Department of Information and Decision Sciences at the Carlson School of Management, University of Minnesota. He has published a variety of articles, to include "Dot Com Effect: The Impact of E-Commerce Announcements on the Market Value of Firms", which won the Best Paper award at the 20th International Conference on Information Systems in December 1999.

Swatman, C., & Chan C. (2000). From EDI to internet commerce: The BHP steel experience. *Communication Abstracts, 23*.

Abstract. This article discusses the issue of business-to-business e-commerce implementation and the factors affecting it, considering the appropriateness of the various theories that underpin research into systems implementation (primarily diffusion of innovation and traditional change management theory). The article describes the results

of a case study of BHP Steel, the largest steel producer and one of the largest companies in Australia, which is a leader in e-commerce implementation. The results suggest that, over time, the driving force for e-commerce changed significantly. From an initial push to improve current business process by adopting electronic data interchange to achieve savings and improve efficiency, the company came to be driven by a desire for greater supplier involvement and customer service in later implementations. The article discusses the ways in which BHP Steel's e-commerce innovations have changed and suggests that, in addition to considering the characteristics of the innovation process, other more contextual aspects of implementation (such as the social system in which the innovation evolves and the timing of the innovation's introduction) be considered in an interorganizational text.

Comments. This article provides a case study of how EDI was implemented at a major company and the reasons for doing so. It introduces the concept of an evolutionary approach to IOS implementation and how partners can influence your ability to move forward. The article is part of the data set for coding, and information supports the development of the Review of Literature section of this paper. Dr. Caroline Chan is an Associate Professor at Deakin University. She has published two articles since 2002.Dr. Paula Swatmanis the Director of the Interactive Information Institute at RMIT University in Melbourne. It is unknown whether Communications Abstracts is a peer reviewed journal, but given that this is a case study and grounded in the experiences of a specific implentation, the author has decided to include this article in the study.

Wang, E., Tai, J., & Wei, H. (2006). A Virtual integration theory of improved supply-chain performance. *Journal of Management Information Systems, 23*(2), 41-64.

Abstract. Organizing and maintaining a competent and flexible supply chain is a major challenge to manufacturers in today's increasingly competitive and uncertain environments. Virtual integration represents the substitution of ownership with partnership by integrating a set of suppliers through information technology (IT) for tighter supply-chain collaboration. From the systems and control perspectives, this study develops a theory of virtual integration with an empirical model to examine the role that virtual integration plays in facilitating manufacturers to achieve greater manufacturing flexibility and comparative cost advantage. Based on a survey of Taiwanese manufacturing firms, our results show that environmental uncertainty tends to motivate manufacturers to increase their manufacturing flexibility, with both virtual integration and supplier responsiveness playing a vital enabling role. The results demonstrate the importance of supplier responsiveness for manufacturers to gain manufacturing flexibility and comparative cost advantage in supply-chain operations. Environmental uncertainty, thus, might first appear as a threat to a manufacturer, but with the help of IT and more responsive suppliers, such a threat could be transformed into a competitive edge, as reflected in the manufacturer's higher levels of manufacturing flexibility and comparative cost advantage.

Comments. This article is a case study that identifies that, while uncertainty is a challenge in the supply chain, IOS's can be implemented to control it. Through this control, a competitive advantage arises. The article is part of the data set for coding, and information supports the development of the Review of Literature section of this paper. It provides evidence of how IOS can be used to control factors that previously were identified as liabilities. Eric Wang is Dean and Professor in the School of Management at the National Central University in Taiwan. He has published 21 articles in a variety of

journals. Jeffrey Tai is a senior industry analyst in the Market Intelligence Center of the Institute for Information Industry, Taiwan and is the author of two articles. Hsaio-Lan Wei is an Assistant Professor in the Department of Information Management at National Taiwan University of Science and Technology and she has written one article.

Wei, H. & Wang, E. (2007). *Creating strategic value from supply chain visibility - the dynamic capabilities view*. Paper presented at the Proceedings of the 41st Annual International Conference on Systems Sciences.

Abstract. To understand the role of supply chain visibility in creating strategic value, this study applies the dynamic capabilities view to investigate the nature of supply chain visibility. This research identifies four important measurable constructs of supply chain visibility that are proposed to drive supply chain reconfigurability and improve supply chain performance. They are sensing for visibility, learning for visibility, coordinating for visibility, and integrating for visibility. Implications for better understanding the nature and the role of supply chain visibility are provided based on the research model and survey results.

Comments. One of the benefits of implementing a IOS is allowing your partners to view and interogate the status of individual orders. This in turn leads to enhancements in JIT and minimizes the bull whip effect that can come from supply chain distortions. This article addresses these issues and is used in this study to support the case that IOS's can provide a competitive advantage not just through decreased costs but also through enhanced services. The article is part of the data set for coding, and information supports the development of the Review of Literature section of this paper. The previous work and status of the authors is not currently known, but the fact that this paper was presented at

the Annual International Conference on Systems Sciences, which is a prestigious and long running conference, speaks to the qualifications of the authors.

Yao, Y., Dresner, M., & Palmer, J. (2009). Private network EDI vs internet electronic markets: A direct comparison of fulfillment performance. *Management Science, 55*, 843-852.

Abstract. Prior literature has documented the performance benefits from the use of electronic data interchange (EDI) and the Internet. Using purchase and fulfillment records from the U.S. government's Federal Supply Service, we provide a direct comparison of performance between a private network EDI channel and an Internet electronic market. Performance is measured using order cycle time and complete orders fulfilled. Our findings show that the Internet-based electronic market outperforms the EDI-based channel on these two important measures. Order cycle times were significantly lower when using the Internet-based electronic market, whereas the percentage of complete shipments was significantly higher after controlling for product, transaction, seller, and buyer-specific factors. The electronic market even outperforms the EDI channel when buyer and transaction characteristics favor the use of EDI. Because EDI is still prevalent in many industries, these results point to the gains that may be realized by switching to the newer technology.

Comments. This article serves to introduce the concept of electronic markets. These markets differ from EDI in that they are open and not directly tied to a supplier. While they differ from EDI, they can be used to accomplish a similar purpose. The competitive advange that electronic markets bring however is so intense that many companies chose to not engage in this type of transactions. This concept is not fully explored yet, but should serve to illustrate how a hypercompetitive framework is achieved and who it

benefits. The article is part of the data set for coding, and information supports the development of the Review of Literature section of this paper. Yuliang Yao is an Assistant Professor at Lehigh University and is the publisher of six articles since 2007. Dr. Jonathan Palmer became president of Principia College in July 2008. When this article was published, Dr. Palmer served as associate dean for academic affairs and professor at the Mason School of Business at the College of William & Mary.Martin Dresner is a professer at the University of Maryland. He has published papers in leading transportation and logistics journals, as well as journals in related fields, and has co-authored a book on supply chain management

Review of Literature

Introduction

Rapid advancements in technology and increasing global competition have put pressure on companies to reduce both costs and time to market. The increasingly turbulent market environment in which these companies operate has made fast reaction time a requirement for success (Furst & Shmidt 2001). The use of information technology (IT) has led to a revolution in the ability of companies to coordinate supply chain relationships. The primary tool that has enabled this coordination is known as the interorganizational system (IOS) (Gosain, Malhotra & Sawy, 2004).

The intent of this study is to determine what, if any, competitive advantage firms can gain by implementing an IOS. As Madlberger (2008) states, "In the last years the intensity of efforts for an intensified collaboration between firms in a supply chain has increased. Interorganizational systems (IOS) have largely contributed to this paradigm shift as they proved to be technological enablers for closer relationships and tighter coordination between trading partners" (p. 1). While there is an assumption that coordination between trading partners is desirable, there is often a disconnect between what is initially desired and the ultimate outcome (Madlberger, 2008). The reasons for this disconnect are explored in this section of the study. It is important to note at the outset that while there is no uniform measure of success associated with the implementation of an IOS, it is in this disparity that a competitive advantage takes shape among the successful adapters – both at the company level and within the supply chains they participate in (Gosain, Malhotra & Sawy 2004).

To understand how an IOS can support competitive advantage, it is important to investigate history as well as to explore both present use and how an IOS can integrate with new forms of technology such as electronic markets (EMs). To accomplish this, this Review of the

Literature is divided into three primary themes. The first theme explores how IOS systems complement and interact with supply chains. The second theme is focused on how EDI is being adapted to the modern IOS environment. The third theme looks at how EMs are innovating IOS technologies.

Components of an IOS

An IOS is an encompassing term that includes a wide variety of technologies (Christiaanse 2005). Historically, the primary component of an IOS was a dyadic messaging environment known as Electronic Data Interchange (EDI). An EDI platform allows firms to exchange information on a timely and frequent basis. The high cost of developing an EDI platform meant that this was a luxury primarily afforded to larger companies (Christiaanse 2005). These platforms, which many times lack clear adherence to standards, are often developed at the instruction of a network leader and to the detriment of the suppliers in the chain (Subramani, 2004).

The high cost of development and lack of standards resulted in an evolution of traditional EDI to what has been termed Internet EDI (Dia & Kauffman, 2006). Internet EDI processes enable the creation of extranets (a private network which include multiple firms), which remove the dyadic limitations of traditional EDI by including customers, businesses and suppliers on the same network (Dia & Kauffman 2006).

The continued evolution of these systems in support of an open and low transactional cost market resulted in B2B hubs, or electronic markets (EMs). As stated by Dia and Kauffman (2006), “Along with electronic catalogs, electronic auctions and other capabilities, these exchanges aggregate product and price information, match supply and demand, and facilitate transactions between buyers and their suppliers” (p. 111). One primary difference between the

various forms of EDI and the EMs is the openness of the trading network they create. EDI works with a predefined set of partners, whereas the electronic market can interface with a wide variety of IOSs (Dia & Kauffman 2006).

Theme One: How IOSs Complement and Interact with Supply Chains

IOSs form a vital part of worldwide B2B transactions. As early as 2003, there were an estimated 30,000 IOS systems in operation supporting a large percentage of the global economic transactions (Subramani, 2004). As of 2006, $1.5 trillion dollars of goods was transacted by IOSs (Dia & Kauffman 2006). As the demand for tighter integration and greater cost controls continues to take hold, it is expected that IOSs will see exponential growth for the near term (Subramani, 2004).

Literature relating to the role of IOSs in the supply chain focuses on the need to tightly integrate the priorities of all members of the supply chain (Gosain, Malhotra & Sawy 2004). The lack of integration leads to the bullwhip effect, which is the distortion of the supply chain as a result of unknown variables (Madlberger, 2008). Historically this variability has been assumed to be an unavoidable byproduct of supply chain management. However with the advent of IOSs and information sharing, it is possible to reduce this variability.

Reduction of the bullwhip effect may represent the greatest potential for increased competitive advantage (Madlberger, 2008).To reduce the variability from the bullwhip effect, it is vital to develop flexibility into the supply chain (Gosain, Malhotra & Sawy 2004). Flexibility can be defined as "how well the competencies of multiple organizations may be combined in temporary alignments in response to customer needs" (Gosain, Malhotra & Sawy 2004 p. 11), and allows for the rapid creation and termination of relationships (Dedrick, Xu & Zhu 2008). It should be noted however, that when seen through the lens of transaction cost economics (TCE),

this option may put some members of the supply chain at risk when they are in a situation where they are in contact with only a small number of suppliers (Dedrick, Xu & Zhu 2008).

Theme Two: Traditional EDI in the Supply Chain

Traditional EDI attempted to introduce flexibility into the supply chain by creating automated linkages between two firms (Christiaanse 2005). Linkages allowed for rapid and predictable exchanges of information between two trading partners (Subramani 2008). The exchanges were typically conducted over a network known as a Value Added Network, commonly referred to as a VAN. (Dia & Kauffman, 2006). Firms that chose to implement EDI experienced reduced shipment errors, higher inventory turnover, and ultimately lower costs of goods (Yao, Dresner & Palmer 2009). As shown in Figure 1 below, this dyadic linkage was limited however in that there was no concept of an integrated supply chain (Christiaanse 2005). Moreover, while traditional EDI enabled the rise of business-to-business (B2B) transactions, EDI is outside the scope of modern technological advancements such as the Internet (Dia & Kauffman 2006).

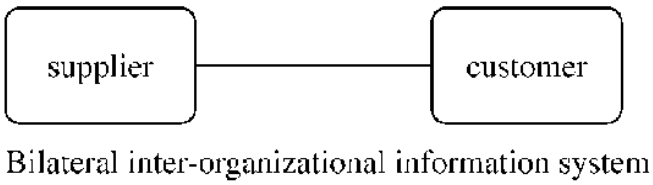

Figure 1: EDI and the Dyadic Exchange (Choudhury, 1997)

In addition to the technical challenges of traditional EDI, there is an inherent risk that prevented the widespread adaption of this form of IOS. Due to the high cost and specificity of these systems, it is easy for the supply chain to become locked (or closed) – which in turn creates the possibility of opportunistic behavior (Gosain, Malhotra & Sawy 2004). For example, it has been

found that in some situations, prominent manufacturers have been known to force trading partners into a proprietary and difficult-to-implement system, as a way to keep them from developing relationships with others (Gosain, Malhotra & Sawy 2004).

The inability of traditional EDI linkages to handle change is one of the key obstacles facing IOS systems today (Gosain, Malhotra & Sawy 2004). This lack of flexibility creates challenges when dealing with market changes or short life span products.

Theme Three: How EDI is being adapted to the modern IOS environment

Limitations within the traditional EDI system have fueled the creation of what is has been called Internet EDI (Dedrick, Xu & Zhu 2008) or sometimes also called Web EDI (Gosain, Malhotra & Sawy 2004). Internet EDI is a network in which IOSs can communicate with all members of the supply chain (Christiaanse 2005). While not necessarily an open network, changes in trading partners can be accommodated with relative ease. This ability to accommodate changes in trading partners is known as partnering flexibility, and under ideal situations represents a substantial improvement over traditional EDI (Gosain, Malhotra & Sawy 2004). Various efforts have been made to increase the viability of EDI systems (Gosain, Malhotra & Sawy 2004). These efforts have led to a variety of initiatives that offer increased partner flexibility and offering flexibility. Of these, this Review of Literature examines three in particular: (a) RosettaNet, (b) XML based e-business, and (c) electronic markets (EMs).

RosettaNet. RosettaNet is a non-profit consortium of companies, founded in 1998. The mission of this consortium is to establish a common language and process for B2B transactions (Damodaran, 2004). The RosettaNet standard identifies two types of major components: private processes and public processes. The private processes refer to the internal processes that are unique to each business. Since these systems develop uniquely and diverge over time, the

RosettaNet standard currently focuses on the public processes, or those activities that are visible to both trading partners (Damodaran, 2004).

Within the RosettaNet standard, each type of public process is defined with a Partner Interface Process (PIP) standard. These PIP standards define the business documents, the sequence in which they are sent, and the quality of service attributes. In other words, PIPs define the dialog and processing steps that take place between trading partners on a supply chain (Gosain, Malhotra & Sawy 2004). There are currently over 50 defined PIPs for various predefined supply chain activities. Trading partners that exchange PIPs do so within a trading agreement that defines the technical aspects of the transactions (see Figure 2 for a diagrammatic interpretation of the process).

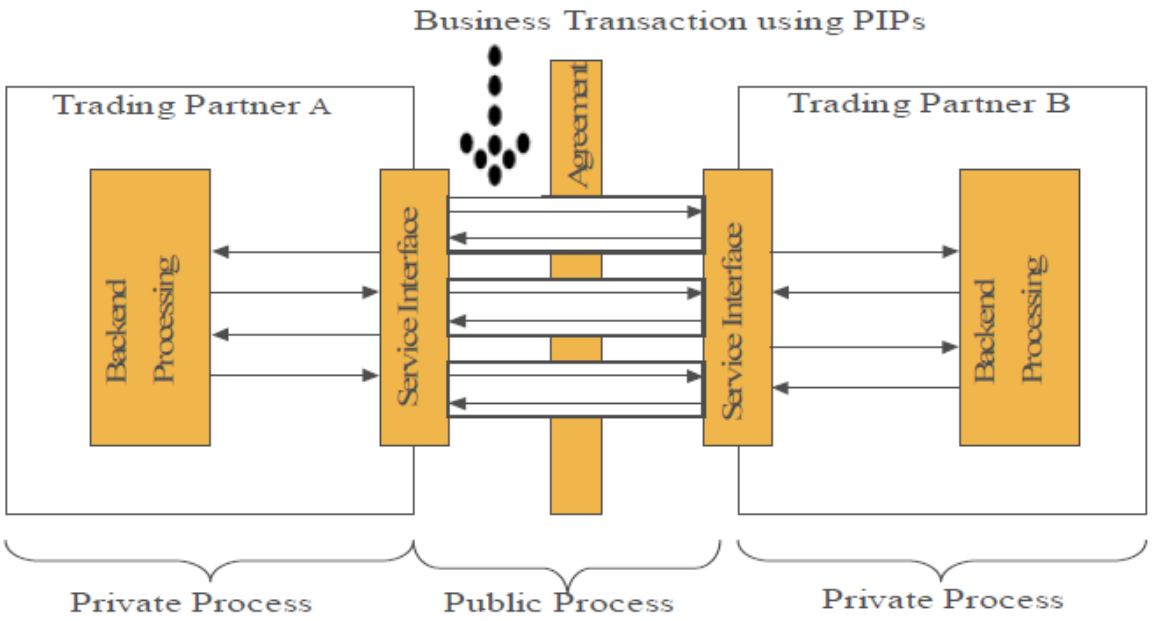

Figure 2: PIP overview within the public/private process (Damodaran, 2004).

XML based web services. The strength of traditional EDI comes from its well defined data and transactions standards (Albrecht, Dean & Hansen, 2005). Once the framework is established between two firms, EDI presents itself as a low cost and efficient mechanism for IOS activities. There are limitations however to the viability of traditional EDI. These include the following:

- EDI is regional: North America uses the X12 standard, whereas the rest of the world has focused on the EDIFACT standard (Nurmilaakso, 2007).
- EDI standards are frequently modified: Since EDI contains little references to business processes, various subsets of the X12 and EDIFACT standards exist. These subsets create problems in communicating between industries (Nurmilaakso, 2007).
- EDI requires expensive transformation software: The software that enables EDI communication is limited and often expensive to implement. Based on the various subsets of standards, EDI often locks customers into unfavorable relationships with venders (Nurmilaakso, 2007).
- EDI favors large companies: The cost of setting up EDI has always been high. While that cost has moderated with the introduction of XML based e-business, there is still a barrier to entry that favors well funded firms (Albrecht, Dean & Hansen, 2005).

XML based web services attempt to address these issues by introducing the ambiguity of the World Wide Web via XML and the Universal Description, Discovery, and Integration (UDDI) registry system (Albrecht, Dean & Hansen, 2005). Web services use open communication standards that are defined by the World Wide Web Consortium (W3C).

Web services must be paired with an XML framework to become functional. One of the most ambitious frameworks to evolve is the ebXML standard. Formed as a joint venture in 1999 between OASIS (Organization for the Advancement of Structured Information Standards) and UN/CEFACT (United Nations Centre for Trade Facilitation and Electronic Business), ebXML attempts to succeed EDI by enabling a "global electronic marketplace where enterprises of any size and in any geographical location can meet and conduct business with each other through the exchange of XML-based messages" (Mertz, 2010, para. 4).

ebXML works on the principle of enabling trading partners to define their capability and publish it to a common registry. Through a process known as discovery, firms identify partners to engage with (CEN, 2010). To better understand the ebXML process, it is useful to step through an example of the process flow, with two hypothetical companies (see Figure 3). A description of the process follows:

Step 1. Company A identifies an ebXML registry. This registry serves as a mechanism to enable firms to discover one another, define trading agreements and exchange XML messages with no human interaction.

Step 2. Company A acquires ebXML complaint software. This can be developed or purchased.

Step 3. Company A submits a document known as a business profile to the ebXML registry. This business profile is an XML document that describes the capabilities, constraints and supported business scenarios that Company A wishes to engage in.

Step 4. Company B, via the same ebXML registry identified in step 1, discovers the business profile that Company A submitted.

Step 5. Company B sends a request to Company A stating they wish to engage in a business scenario supported by the profile submitted.

Step 6. Company B submits a proposed business arrangement directly to Company A.

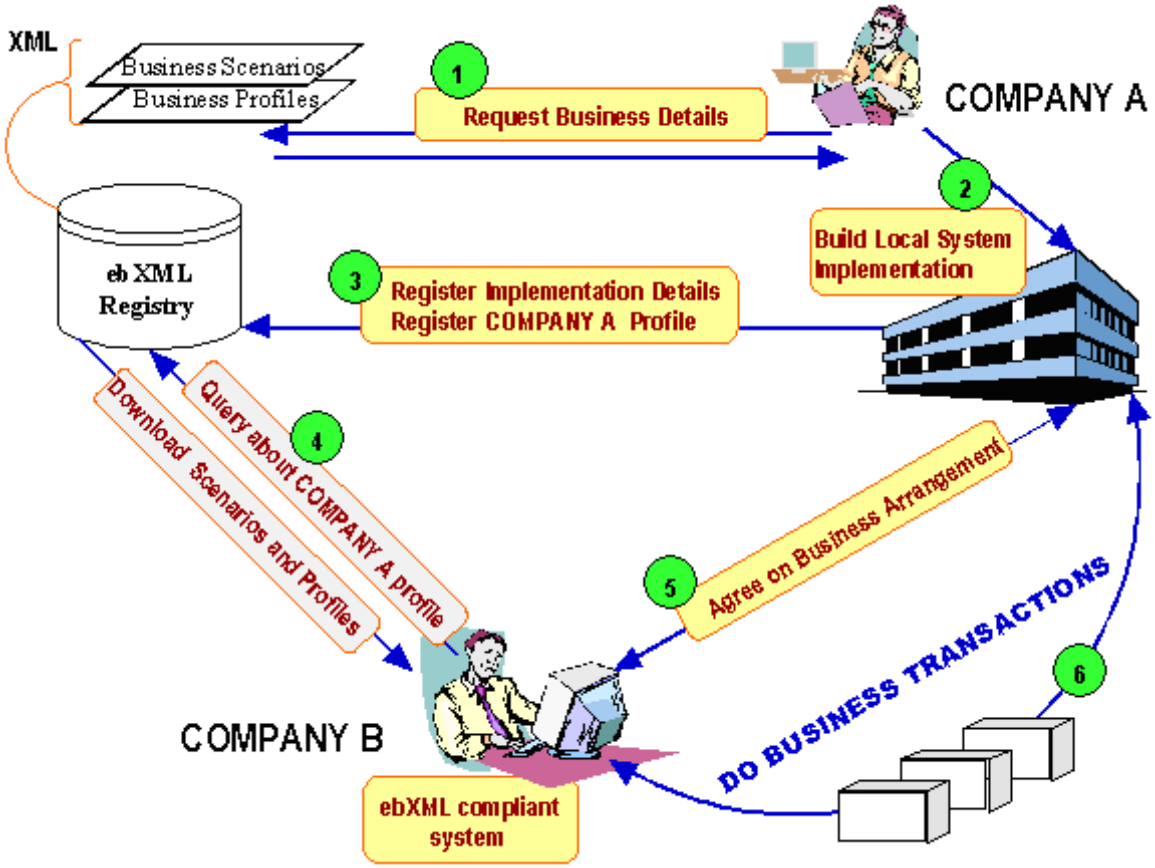

Figure 3: ebXML Process Flow (CEN, 2010)

Electronic Markets. Electronic markets refer to electronic intermediaries that provide product offerings for buyers to purchase, and facilitate transactions between buyers and suppliers (Yao, Dresner & Palmer 2009). Electronic markets are conducted over the open standards of the Internet (Zhu & Kramer 2005).

Electronic markets differ from traditional EDI in that there is no one-to-one linkage between firms. Instead, firms connect to a central hub in which they identify themselves as a supplier or buyer of various services or goods. The hub coordinates the data sharing that eventually leads to the creation of trading partners (see Figure 4 for a diagram of the hub model).

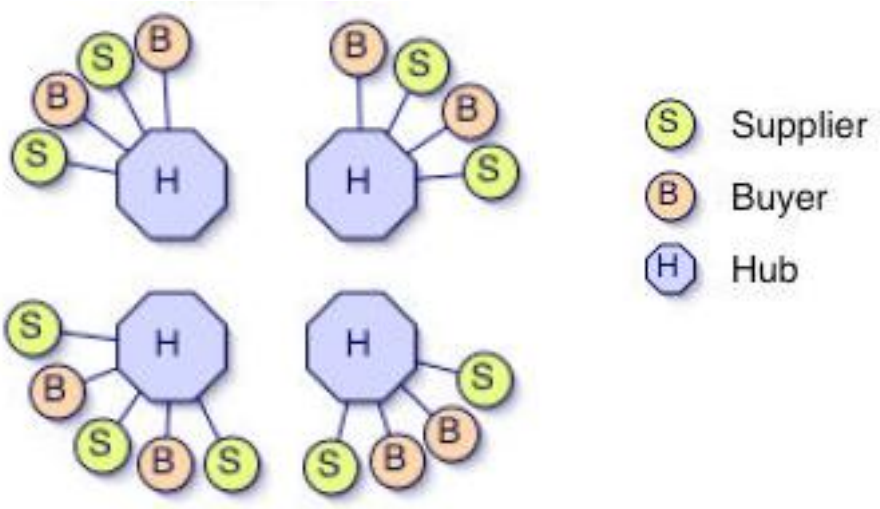

Figure 4: B2B Hub Model (Albrecht, Dean, & Hansen. 2005).

By allowing firms to aggregate offerings and easily compare pricing information, hubs provide a downward pressure on price and increased economies of scale that produce competitive advantages across all layers of the supply chain. In addition, identifying a hub with which to interact enables firms to standardize transaction interfaces, which further drives down costs.

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Conclusion

The purpose of this literature review is to identify in which ways an IOS enables competitive advantage. In the course of analyzing the selected literature base, it is the conclusion of this study that IOSs can enhance the competitive advantage of firms in three key areas. As Porter (1985) describes, there are various elements that define competitive strategy. To quantify the competitive advantages, the four elements identfied as most relevent to this topic include: (a) switching costs of suppliers, (b) capital requirements as a barrier to entry, (c) access to distributors, and (d) relationships between price and quality. These elements are used to measure success in the key areas that define competitive advantage. This section of the paper provides an initial brief review of the evolution of IOSs, followed by the three key competitive advantages.

IOS evolution

The literature refers to an evolution of IOSs based on existing technology. Prior to the 1960's, communication between firms was limited to telephone and other non electronic means. Firms that chose to pursue a competitive advantage based on interorganizational communication had limited tools to accomplish that task.

In the 1960's, firms realized that there was a competitive advantage in being able to process large amounts of order information quickly and accurately. With the increasing dispersion of computers and telecommunication technologies, there was an increasingly viable toolset to help capitalize on this realization. In 1979, the first EDI standards were published and IOSs became a reality. Network leaders were able to push EDI on all members of their supply chain, which provided a huge competitive advantage in that they had control over suppliers who were basically locked in due to the high cost of entrance. Suppliers chose to participate however, as a way to gain access to these perferred supply chains (Zhao, Xia, & Shaw, 2007).

The continuing evolution of computer technology and the introduction of both XML and the Internet provided an increasingly sophisticated toolset that allowed faster implementation times and increased visibility between partners (Gosain, Malhotra & Sawy 2004; Huang, Janz & Frolick, 2008; Narayanan, Marucheck & Handfield, 2009). While EDI continues to be a relevent force in legacy IOSs, new technologies such as RosettaNet and ebXML are providing early adapters with cost savings that are increasingly driving migration away from EDI (Damodaran, 2004).

Ultimately the advantage goes to the firm, or supply chain, that makes the most innovative use of existing technologies to lower costs and provide superior services (Porter, 1985). By using available technologies as tools to support innovation, firms using IOSs have realized competitive advantages.

Competitive advantage #1: Access to preferred supply chains

Next generation IOS technologies, to include RosettaNet and XML based web services, are often developed by consortiums of industry leading firms. For example, RosettaNet is backed by member companies that represent $1.2 trillion dollars of annual revenue. Intel, one of the leading members of the RosettaNet community, requires all suppliers to interface with it through this technology (Greenemeier, 2002). As of 2008, there are an additional 2,000 companies that are making use of RosettaNet. Access to these supply chains requires the use of this specific technology (RosettaNet, 2009).

While ebXML lacks the depth of users when compared to RosettaNet, there is a growing list of companies that are moving towards this standard. Fujitsu, PeopleSoft and CommerceOne are three examples of firms that rolled out ebXML based supply chains (ebXML Industry Support, 2006).

Competitive advantage #2: Ease of entry into complementary supply chains and painless exit.

The ability for trading partners to quickly form and disolve relationships based on short term benefits is one of the primary advantages provided by a successful IOS. This ability is only realized through an IOS implementation that is based on commonly accepted standards (Gosain, Malhotra & Sawy 2004). As defined by Porter (1985), one of the determinants of the bargining power of suppliers is the switching costs of suppliers and firms in the industry. An IOS can reduce these switching costs by enabling fast transistion between suppliers to meet the immediate needs of the supply chain (Gosain, Malhotra & Sawy, 2004).

When describing competitive advantage, Porter (1985) defined, capital requirements as a barrier to entry, that can limit the number of available participants in an industry. Modern IOSs that allow for low cost and rapid replacement of members assist in expanding the market of available suppliers. This expansion lowers the cost of business overall, through increased competition (Christiaanse 2005).

Competitive advantage #3: Ability to control costs by increasing visibility into the supply chain.

As stated in the Introduction to this study, one of the primary obstacles in supply chain management is limiting the bullwhip effect. This bullwhip effect is a "distortion in the supply chain that increases with growing distance from the final consumer" (Madlberger, 2008, p. 1). Supply chains in which an aggregate decision is made by all participants to increase visibility produces a net benefit to all through reduced uncertainty and enhanced performance (Wei & Wang, 2007).

Many factors contribute to the bullwhip effect, but the resolution is always found in better knowledge transfer (Fenstermacher & Zeng, 1999). Increasing visibility and subsequently

enabling knowledge transfer is one of the goals of both RosettaNet and ebXML (Albrecht, Dean & Hansen, 2005; Damodaran, 2004). The success of both of these technologies can be measured by the rapid growth in implementations, seen in the last several years (RosettaNet, 2009; ebXML Industry Support, 2006).

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Appendix A

Search Results Report

Database Name	Search Term	Results	Quality
Business Source Premier	EDI	3085	Poor
	Electronic Data Interchange	4640	Moderate
	supply chain technology	290	Moderate
	supply chain xml	1	Excellent
	supply chain & EDI	214	Good
	EDI & B2B	50	Good
	outsource & supply chain & technology	65	Moderate
Academic Search Premier	EDI	33	Poor
	Electronic Data Interchange	1378	Moderate
	supply chain technology	34	Moderate
	supply chain xml	302023	Excellent
	EDI & B2B	34	Good
	outsource & supply chain & technology	16	Moderate

UO Computer Science Index - Top Results	EDI	145	Poor
	Electronic Data Interchange	116	Excellent
	supply chain technology	116	Good
	supply chain xml	87	Moderate
	EDI & B2B	64	Moderate
	outsource & supply chain & technology	34	Poor
ACM Digital Library	EDI	1844	Excellent
	Electronic Data Interchange	1435	Excellent
	supply chain technology	3428	Moderate
	supply chain xml	610	Good
	EDI & B2B	99	Excellent
	outsource & supply chain & technology	85	Poor
Computer Source	EDI	800	Moderate
	Electronic Data Interchange	1289	Moderate
	supply chain technology	116	Good
	supply chain xml	67	Moderate

	EDI & B2B	23	Good
	outsource & supply chain & technology	15	Moderate – Poor
Google Scholar	EDI	549000	Poor
	Electronic Data Interchange	127000	Moderate. Some good articles, most irrelevant
	supply chain technology	1280000	Poor. Scattered and too many results
	supply chain xml	28700	Good
	EDI & B2B	11800	Moderate
	outsource & supply chain & technology	29100	Poor - Moderate. Not focused.
UO Library Catalog	EDI	124	Very Poor
	Electronic Data Interchange	1	Poor
	supply chain technology	0	NA
	supply chain xml	0	NA
	EDI & B2B	0	NA

	outsource & supply chain & technology	0	NA
WorldCat	EDI	1803	Very Poor
	Electronic Data Interchange	1111	Excellent
	supply chain technology	1206	Good
	supply chain xml	28	Good
	EDI & B2B	14	Moderate
	outsource & supply chain & technology	6	Poor
IEEE	EDI	0	NA
	Electronic Data Interchange	100+	Excellent
	supply chain technology	100+	Moderate
	supply chain xml	100+	Moderate
	EDI & B2B	100+	Good
	outsource & supply chain & technology	100+	Good

Database Name	**Search Term**	**Results**	**Quality**
WorldCat	Supply chain management system	5511	Good. About 70% of articles are outside my scope. 30% seem like they are varying degrees of relevant however.

	Interorganizational Information Systems	1096	About 50% worth looking further into. Some articles are 10+ years old. I cannot pull the full text articles. System issues?
	"Interorganizational Systems" "Information Systems"	1096	Results look identical to previous search
	Interorganizational systems & supply chain	133	Some results regarding relationships and network building. Not sure how applicable this will be to my topic. May need to come back to analyze. Some good results though. Still cannot find full text.
IEEE	Supply chain management system		Not targeted towards IOS.
	Interorganizational Information Systems	100+	Interesting, but not well targeted towards Supply Chain.
	"Interorganizational Systems" "Information Systems"	0	Odd. No results at all. Removed quotations and same results.
	Interorganizational systems & supply chain	100+	Very good. One of the best result sets yet.
Academic Search Premier	Supply chain management system	614	Not targeted. Cannot find any top-25 worthy articles
	Interorganizational Information Systems	128	Decent, but most not applicable. One article I cannot find the full text for: "Modeling and Monitoring of E-commerce Workflows". Keep on looking.
	"Interorganizational Systems" "Information Systems"	128	Diverse. Not targeted.
	Interorganizational systems & supply chain	63	Excellent.

Appendix B

Coding Results

Citation	Coding Terms	Existence
Christiaanse, E.(2005). Performance benefits through integration hubs. *Communications of the ACM, 48*, 95-100.	EDI	Yes
	IOS	Yes
	EMs/e-market/emarket	Yes
	SCMS	No
	Private Network	No
	Integration	No
	Internet EDI	No
Dedrick, J., Xu, S. & Zhu, K. (2008). How does information technology shape supply chain structure? *Journal of Management Information Systems, 25*(2), 41-72.	EDI	Yes
	IOS	Yes
	EMs/e-market/emarket	No
	SCMS/Supply Chain Management System	Yes
	Private Network	No
	Integration	Yes
	Internet EDI	No
Dia, Q., & Kauffman, R. (2006). To be or not b2b: Evaluating managerial choices for e-procurement channel adaption. *Information Technology and Management, 7*, 109-130.	EDI	Yes
	IOS	Yes
	EMs/e-market/emarket	Yes
	SCMS/Supply Chain Management System	Yes
	Private Network	Yes
	Integration	No
	Internet EDI	Yes
Furst, K., Shmidt, T. (2001) Turbulent markets need flexible supply chain communication. *Production and Planning Control, 12*(5). 525-533.	EDI	Yes
	IOS	Yes
	EMs/e-market/emarket	No
	SCMS/Supply Chain Management System	Yes
	Private Network	No
	Integration	Yes
	Internet EDI	Yes
Gosain,S., Malhotra, A., & Sawy,O. (2004). Coordinating for flexibility in e-business supply chains. *Journal of Management*	EDI	Yes
	IOS	Yes
	EMs/e-market/emarket	Yes
	SCMS/Supply Chain Management System	No

Information Systems, 23, 7-45.	Private Network	Yes
	Integration	Yes
	Internet EDI	Yes
Han, K., Kauffman, R., & Nault, B. (2008). Relative importance, specific investment and ownership in interorganizational systems. *Information Technology Management, 9,* 181-200.	EDI	Yes
	IOS	Yes
	EMs/e-market/emarket	No
	SCMS/Supply Chain Management System	No
	Private Network	No
	Integration	No
	Internet EDI	No
Huang, Z., Janz, B., & Frolick, M. (2008). A comprehensive examination of Internet-EDI adoption. *Information Systems Management, 25,* 273-286.	EDI	Yes
	IOS	Yes
	EMs/e-market/emarket	No
	SCMS/Supply Chain Management System	Yes
	Private Network	Yes
	Integration	Yes
	Internet EDI	Yes
Lai, I., & Long, A. (2007). The strategic changes by adopting Internet based interorganizational systems. *Management Research News, 30,* 7.	EDI	Yes
	IOS	Yes
	EMs/e-market/emarket	No
	SCMS/Supply Chain Management System	No
	Private Network	No
	Integration	No
	Internet EDI	No
Madlberger, M. (2008). *Interorganizational collaboration in supply chain management: What drives firms to share information with their trading partners?* Paper presented at the Proceedings of the 41st Hawaii Annual International Conference on Systems Sciences.	EDI	Yes
	IOS	Yes
	EMs/e-market/emarket	No
	SCMS/Supply Chain Management System	No
	Private Network	No
	Integration	Yes
	Internet EDI	No
Malone, T.W., Yates, R., & Benjamin, R.I. (1987). Electronic markets and	EDI	Yes
	IOS	Yes
	EMs/e-market/emarket	Yes

electronic hierarchies. *Communications of the ACM, 30,* 484-497.	SCMS/Supply Chain Management System	No
	Private Network	Yes
	Integration	Yes
	Internet EDI	No
Subramani, M. (2004). How do suppliers benefit from information technology use in supply chain relationships? *Mis Quarterly, 28*(1), 45-73.	EDI	Yes
	IOS	Yes
	EMs/e-market/emarket	No
	SCMS/Supply Chain Management System	Yes
	Private Network	No
	Integration	No
	Internet EDI	No