

# Business-to-Business Transaction Diffusion: X12 Standards

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**ABSTRACT**

Accredited Standards Committee (ASC) and Data Interchange Standards Association (DISA) as the administrative arm is the United States business to business (B2B) transaction standard developing organization (SDO). This paper focuses on ASC's challenges in the standardization diffusion process of the X12 standard. Specific questions include what industry of X12 membership is most actively involved and what is the most active role played by the different organizations involved in the X12 B2B exchange? The progression of X12 membership is examined over the years, and strategies to improve this. The findings reveal that the most active sector is the computer and consulting industry followed closely by the healthcare which is driven by the Health Insurance Portability and Accountability (HIPPA) legislation. The Finance, and Insurance, show reluctance in joining the wagon probably because they formed there own alliances within the industry. Furthermore, the early adopters, the automotive sector, no longer participate in the X12 standard, because they have established their own B2B data platforms that support their business requirements.

**Keywords:** X12 standards, diffusion, and business to business e-commerce

**1. INTRODUCTION**

Business to business (B2B) e-commerce is a successful technological innovation involving sending and receiving information using computer technology which has been used for decades. The first electronic data exchange formats came with industrial suppliers to the United States (U.S.) government in the 1950s. As more players from different industries got involved, over the years the U.S. realized a need to develop common Electronic Data Interchange (EDI) formats and build cross industry standards to increase efficiency. In 1979 American National Standards Institute (ANSI) as the U.S. standardization member body of International Organization for Standardization (ISO) chartered Accredited Standards Committee (ASC) X12 to develop and maintain the cross-industry B2B U.S. standard. Today X12 is being modified to support EXtensible Markup Language (XML) as the newer syntax rising out of needs for organizations to reinvent their business processes and information technological infrastructures. The U.S. is still the region in the world responsible for the highest volumes of B2B revenues. United States based B2B e-commerce transactions continue to drive the global adoption rate (McGann, et al 2005).

The objectives of this paper are (1) to review the status of B2B e-commerce diffusion by X12 standards in the U.S. Specifically we assess X12 diffusion by industry sectors, (2) to identify the characteristics of main adopters in terms of roles played in the B2B supply chain, (3) to capture the strategies of increasing diffusion of X12 standards. These would be beneficial to other industrialized nations that are aiming to replicate the adoption pattern of the U.S.

The paper is organized as follows. Chapter 2 gives a brief background about B2B standards focusing on the X12 standard, followed by the methodology used in addressing the goals. Chapter 3 presents the research approach used for this study. Chapter 4 presents our empirical findings gathered at DISA and analysis of the findings. Chapter 5 presents our concluding remarks and issues for future work.

**2. B2B STANDARDS**

A standard as a key strategic element for successful e-commerce transactions among different trading partners is paramount (Reimers, 2001). Standards contribute to improving business processes, reducing purchase and inventory costs, increas-

ing productivity and market efficiency, and taking advantage of new business opportunities with market intelligence techniques (Choudhury, 1997, Nelson and Shaw 2005, Medjahed et al, 2004).

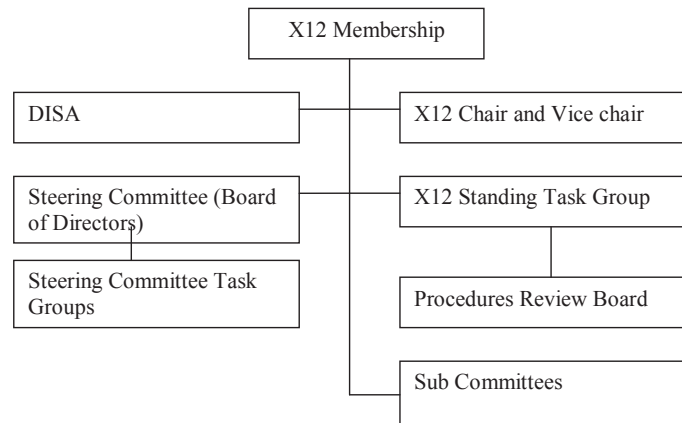
**2.1 X12 Standards**

Among many other standards, X12 was the first and still is the predominant cross-industry B2B electronic transactions standard in the U. S. (Cline, and Piazza, 1992). Since 1979, X12 has the mandate of developing the B2B transaction standards. In 1987, X12 created Data Interchange Standards Association (DISA) as a non profit to serve as its secretariat. Representatives from the various industries as employees of member companies, meet face to face three times a year, and vote on agreed upon standards that are published by ANSI ASC. Development of the standard is done in between the meetings as an ongoing process. The member company representatives continue to discuss through e-mail, or teleconference until a standard is approved for publication. Membership is open to all interested organizations. The ASC X12 standards and transaction sets are available at a fee from DISA. The general membership is responsible for electing a chair and vice chair every two years that makes up the management committee supported by a steering committee that includes the immediate past chair, vice-chair and elected members of the various subcommittees.

The technical and business processes knowledge is acquired from the members as they know best what kind of standards they need. There are Industry sub-committees, namely government, finance, transportation, and healthcare to address the specific needs of the industry. Figure 1 below shows the organizational structure of X12.

The (ASC) X12 published its first version in 1983, since then it publishes versions annually and releases transaction sets after the trimester meeting. The latest version is 5, release 3 (5030). The transaction sets which are an equivalent of smart documents in EDI, enable data to be exchanged between agreed upon business partners in various industries. ASC X12 facilitates electronic commerce with more than 315 transaction sets across government, education, finance, supply-chain, legal, transportation, healthcare and insurance industries. Since 1997 X12 has

Figure 1. X12 organizational structure



been cooperating closely with the United Nations, Electronic Data Interchange For Administration Commerce and Transport (UN/EDIFACT), the global standard in EDI transactions.

Adoption of X12 is predominant in the very large companies. Smaller and medium-sized companies (SMEs) do not have the infrastructure to tag documents using X12 and hence 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 (Amoroso, and Sutton, 2002). However it is still believed that the general adoption of B2B is heavily influenced by SMEs. The efficiencies and benefits are still in involving the SMEs because everybody gains that way (Wagner, 2003).

### 3. METHODOLOGY

In the first phase of data collection to gain an understanding of B2B e-commerce adoption across industry sectors, documentation sources of DISA were reviewed. In tables 1 and 2 we present relevant inferences showing the membership as a representation by sector, and role area. The sample size was 250 who comprise X12 membership at the time of data collection. The President of DISA, Mr Jerry Connors and current (ASC) X12 Chair, Dan Kazzaz were also interviewed. Before visiting the interviewees they were contacted, with a brief introduction to the purpose of the study. 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 diffusion process, and then we specifically discussed the strategic issues. The interviews were organised in a pattern as to look out for similar categories for the analysis stage.

### 4. ANALYSIS

The Analysis chapter presents the findings and interpretation of the results. The highest representative sector percentage is the computer and consulting industries at 34 percent. The computer and software industry have been at the lead of using advanced EDI to streamline processes. Combining XML techniques with the company's system configuration into a supply chain management is on the top of the agenda of most of the industry. The X12 efficiencies have attracted both the big and small businesses, software developers like Ahmer Taylor, I.M. to computer consultants like EDI Source Inc and IBM Corporation. Companies are actively involved in open channels in different forms of applications with their business customers. The other representative analogy of companies and firms under this sector representing the biggest percentage is the vastness of the industry, from general computer companies, consulting, and software companies to standards developers.

The Health sector follows at 32 percent using X12 adoption under the Health Insurance Portability and Accountability (HIPPA) act. This is probably one of the few sectors that have attracted government participation more than any other. This could be based on the reasoning that the other sectors are more driven by the private rather than the public systems.

The financial, and insurance is at 15 percent. This can be explained by the ease of developing XML standards with groups such as Interactive Financial Exchange (IFX) an open standard financial data protocol. Other competitors include Open Financial Exchange (OFX), dealing with small transactions and Automated Teller Machines (ATM) standards. In the industry there is no unified standard, but efforts are underway to have all these standards working compatibly. Interactive Financial Exchange has been struggling financially to keep going so they have not been able to get as many members to come to the table and work with them and pay dues to the organization. Problems come from most companies wanting to use the standards but not ready to be involved in the startup operations of setting up the framework. In the age of internationalization of products and services through the Internet, coupled with stiff competition, banks, insurance companies and other financial institutions need to strategically rethink the fundamental ways they provide financial services. A revolution is going on and for the financial institutions not using the right strategies. The member organisations in this category are banks, banking financial and banking government.

Transportation sector is at 7 percent. The high need of connecting business partners and their goods and services, internationally is hopefully going to bring more participation from the transportation sector. This is all geared at making trade in the

Table 1. List of companies by industry (N=250)

Sector	100%
Financial and Insurance	15
Computer and Consulting	34
Health	32
Transportation	07
Other (Manufacturing, Apparel, Chemical, e.t.c	12

Table 2. Companies by roles

Role Area	100%
General Interest	25
User	25
User-Provider	10
Vendor- Provider	12
Not Identified,	27

industry faster and cost effective. The companies include general transportation, transportation-motor, transportation-rail, and transportation-ocean.

The combined sector at 12 percent includes all the other sectors that are not generally classified above; examples include manufacturing, apparel, and chemical for example DuPont Company. The industries like automotive that were expected to continue being major players are not well represented and Jerry Connors, DISA President has an explanation for that. "These were among the founding member companies in the 70s but as they implemented they found no need to develop new transactions and, hence they pulled out". Dan Kazzaz, the ASC X12, current chair concurs with this notion "it is hard to get big companies to continue working after they completed developing their core message."

As shown in table 2, generally as far role playing (in the B2B transaction) is concerned the majority are the users at 25 percent; we have some few user-providers at 10 percent and vendor-providers at 12 percent. The User refers to the companies and organisations in the supply chain that generally receive, standardized documents using B2B e-commerce. The General Interest Companies are the firms that have shown some level of adoption. These are actors with a two way relationship, in form of Users. In addition they send all their transactions over the EDI platform. They have possibility scenarios of many to one. Vendor-Provider these are more than users themselves in sending and receiving but they also provide the technical platform for the supply chain management, in the transaction process. Through secure and authenticated connections the vendor-providers authorize their respective end users for the B2B connections.

#### 4.1 X12 Performances

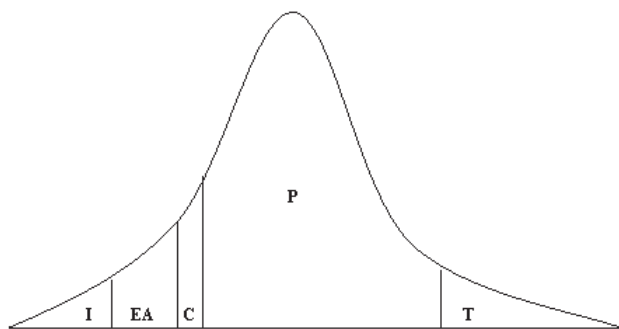
The use of X12 has been steadily growing from the mid 80's (see table 3) when the concept became popular for cutting costs and reducing processing time. However the late 90's and early 2000, plagued by the dotcom era problems, experienced a slight decline. This however is picking up as new models reveal how B2B e-commerce can reduce transaction costs such as time and effort in finding products, services solutions, potential buyers and suppliers. The highest percentage is from 2003 to 2006, (33 percent) which could be explained by regained confidence after the dotcom era. This also confirms (Bonaccorsi, and Rossi, 2002) reference made to the higher the number of adopters the higher the probability for others with the intent to adopt to join the band wagon effect.

Other issues include the telecommunication infrastructure, the greater numbers in the firms using the technology the greater the investment in the infrastructure which in turn brings in more adopters. In deciding to adopt there was reference of how many other adopters are in the sector and how many other intend to adopt. Other firms wait for early adopters to see their performance and decide whether

Table 3. Progression of EDI X12 membership in the last 2 decades

Period	%
1985-90	17
1991-96	27
1997-02	21
2003-06	33

Figure 2. From Moore (1991) showing adoption process



they will join or not. Critical mass of early adopters brings forth the industry pressure needed to bring in the majority and late adopters. Then the decrease as most firms adopt. These patterns with the sigmoid path as seen in figure 2 below. Starting with a few companies adopting the e-commerce technology and adoption increasing as other firms learned about the new technology. Other inferences include variables such as the size of the organization; value of the technology has little to do with the technology adoption. Technology adoption process has variances between the technology expectations and the technology value. This conforms to Moore’s technology adoption life cycle (Moore, 1991) with the main categories of adopters as innovators (I), early adopters (EA), pragmatists (P), and the traditionalists (T). Chasm (C) is the time lag between the early adopters (EA), pragmatists (P).

**4.2 Performance by Industry Sector**

The healthcare industry in spite of being a late starter shows tremendous growth (as shown in table 1). Jerry Connors says “healthcare industry is the most active industry today.” He adds that this is partly because the federal government of the U.S. mandated that all medical practices use the HIPPA law. And HIPPA requires that all medical practices and all healthcare insurance companies use X12 for claims and other administrative transactions. So, it is a constantly emerging situation that will be going on for a long time. Currently in the healthcare sector, there are many other different standards; X12 mostly works with administration and billing not clinical. There is a need to harmonize these standards so that they can be more interoperable.

In the 80s subsequent to the recession in the 70s, the automotive industry needed to change how it did business. In order to have just-in-time inventory you have to have messages from the manufacturer all the way through the supply chain coming in very quickly. The automotive sector had not been doing Just in Time (JIT) inventory replenishment, so they were either buying too much that created storage problems or too little and hence running out of stock while they made their cars. As a result they knew that they needed to switch to JIT. This drove X12 adoption and they basically pumped the resources into X12 to make it happen for all their suppliers. For its success, software vendors, and standard organisations were needed for the suppliers to communicate. So, the automotive industry made it happen in their value chain. Similarly, the apparel industry pushed on the retail industry to try and save themselves and the apparel industry did not succeed so well in saving

themselves because they ended up sending all their manufacturing overseas. But they basically were trying to do JIT inventory for themselves. They picked up the same idea as they moved it to retail. The whole supply chain activities that happen inside the retail environment happen using the X12 standards.

Through the progression of years the big companies like General Motors concluded that they have got what they needed, so membership dropped to about half. Jerry Connors says “for a long time in the late 80s and 90s we had huge participation with a membership of up to 700 to 800 from all industries across the country, and thousands at the meetings.” Mr. Connors adds that in the last few years some of the big companies have got what they needed; “they have B2B data platforms that meet their needs, so, they don’t feel the need to participate as actively as they did before.” With big companies it is very hard to get them to agree, some especially in the automotive industry felt the need to go international, which also affected X12 membership (see table 3). Today the automotive industry does not participate in X12 and has minimal representation with United Nations Centre for Trade facilitation and Electronic Business, (UN/CEFACT). As stated above they are not building new messages. Their participation is missed and there are efforts to bring the two organizations together to see this reversed. They have a wealth of experience and financial clout, which would greatly enhance the ASC X 12 performances. This would help X12 in general build better standards.

ASC X12, strategies of increasing diffusion of X12 include using the emerging language XML, with the highly acclaimed syntax neutral architecture called Context Inspired Component Architecture (CICA), which is more flexible and human readable than EDI. Jerry Connors, says” what we are trying to do with this architecture is to set ourselves for the long term future so that whatever comes along in XML we will be ready for it.” With this approach ASC X12 with its experience and technical expertise, as the U.S. B2B primary standards body is leading the way to convergence of EDI and XML Standards to handle the business processes within an Internet based e-commerce environment. Challenges with the CICA architecture are that it is complicated. It is hard to get a wide group of people to understand that they can model their business and build messages simultaneously. Dan Kazzaz says, “What we are trying to do is to encourage the software community to develop tools, so that the data involved in a particular business message can be entered into the tool and the tool will help them model their message, the model can then automatically populate the X12 CICA.” “This is a very high priority for us right now. The people at the end in the sub-committees vary in technical expertise; we want to create a platform that will allow as many as possible to build CICA complaint messages without having to understand all the new nuances of the architecture. If they enter the data it will come out the back end the way they want it and have strong, reusable component.”

**5. CONCLUDING REMARKS**

All indicators show a continued interest in B2B e-commerce in the U.S. The obvious advantages that B2B e-commerce brings with it such as efficiency makes B2B e-commerce a perquisite across all industries in the transportation, government, real estate, healthcare, education, retail, grocery, warehousing, and financial services. However, there are considerable gaps and mysteries in the different sectors to the new adoption insights. The business relationships between many companies have been unique to their business processes, hence their concerns over the new ideologies that the ASC X12-XML would address all the bottlenecks in electronic business. In addition concerns with data security and the reliability of the standard still arise.

Our findings show that much of the healthcare sector has woken up to the potential of B2B e-commerce, as confirmed in the interview with the X12 Chair. From the interviews, among the challenges to adoption significant issues identified include; barriers to prioritization by top management, implementation obstacles such as integration with internal application systems and existing business methods, and, for banks, consideration of B2B e-commerce technologies as a close relation to corporate banking.

EDI platforms built by the Fortune 500 companies to exchange electronic messages were very expensive; hence they are not keen on the change because of the high investments in terms of time, money and human resources made earlier on. Besides, many of them believe they are doing fine with their EDI platforms and are not interested in investing more money in making vast changes, though some are willing to make small incremental changes as they watch closely the return of investment. Main questions still remain what is the move to XML going to get me? Hence the challenge for X12 remains to determine and teach its member-

ship and potential members the value proposition of using syntax neutral model (CICA) to create new messages. They intend to address this through a strategy of proposing new bodies of work and working to ensure that application software vendors support these new messages. Moving from EDI to XML by small increment changes, with compatible content, rather than big moves as the value of moving over is appreciated. E-commerce activity is geared towards empowering SMEs to participate. This is expected to bring back the software vendors to build relationships, hence increasing the diffusion rate. However, before all this happens, harmonization is needed for the different standards within X12 and the newer XML to be more interoperable. Efforts to address this are there but still in their early stages. Mr. Kazzaz, adds, "my vision includes seeing the American standard being synonymous with the international standards. Harmonizing the standards will create more efficiency." With this said challenges remain for ASC X12 like to get the competing standards groups to stop and evaluate the benefit that would come from harmonization.

## 6. FUTURE WORK

To further 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 business to business (B2B) adoption. As we have seen the more able larger organizations have seen tremendous growth in doing their business-to-business 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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