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## Standards-based B2B e-Commerce Adoption

Moses Niwe,

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*This study presents the preliminary findings from an explorative study of Industry Data Exchange Association (IDEA) concerning challenges, benefits and problems in adoption of standard based business-to-business e-commerce. IDEA is a standards organization facilitating business to business e-commerce in the electrical Industry.*

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### 1. Introduction

Information and knowledge have become key strategic resources, upon which organizations across all industries make their decisions. Trends that have made information systems of strategic importance include globalization and competitive pressures for increased quality with lower costs (Chen, 2002; Clarke, 2001; Laudon and Laudon, 2006).

In the global business environment, businesses should see the enhanced role of electronic business as particularly increasing the importance of information systems. The Internet with its open environment, and other networks have made it possible for the organization to access and exchange enormous amounts of electronic information both inside in the organization and around the world with minimal time resulting in lower communication and coordination costs.

With the arrival of the Internet, words synonymous with “e”, standing for electronic are the buzzword for state of the art products and services today, from e-traveling to e-banking (Alter 2002). The first idea of “e” goes back to the 1960s in electronic data processing. Later this concept developed as electronic mail and then electronic data interchange (EDI), which later transformed into electronic commerce (e-commerce) applications that dealt with the electronic transfer of funds in the early 1970’s. However, the applications were limited to large corporations like the financial institutions that could afford the big expenses. These inter-organizational systems (IOS) expanded from financial transactions to other kinds of transaction processing and extended the types of participating companies to manufacturers, retailers, services, and other forms of business. As the World Wide Web arrived in the 1990s, it grew explosively with new forms of e-commerce. As a result both business to consumer (B2C) and business to business (B2B) examples of electronic business models have emerged.

Originally e-commerce was related with B2C, which dealt with basic forms of online purchase transactions. However B2B is bringing in more revenues. Exponential figures from Forrester, Gartner, IDC, Jupiter and other technology

related research groups predict that worldwide B2B e-commerce revenue alone will exceed \$15 trillion by the year 2010 (Turban, E. et al 2006). Interest has broadened to B2B transactions that are governed by inter-organizational linkages, and high value. For this reason, B2B e-commerce technologies have a key strategic role in organizations across all industries in the global Internet based economy (Lawer et al., 2004; Porter, 2001; Thatcher and Foster, 2002).

There are many possible activities for e-commerce, such as: production, distribution, marketing, sale, etc. In fact, when discussing e-commerce, most people refer to either activities between an organization and its customers, B2C, or activities between two or more organizations, B2B. This thesis focuses on B2B. Business-to-business e-commerce, also known as electronic B2B or just B2B, refers to transactions between businesses conducted electronically over the Internet, extranets, intranets, or private networks. The working definition of B2B to be used in this thesis is electronic versions of documents in a standardized format such as X12 or the flat file equivalent being moved from computer to computer (Wise and Morrison 2000; Clayton and Waldron 2003). Hence, the term EDI is expanded to encompass various applications of B2B e-commerce. In this case an extensible markup language (XML) document; a meta language written in standard generalized markup language that allows one to design a markup language, used to allow for the easy interchange of documents on the World Wide Web is really EDI (Varon, 2002). Flat file or web form, Excel spreadsheets electronically are forms of EDI (Domaracki, 2001). This is an important issue to understand because most companies, especially small and medium sized, do not have the infrastructure to tag documents in the classic EDI sense. They do not want to spend the money on it because it is too expensive, difficult, and complex (Subramaniam, and Shaw 2002). Small companies want other ways to work around the costly issues but still get the benefits of doing B2B e-commerce. However, it is still believed that the general adoption of B2B is heavily influenced by small and medium sized enterprises (SMEs) (Wagner, 2003). The efficiencies and benefits are still in involving the SMEs because everybody gains that way. What we have seen in the last 5 to 6 years is a progression of EDI being redefined unlike the old fashioned way.

With this background, the principal objective of this paper is to examine the issues and challenges faced by firms in adopting B2B e-commerce. To understand the solutions qualitatively, we examine a standards organization in the electrical industry. The data was collected through electronic mail correspondences, interviews and company documentation. The case selected was largely due to their willingness to participate in this study. From previous work, (Niwe, 2007b), the organization adoption of X12 standard as the widely accepted U.S. B2B e-commerce standard in the last 20 years was used as the unit of analysis.

### **1.1 Electronic Data Interchange**

Electronic Data Interchange as a type of IOS is a foundational block for understanding B2B e-commerce. In EDI, organizations use proprietary value

added network (VAN) infrastructure to share business document forms like invoice, and shipping schedule, between a sender and receiver computer, for business use (Riggins, and Mukhopadhyay, 1999). The condition is that both trading and business partners have to meet all the necessary basic requirements for communication. For this to happen companies involved have to make step by step refinement, to their business processes and systems. According to (Chan and Swatman, 2000; 2004) this is considered as the first step in the e-commerce implementation process.

## 1.2 B2b E-commerce

The value of B2B e-commerce technology as a solution to cutting costs and maximizing profits is appreciated by most firms in the digital economy. Traditional supply chains such as EDI with their inefficiencies have been responsible for the need for firms to find better options and hence the keen interest in the B2B e-commerce model that works at addressing these problems (Niwe, 2007a). There are documented benefits for B2B e-commerce adoption across all yielding industry sectors (Archer, and Yuan, 2000). As (Kehal and Singh 2005; Berthon et al, 2003) point out B2B e-commerce systems have resulted in lower transactions costs. (Lucking-Reiley and Spulber, 2001) mention productivity and efficiency gains. B2B e-commerce also has facilitated entry into new markets plus extension of existing markets. In addition, use of electronic representations of business transaction documents can reduce processing and handling, thereby reducing processing costs, data entry errors and cycle times as electronic commerce is based on background, system to system communication and document processing (Ratnasingam, 2002; Amit, and Zott, 2001). Therefore there is no doubt that this technology is beneficial. However, issues still remain for organizations, e.g. why we are not seeing the full benefits after all the hype about the tangible benefits this technology provides.

Assessing B2B involvement by industry reveals different patterns of growth by sector. Starting with the financial sector as the earliest adopters; for about three decades big banks have provided corporate clients with electronic banking services over private networks using B2B. However, this was a limited service to only a few collaborations due to the high cost involved (Yan and Paradi, 1999; Tassabehji, 2003). This changed over time with the advent of the Internet and rise in computer technology, because the traditional e-commerce moved to the web with all its advantages. Through the Internet, new products and services are reached and delivered with B2B e-commerce technologies, addressing the concerns of costs, and creating many more business opportunities. B2B performance for other sectors is better defined by region and private versus public platforms. For example, in the United States (U.S.) the Health sector, is probably one of the few sectors that has attracted government participation more than any other. Speculations could be based on the reasoning that the other sectors are more driven by the private rather than the public systems. Most of the sectors are driven by their functional needs. For example, the high need of connecting business partners and their goods and

services, internationally has caused the transportation sector to develop very fast. This is all aimed at making trade faster and cost effective. Other sectors driven by their business function include manufacturing, and apparel. The manufacturing sector is reported to be leaders in B2B e-commerce adoption (IIE Solutions, 2001)

There are literature sources on inter-organizational systems in the form of B2B e-commerce. However few studies have concentrated on the successful adopters of B2B e-commerce by industry and the companies' experience. Despite the predictions and promises of B2B e-commerce, it is still at the beginning of the adoption process (Gurunlian and Zhongzhou, 2001). Furthermore, regarding perspective, the continuous improvement of hardware and software changes the focus of organisational performance from technological to strategic issues. For many organizations in their quest to adopt B2B e-commerce technologies, emphasis has been placed on operational and implementation issues and ignoring the strategic aspects such as the industry pressure (McEwan, 2001; Chan and Swatman 2004; Gattiker, et al 2000). Hence understanding strategic issues in B2B e-commerce adoption for stakeholders has become important.

### **1.3 B2b Technology And Standards**

B2B technologies used in web-based IOS standards includes system interoperability technologies such as applicability statement 2 (AS2), a file format specification about how to transport data securely and reliably over the Internet. File transfer protocol (FTP) is a protocol used to transfer files over a transmission control protocol/Internet protocol (TCP/IP) network, e.g. after developing the hypertext markup language (HTML) pages for a web site on a local machine, they are typically uploaded to the web server using FTP. However, B2B data usually is EDI messages though it may be of any other message type. AS2 specifies how to connect, deliver, validate and acknowledge data. It creates an envelope for a message which is then sent securely over the Internet. Security is achieved by using digital certificates and encryption. It has provided many benefits including removal of value-added network (VAN) costs

Standards are among the key technological factors for successful e-commerce transactions for different trading partners (Reimers, 2001). Because standards contribute to improving business processes, reducing purchase and inventory costs, increasing productivity and market efficiency, and taking advantage of new business opportunities with market intelligence techniques (Choudhury, 1997, Nelson and Shaw 2005, Medjahed et al, 2003). Using propriety standards business documents such as purchase order, invoice, shipping schedule, and claim submission are being exchanged via networks between the business partners. There is general agreement that adopting electronic communications based on standards is a goal worth attaining. However, when day-to-day business operations are effected, there are a variety of factors which force organizations to adopt other options. Governments and other standard-setting bodies, i.e standard developing organization (SDOs) have made significant accomplishments in developing standards to support B2B.

They play a coordinating role in developing the infrastructure necessary to support standard-based communications. SDOs are those organizations accredited and who operate under the procedural jurisdiction of ANSI in the U.S. and ISO internationally and who produce standards that are recognized as national body standards or ISO standards. For example the Institute of electrical and electronics engineers (IEEE) is an ANSI Accredited Organization, and they receive limited immunity from anti-trust in the US because their procedures are audited by ANSI on a regular basis to make sure they embrace the vision that ANSI endorses. There are a lot of organizations, including not just IEEE and the Internet engineering task force (IETF) but also organization for the advancement of structured information standards (OASIS) and the world wide web consortium (W3C), that are very well run, produce extremely valuable results, and are probably as open as (and sometimes more so than various accredited or recognized organizations. The IETF, W3C, OASIS and all other organizations are standards setting organizations, a super-set of organizations from SDOs, consortia, commercial joint ventures, alliances who create specification in collaboration with other organizations and entities other than themselves (Söderström, 2002).

Internationally electronic data interchange for administration commerce and transport an ISO standard for EDI was proposed as the worldwide standard. Another standard XML, supports B2B transactions and has become the format for EDI and Web services. ANSI X12 and OASIS are two of the most publicized cross-industry SDOs. OASIS is a non-profit, international consortium that drives the development, convergence, and adoption of e-business standards. Members themselves set the OASIS technical agenda, using a lightweight, open process expressly designed to promote industry consensus and unite disparate efforts. The consortium produces more web service standards than any other organization along with standards for security, e-business, and standardization efforts in the public sector and for application-specific markets (OASIS, 2007). OASIS is developing electronic business using eXtensible Markup Language (eXML) for the formatting of XML-based business messages. Electronic business XML is a modular suite of specifications that enables enterprises of any size and in any geographical location to conduct business over the Internet. Using eXML, companies now have a standard method to exchange business messages, conduct trading relationships, communicate data in common terms and define and register business processes (eXML, 2007). RosettaNet is an example of an industry focused SDO organizations that aims at creating open e-business processes. RosettaNet is a non-profit consortium of cross-industry companies working to create, implement and promote open e-business process standards (RosettaNet, 2007).

## 2. Methodology

The study uses an integrated approach of qualitative techniques comprising in depth interviews and analysis of expert opinions. Qualitative research approaches are suitable for answering research questions of exploratory nature (Myers,

2005; Trochim, 2005; Miles and Huberman, 1984). We chose this approach, because the main body of empirical knowledge that is relevant to our research objectives is tacit – it lies in people’s heads, experiences and work practices, most of which is not documented (Niwe, 2006a). Hence, in this study we interview experienced experts in the industry. We use interviews, e-mail correspondences and documentation reviews for data collection. Expert opinions are used, to have the sector’s perspective central to the research process, thus providing means of validation of the research results (Niwe, 2006b).

To address the research objective data collection used a three-phased approach. The data was collected by a fieldwork study in the U.S for two months period during June and July 2006. The U.S is the region in the world responsible for the highest volumes of B2B transactions (67%), and highest volumes of B2B revenues which continue to drive the global adoption rate (McGann, et al 2005). The research process begins with developing the research questions that are used in data collection. Each interview was approximately forty five minutes. First they were asked about scope and e-commerce applications that they have implemented in their respective roles and future plans. Secondly, we asked them to recall general problems that they encountered from the adoption process, and then we specifically discussed the strategic issues. The interviews were organised in a pattern as to look out for similarities for the analysis stage. The interviewees are top managers such as, president or heads of e-commerce division. The interviewees were asked about their firms’ e-commerce operation. The next step involved selecting the experts to be used and the appropriate data gathering techniques. This was accomplished with the help of an Interview guide, using structured and unstructured interviews with experts that were or are involved in the e-commerce implementation of IDEA. Documentation sources included the organization’s documentation both past including archival records and present documentation. The next step involved evaluating and analyzing the data with the help of identifying keywords. These activities were iterative and to some extent simultaneous.

The case selected was largely due to its willingness to participate in this study. The adoption of X12 in the last 20 years was used as the unit of analysis. Also the entire supply chain was considered which includes manufacturer, distributor and retailer. The case examined aimed at building a richer understanding of a single supply chain. As not many research perspectives exist on the adoption of B2B e-commerce over the entire supply chains, single company cases are an appropriate research approach (Yin, 1989).

### **3. Idea And B2b Practices**

Industry Data Exchange Association (IDEA) is the e-business standards organization professionally focused on the electrical parts industry consortium in the U.S. In 1998 Industry Data Exchange Association was created by National Electrical Manufacturers Association (NEMA) and the National Association of Electrical Distributors (NAED) to manage the development of network systems,

which foster e-commerce for their customers and members in the U.S. Though it is expanding to other industries on the retail side, the principal focus in the wholesale is electrical. Industry Data Exchange Association's principal B2B e-commerce network is Industry Data Exchange (IDX2), an Internet business communication service (extranet) that enables trading partners to exchange business documents such as purchase orders, advance ship notices and claim submission, securely very cost effectively. The IDX2 also enables the delivery and access to IDEA's industry data warehouse (IDW2). The IDX2 provides all of the traditional electronic data interchange services. IDX2 provides interconnections to the traditional VANs allowing customers to trade with partners that are not part of the IDX2 community as well as direct connect to other exchanges. We interviewed IDEA president, Mike Rioux and IDX2 Manager, Tom Guzik.

IDEA emphasizes providing e-commerce based solutions in standards, services and training. IDEA accomplishes this with the Industry Data Warehouse (IDW2), the Industry Data Exchange (IDX2) and e-Business data and transaction Standards developed by IDEA. Mike Rioux, IDEA President "If somebody calls up and wants a solution we give it to them if they want standards we give to them. If they want just information or training we give to them and our objective is make money like everybody else in the capitalist world so we are trying to sell them services. If we sell service then our owners reap the benefits and our owners have members who are distributors and suppliers. And they end up with a lower supply chain cost. Our model is a little different we are not a privately owned company we do not have stocks and dividends but we have rates and charges to the customer that belong to the organizations."

The IDEA service suite maximizes supply chain efficiencies for companies, allowing them to conduct business electronically with 100 percent of their suppliers, customers and strategic partners. Mike Rioux, IDEA President says "Our products are services intended to provide proven business data and business-to-business (B2B) solutions that drive down supply chain costs, slash cycle times and enhance customer satisfaction by cutting across the supply chain. We also offer them an opportunity to drive up their sales because that what it is really about, to sell more products."

IDEA started with opening up their networks in April 2001 with 50 customers doing over a million kilo-characters worth of B2B. Today they have over 270 customers and doing six million kilo-characters that they process across their B2B IDX2 network. This is done in various formats (versions of B2B). A web form on a web page allows a user to enter data that is, typically, sent to a server for processing and to mimic the usage of paper forms. Forms can be used to submit data to save on a server (e.g., ordering a product) or can be used to retrieve data (e.g., searching on a search engine).

In terms of the network, IDEA started with a frame relay network. Despite the positive aspect of security, the network provided, they had to deal with the disadvantage of hardware and software cost being too high, hence this turned out

to be a bad experiment. The results of this did not go well partly because the target group was limited to the very large purchase expense in large companies. In 2000, IDEA got an Internet based Applicability Statement 2 (AS2) communications network being among the very first adopters, when they launched in April 2001. When AS2 EDI over the Internet (EDI-INT) was just starting out it gave them a leading edge and since then IDEA has been looking at enhancements on this Internet based AS2 communication network and consequently watching a steady growth with B2B EDI solutions adopters.

In distribution, there is a lot more they can get out of e-commerce because distribution did not adapt the Internet based AS2 communication network. Retailers such as Home depot, and Sears all went on 100 percent with the AS2 communications network because of the volume of transaction that they could handle. Hence they are already fully mature in the adoption process doing peer to peer AS2 connections, XML and all their variations. Most of electrical part manufacturers are convinced of the benefit of EDI, flat file or B2B, thus growth is evident for IDEA. The lead adopters come in and as they become more technically secure in the way of doing B2B e-commerce transactions, there is room to move on to other avenues such as B2B integration.

IDEA's growth rate without sales and marketing is between 12 to 15 percent annually. IDEA has very few non-electrical companies using their IDX2 network for example grocery and pharmaceutical but they do not go out and sell the services to them. Such instances arise when one of their known customers compels their clients, that they could be selling electrical products to, for example, a warehouse, because it is good and saves them money, hence, as (Hart, and Saunders 1997) propose, issues of power and trust arise in the B2B EDI technology adoption. Tom Guzik, says "We just landed an account with a corrugated cardboard box company called Crew Wall, they are not in the electrical industry but still there going to benefit from the network." However IDEA does not focus on that market because they are owned by the electrical industry. It is noted that they do not have all the electrical manufacturers and distributors on their network hence their focus is still to maximize the electrical industry. Mike Rioux agrees that "the principal reason for the 12 to 15 percent annualized growth is the Internet." Value Added Networks (VANs) are expensive and require leased lines and if the Internet is used as the transport means to send an EDI document it takes some costs out of the equation. This is what the IDEA network does with the help of the Internet.

Issues include the telecommunication infrastructure, and challenges with the B2B tools being complicated. Furthermore IDEA, concern also includes the companies assuming that it is normal course of doing business without collecting matrix on error rate, e.g. orders or invoices. The business relationships between many companies have been unique to their business processes, hence their concerns over the new ideologies that the X12-XML would address all the bottlenecks in electronic business. In addition, concerns with data security and the reliability of the standard still arise.

#### 4. Concluding Remarks And Implications For The Future

B2B is a very complex heavy set of message standards, with so many variations that they differ from network to network, from Industry to Industry, and are quite expensive to interface with all its variations. They have generally been designed for batch transmission and processing. Just adding this to the Internet does not really do much to solve the problem, or add any real benefit. It is would be like saddling the Internet with a paper-based system - e.g. sending faxes to people rather than emails. IDEA companies need to learn how to extend the core applications such as customer relationship management with their business partners.

In the management of the supply chain the key resource is the information format. For most companies the approach to adoption is being done the other way round. Like many other companies IDEA members are being pressured into adopting by the industry rather than seeing the benefits. Hence, failure rates attributed to failure to change the internal procedures. The B2B systems are not integrated with the internal systems. These adopters need to map strategic business process reengineering plans for their B2B technology to be improved.

From the study many further interesting issues arise, such as whether companies buy in to standard based B2B e-commerce as a method of adoption. Places shown where they do include hardware or software interfaces. Also, do vendors use standards if they can do something better on their own and sell it? Are purchase decisions impacted by the presence of standards? If the answer is yes, then we can proceed to the next question. Do firms that embrace standards in their products do better financially than firms that reject standards? There is no proof (that the billions that various industries pour into standards really produce some significant payback) that standardization rewards it proponents in the IT industry.

Furthermore, to advance the research of B2B e-commerce adoption beyond the U.S., we propose to look at a comparative study of government case studies of U.S., versus European Union and its member states. Eliminating paper based business transactions with its expenses has been the main motivation behind B2B adoption. As we have seen, the more capable larger organizations have seen tremendous growth in doing their B2B electronic transactions over the widely accepted standards of the US (ANSI X12) for the U.S. organizations. For European Union, a case study of Sweden and, UN EDIFACT, could be examined to compare the different firms, and present a synopsis of the adoption for the two predominant standards.

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