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# Assurance Services for Business-to- Business Electronic Commerce: A Framework and Implications

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# Assurance Services for Business-to-Business Electronic Commerce: A Framework and Implications

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**Abstract**

The electronic commerce assurance market has been estimated to be potentially worth $11 billion. To date, the focus of assurance services has largely been on web commerce (and, therefore, business-to-consumer or B2C) related services, leaving the business-to-business (B2B) electronic commerce market relatively untapped. Yet, with electronic data interchange (EDI) being mandated by large companies and government agencies, small- to medium-sized firms have struggled to acquire and implement this technology with little understanding of this new age of electronic commerce. As the ubiquitous Internet allows more firms to become EDI-

capable, there is an imminent need for having some independent means for assuring the quality of B2B electronic commerce and related business practices. This need is not only crucial for smaller trading partners, but is essential to the success of larger firms that want to realize reduced cycle times, improved customer service, and a greater return on their technology investments by electronically controlling the entire value-chain. This paper proposes a framework for delivering B2B electronic commerce assurance services and discusses some potential implications for such services.

**Keywords:** Electronic commerce, information systems assurance, business-to-business commerce, framework

## I. INTRODUCTION

The primary driver behind the emergence of assurance services is the increasing role that accountability is playing in social, economic, and political life. A diverse set of stakeholders in contemporary organizations want those who affect their life to be accountable for the responsibilities they have assumed. Effective judgments about the level of achievement for economic and other responsibilities depend on the ability of the decision maker to acquire sound information (Elliott and Pallais 1997a).

According to the AICPA, assurance services are “independent, professional services that improve the quality of information, or its context for decision makers” (Elliott 1998). Thus, *assurance services* in general terms can be described as activities conducted by trusted, independent organizations (private or not for profit) to certify and/or validate business transactions between trading partners and/or trading partners and consumers. In the electronic commerce arena, this is achieved by verifying the authenticity of trading partners, reviewing internal control mechanisms (security and integrity of transactions), assuring that performance of services is as promised, and that all regulatory and/or operating procedures are complied with by each trading partner. The fundamental objectives of electronic

commerce assurance services are to reduce risks, assess internal controls, and increase the buyer's confidence or trust in electronic commerce transactions. These goals are achieved by providing businesses, trading partners, customers, and the public at large with the "assurance" that commercial transactions conducted electronically using the Internet, private networks, and web-based systems are safe, secure, and backed by appropriate internal controls (Greenstein and Feinman 2000; Nagel and Gray 1999). The certification agency or assurer provides a "seal of approval" that is placed on the interested business' web site and it in turn receives remuneration from the certified company in the form of a fee for services rendered.

Electronic commerce assurance is potentially the largest of the assurance services markets with the potential to generate $11 billion of revenue (Elliott and Pallais 1997a). In an effort to gather a foothold in this lucrative market, multiple organizations and businesses have entered the marketplace with certifications for electronic commerce systems—albeit primarily focused on business-to-consumer based web assurance to date. Business organizations and entities providing these services include, for example, the Better Business Bureau, Visa, and American Express. Information systems professionals' organizations have also become involved as evidenced by the International Computer Security Association's (ICSA) web assurance seal. The accounting profession has also seen opportunity in the electronic commerce assurance arena and has launched probably the broadest range of assurance products and proposed products through the efforts of the joint task force of the Canadian Institute of Chartered Accountants' (CICA) Task Force on Assurance Services (TFAS) and the American Institute of Certified Public Accountants' (AICPA) Assurance Services Executive Committee (ASEC).

Not surprisingly, the glamour of the Internet has taken priority as the bulk of the available electronic commerce assurance services launched to date have been directed at providing assurance supporting the safety of web-based commerce in business-to-consumer markets. These web-based products were developed with the recognition that consumers who buy goods and information over the Internet

desire assurance that the information they supply in a transaction is not misused, that the seller will deliver the goods or services as they were ordered by the customer, and/or that the seller's practices regarding delivery, claims and complaints have been disclosed and represent the actual business processes used (Elliott and Pallais 1997c). In essence, a seller wishing to establish credibility with customers purchases the service.

The various assurance providers in the assurance marketplace have brought a wide range of product quality to the web. Challenges in the marketplace have come from organizations aiming to be the low cost alternative (e.g., Better Business Bureau with assurance limited to company registration with the Bureau), high quality providers (such as the ICSA Certification and the CICA/AICPA's WebTrust), and other organizations with specific credibility/advantage with consumers (e.g., MasterCard, Visa, American Express, and JCB). Evidence of the variability in success of the products is illustrated by the fact that only 28 U.S. web sites are using WebTrust at the time of this writing and over 1,000 web sites have subscribed to the credit card companies' security validation service.

What would seem to hold more promise for information systems (e.g., ICSA) and accounting (e.g., CICA/AICPA) professionals would be to focus on business-to-business (B2B) commerce where the assurance providers' credibility should exceed other likely competitors' reputations and the advanced dimensions of services, which include examination of the underlying business processes, should be much more desirable. Take, for example, the business model adopted by the AICPA (see Figure 1). The model highlights the key information flows of an organization as providing interaction with customers, suppliers, capital suppliers, the community, and talent (Elliott and Pallais 1997b). Web assurance products are really targeted at the customer relationship. Business-to-business commerce in such organizations is more focused on suppliers and other intermediaries in the value chain—the traditional focus of electronic commerce where electronic data interchange (EDI) has been the predominant platform. The critical importance of underlying business

processes in an electronic commerce environment was highlighted by the difficulties faced by business-to-consumer e-retailers in delivering Christmas orders in a timely manner in 1999. Furthermore, as more companies move to B2B e-commerce, firms are finding it difficult to abandon partners that were known and reliable for a more competitive market place where cost savings are critical but the vendors are unknown (Banham 2000). This situation reinforces our previous arguments for the need to develop assurance services in the emergent area of B2B e-commerce.

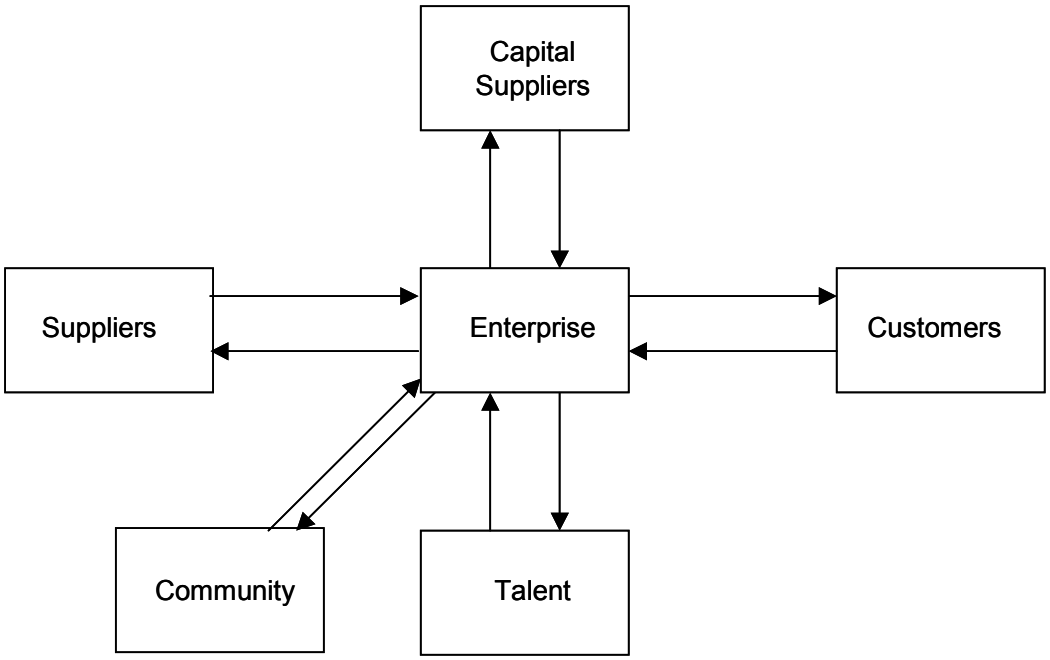



**Figure 1. Business Model for an Enterprise's External Information Flows (Adapted from Elliott and Pallais 1997b)**

A business-to-business electronic commerce focus would actually be more in tune with the general service identification of the CICA/AICPA's TFAS/ASEC task force. In discussing the findings of these task forces, Elliott and Pallais (1997a) note that one of the primary service opportunities identified is the need to assess whether the information features of electronic commerce function in accordance with accepted criteria for evaluating the integrity and security of electronic transactions, electronic documents, and supporting systems. In this context, Elliott and Pallais

(1997a, p. 49) also recognize that little is known about what these criteria should be and voice the need for academic researchers to seek "[c]riteria for assessing the integrity and security of electronic commerce."

This paper proposes a framework for B2B electronic commerce assurance services that is grounded in the results of a study into the nature of EDI-based electronic commerce and the impact on organizations of varying sizes. Perhaps of most interest are the results indicating that many small and medium sized vendors have difficulty fully integrating EDI into their internal business processes and that the EDI connection becomes essentially little more than a glorified fax machine. As major companies such as WalMart and the Big Three U.S. automakers, and state and federal government procurement agencies mandate that suppliers use EDI, an associated need arises for assurances that such suppliers are strategically implementing EDI. This is intended to shorten the time between ordering and shipping and appears to be a probable candidate for a high demand service. These, and other issues, are explored in the remainder of the paper.

## II. BACKGROUND

**Business-to-business** (inter-organizational) electronic commerce, henceforth referred to as B2B, facilitates the management of suppliers, inventory, distribution and logistics, channel, and payment systems over the Internet and/or private networks. This form of electronic commerce will potentially make up the largest proportion of Internet commerce. **Business-to-consumer** electronic commerce, henceforth referred to as B2C, facilitates the cycle of reviewing product information, buying products with electronic cash and other secure payment mechanisms, and even having some electronic goods delivered over the Internet using the World Wide Web (WWW) interface.

EDI is a critical element of B2B electronic commerce today and has clearly changed the way organizations do business. It has become a critical business tool for many companies of all sizes and industries. In 1995, less than 2% of the 5

million to 6 million companies in the U.S. with revenue greater than $1 million were using EDI (Mohan 1995). However, corporate America's EDI-related expenditures are estimated to grow to $3.8 billion by 2002 (Wilson 2000).[1] Contemporary business practices such as just-in-time (JIT) manufacturing, vendor managed inventory (VMI), and quick response retailing (QR) rely on the rapid transfer of transaction data to gain a competitive advantage in the market place. Speed, responsiveness, productivity, and improved customer service have become key to corporate survival. Further, firms around the world have adopted EDI standards such as ANSI X.12 or UN/EDIFACT. For these reasons, EDI (whether it is conducted via a VAN or the Internet) has become a key enabling technology for B2B commerce and electronic trade around the globe.

Furthermore, businesses and state and federal governments are all emphasizing the importance of leveraging electronic commerce technologies such as EDI and e-mail for competitive advantage by reengineering business processes and improving customer service. In fact, the Federal Electronic Commerce Acquisition Team, in its October 1994 report on "Streamlining Procurement through Electronic Commerce," called for the use of Electronic Commerce (EC) technologies to reduce procurement costs, improve business processes, and enhance customer service quality. The federal government has already completed implementation of a government-wide electronic procurement system that includes centralized vendor registration, cross-referenced databases, multiple EDI standards, financial EDI, and a collection of "virtual" networks for communications (e.g., http://www.fss.gsa.gov). The implementation of these recommendations is having a major impact on numerous small- to medium-sized businesses around the country. To illustrate this point, consider that the Department of Defense (DoD) alone contracts with nearly "500,000 or so suppliers," of which more than 99% are small businesses that

[1]Based on a report published by the Giga Information Group (Wilson 2000). Giga's estimates take into account all computer-to-computer transactions, not just those done over traditional value-added networks (VANs).

employ fewer than 500 employees (Brown et al. 1999). Furthermore, since small- to medium-sized enterprises (SME) employing less than 500 employees constitute 99.7% of all employers in the U.S., they dominate the typical supply chain of most large companies (National Federation of Independent Business 1997; SBA, 2000). Thus, any new information technology initiative (or imperative) from federal or state level procurement agencies and larger corporate organizations has critical ramifications for most small- to medium-sized firms.

## OVERVIEW OF EDI COMPONENTS AND PROCESSES

Electronic data interchange (EDI) is the computer-to-computer interchange of business transactions that conforms to specified standards over a communications network that includes at least two *trading partners*. These interactions include the interchange of common commercial information typically consisting of purchase orders, shipping notices, invoices, related acknowledgments, funds transfer with banks, etc. EDI automates the slow, labor-intensive exchanging of transactional documents in paper form via fax and/or regular mail. The EDI enterprise is a *hub* of activities. *Hubs* represent the accumulation point for transactions from multiple trading partners. For example, WalMart is a *hub* with more than 5,000 electronic hook-ups with its vendors. The *trading partners* can be viewed as *spokes*. *Spokes* (vendors, customers, etc.) become part of the extended EDI enterprise. Larger *spokes* can be *hubs* of their own supplier/customer networks. Most SMEs tend to be *spokes* for large *hub* organizations.

EDI requires five key elements: (1) electronic mail for rapid personal (administrative) communications; (2) secure on-line networks for rapid communications such as third party or value added networks (VANS) and/or the Internet; (3) at least two organizations conducting joint, electronic business transactions (trading partners); (4) standard protocols for file and message transfers (standard EDI message formats can be those developed by industrial organizations [e.g., TDCC/EDIA, VICS, WINS], proprietary [e.g., General Motors], national [ANSI X12]

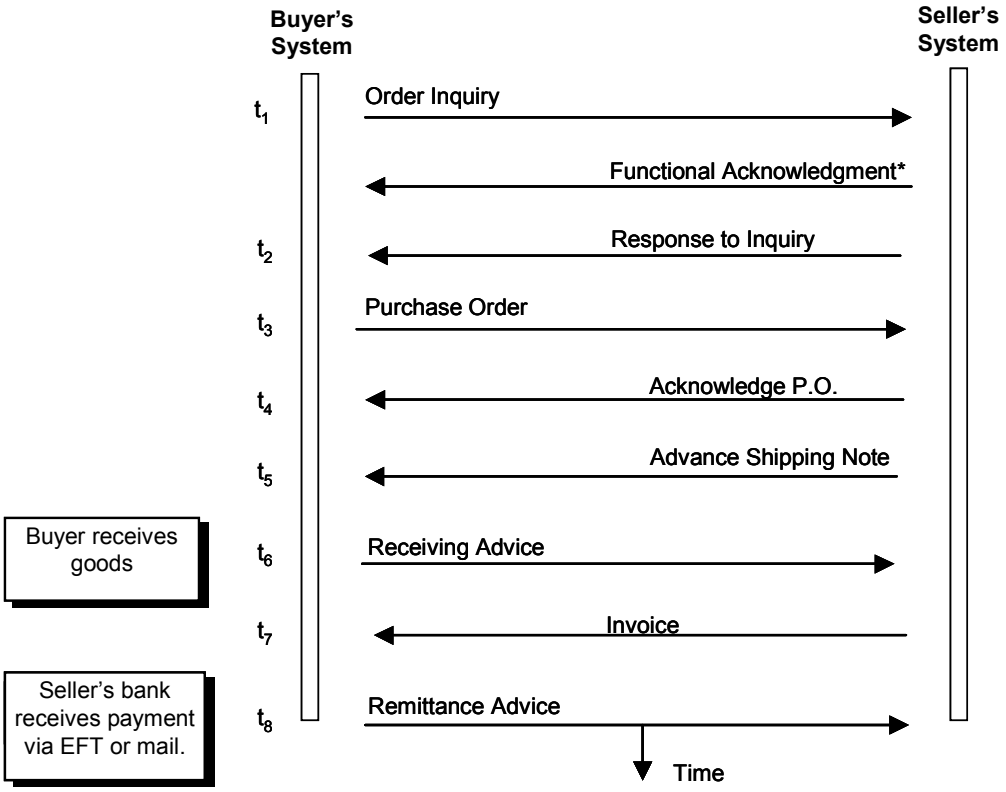
or international [UN/EDIFACT]); and (5) data processing tasks at both (all) organizations pertaining to a transaction that are supported by independent application systems. There are three generic approaches to implementing EDI links:

- The first approach employs a direct EDI link between vendor and customer using a modem and telephone line. Many large hub organizations own and operate a private network service (e.g., Wal-Mart) that all business partners are required to use. Trading partners establish communications using a dial-up link to the hub's network.
- The second approach revolves around indirect EDI links through value-added networks (VANs) or "third party electronic clearing houses." These independent EDI networking vendors provide all of the necessary software and communications services and essentially perform the function of an electronic post office for numerous business partners.
- Finally, with the development of better Internet browsers and Internet compatible software that incorporates adequate security measures including encryption, the robust and cheaper Internet is fast becoming the medium of choice for transmitting electronic documents and messages.

Due to the continuing lack of seamless standardization within industries at the present time, a firm is quite likely to simultaneously use more than one approach for EDI transmission. For instance, a spoke enterprise in the automotive industry might utilize an indirect link with most of its buyers except with major EDI hubs such as General Motors or Ford. Thus, GM may require that its trading partners use their proprietary EDI network and standards to link with each of their worldwide production facilities. In such an event, the spoke enterprise may end up assuming the burden of maintaining multiple EDI systems.

Figure 2 illustrates the EDI process, chronologically, in terms of a set of typical business transactions between a buyer and seller. First, the buyer's EDI system initiates an order inquiry that is automatically acknowledged by the seller's system to indicate that the communication was received without any errors. Next,

the buyer's system initiates a purchase order that is acknowledged by the seller's system. At the time of dispatching a shipment, the seller sends an advance shipping note and on the receipt of goods the buyer may send a receiving advice. Next, the seller may send an invoice that is used by the buyer to trigger a remittance advice and an electronic funds transfer (EFT) is made from the buyer's bank to the seller's bank (financial EDI). It should be emphasized that the time dimension is exaggerated in Figure 2 for clarity; the time delay between paired transaction events is greatly reduced, if not eliminated, in comparison with a paper-based system.




*All electronic messages from both systems receive an automatic functional acknowledgment to confirm that a transmission was received.

**Figure 2. The EDI Business Transaction Process**

## LIMITATIONS IN EDI IMPLEMENTATION AND EXECUTION

Unfortunately, EDI technology is not necessarily a panacea for increased productivity. Although much is made of the potential advantages of inter-organizational systems such as EDI, many firms (especially SMEs) adopt EDI without adequate forethought. In consequence, these firms do not take complete advantage of the full potential of EDI technology and hence obtain little operational or strategic benefits from its use. In some instances, smaller, spoke enterprises have faced more work (rework), reduced productivity, programming problems, constantly changing customer needs, longer business cycles, incompatible message formats, lack of seamless integration, and burgeoning ongoing maintenance expenditures (Khazanchi 1995).

Consider the following scenarios based on case studies conducted by one of the authors. A subsidiary of a Fortune 500 business had been using EDI for more than five years. In an interview with the internal audit group, it was revealed to the researcher that EDI transactions were neither tested nor verified by the audit department. In one instance, an EDI purchase order was sent with an extra zero to suppliers for more than a year. The error went unnoticed for a significant period of time because the suppliers receiving the incorrect purchase order failed to inform the company. The suppliers realized that the quantity was an error and automatically reduced the quantity to be delivered by a factor of 10 and sent the shipment. In another instance, a major retailer mandated a small business manufacturer of prescription tanning lamps to use EDI. The small firm owner capitulated (since the major retailer was his largest buyer) and implemented a proprietary EDI system. Today, this company uses EDI for getting orders from this major customer and no other. Orders are downloaded from their VAN mailbox and printed. The order information is then rekeyed into their internal manufacturing/ accounting application. EDI technology is essentially used as a high-tech fax machine.

The first example illustrates how even large businesses fail to assure the quality of information being electronically transmitted and hence fail to control the risks associated with electronic linkages with trading partners. The second scenario exemplifies the situation in numerous small- to medium-sized businesses around the nation. As businesses and state and federal governments are all emphasizing the importance of leveraging electronic commerce technologies such as EDI, e-mail, and the Web, small firms are being pressured into adopting EDI or other similar technologies without adequate forethought and planning. If the larger firms and government procurement agencies want to truly achieve the efficiencies and long-term benefits of EDI implementation, they need to have some assurance that the small firm ensures that EDI is integrated internally and that business processes are reengineered to suit this new way of doing business. Furthermore, in the long term, it is to the advantage of both the larger hubs and their smaller spoke trading partners to ensure that smaller firms are more effective in their use of EDI technology. Thus, this paper proposes three categories of EDI assurance services that could impact the ability of companies to deliver products and services in a timely and cost-efficient manner. The next section will describe existing models for electronic commerce assurance for both B2C and B2B electronic commerce, followed by a discussion of the results of research conducted to assess the organizational impact of EDI on SMEs. This analysis becomes the basis for the development of a proposed framework for a broader range of electronic commerce assurance services in the B2B marketplace.

## III. ASSURING B2B ELECTRONIC COMMERCE: A GROUNDED CONCEPTUAL FRAMEWORK

Consistent with the methods advocated for grounded theory (Glaser and Strauss 1967), the research discussed in this paper focuses on the application of a multi-tiered approach to the development of a broad-based conceptual model for B2B electronic commerce. First, an examination of extant B2C electronic com-

merce assurance models that have already been implemented in practice was conducted. These models were analyzed in an effort to understand the dimensions of assurance that have been chosen as important by the various assurance providers. Second, an examination was conducted of the newly introduced assurance service, WebTrust ISP, which is targeted more toward the B2B electronic commerce market. Again, our interest was in the dimensions that were identified as critical by the providers. Third, the results of an empirical examination of the organizational impact of incorporating EDI-based electronic commerce by SMEs in their business model were utilized to gain a better understanding of the key issues that could impact (or limit) the efficiency and effectiveness gains that are perceived to flow from the use of EDI for B2B commerce. The study used a mix of preliminary discussions, observations, and readings to generate a questionnaire for organizing the identified phenomena. The results of the questionnaire were used to fuel additional interviews and discussions in an effort to flesh out the key issues in SMEs' implementation of EDI.

## B2C E-COMMERCE ASSURANCE

The B2C electronic commerce assurance services market arose primarily from consumers' initial reluctance to make purchases over the Internet. In part, this was fueled by the failure of companies to disclose their data privacy and security policies on their web sites (Greenstein and Feinman 2000), and in part by horror stories of credit information being stolen over the Internet. A number of assurance seals have been made available that provide a varying range of assurance as to the security of conducting business with the given web site. We analyzed five such products: the Better Business Bureau, Veri-Sign, TRUSTe, ICSA, and WebTrust.

The Better Business Bureau (BBB) provides the least assurance. The basic requirements are that the organization must (1) belong to the BBB, (2) have information on ownership and management filed at the BBB, (3) be in business for at least one year, (4) meet BBB guidelines for on-line advertising, (5) respond

promptly to consumer complaints, and (6) agree to binding arbitration at the consumer's request for unresolved disputes.

Veri-Sign focuses specifically on security level issues. The basic requirement for Veri-Sign are (1) third-party verification of the business entity's registration information, (2) domain name confirmation, (3) export controls confirmation in regard to encryption practices, and (4) use of Veri-Sign's products that facilitate transmission of encrypted data and verification of parties involved in a transaction.

TRUSTe focuses specifically on privacy level issues, although customer complaints are also addressed. The basic requirements for TRUSTe are that the organization (1) adhere to TRUSTe privacy policy disclosure standards, (2) provide an on-line statement on privacy practices, (3) respond to customer complaints satisfactorily, and (4) allow site compliance reviews by independent third-parties.

The International Computer Security Association (ICSA) provides assurance on both security and privacy dimensions. The predominant orientation is toward a detailed test of security procedures, practices, and devices (both logical and physical). Tests are run through examination of the internal construction of site security and through remote assessment by analyzing the site similarly to what an external hacker would do in attempting to penetrate or disable a site.

WebTrust, a product of the American Institute for Certified Public Accountants (AICPA) and the Canadian Institute of Chartered Accountants (CICA), is the most comprehensive of the services. While most of the other certifications are done on an annual basis, WebTrust must be renewed every 90 days (AICPA/CICA 1999a). Three principles form the guiding framework: (1) business practices and information privacy must be disclosed on-line and transactions must be executed as prescribed, (2) transaction integrity—i.e., customer transactions are completed and billed as agreed, and (3) the entity maintains effective controls over customers' information.

In analyzing the various products that are available in the B2C marketplace, the focus seems to be on five dimensions: (1) privacy issues, (2) business infor-

mation processing integrity, (3) security of transmission, (4) security of storage, and (5) business policies. Given the repetitive occurrence in the above examples of privacy, security (both dimensions) and business policies, any generalizable framework for electronic commerce assurance should address these dimensions to some degree.

## B2B E-COMMERCE ASSURANCE

Much less has been done from an assurance standpoint in the B2B electronic commerce market. From a purely assurance perspective, the AICPA/CICA's WebTrust ISP product is the only one known by the researchers to exist. There are peripheral products on the marketplace that may also provide insight and, as such, we also examine the EDI reporting mechanisms of Harbinger Inc., which provides information on the EDI capability of certain companies for a fee.

The AICPA/CICA report, *WebTrust-ISP$^{SM/TM}$ Principles and Criteria for Internet Service Providers in Electronic Commerce*, highlights a range of services that an Internet service provider (ISP) could provide "on behalf of an e-commerce client:

- Ongoing Web server and related technology configuration and maintenance
- Internet service provision for e-commerce and general uses
- Tailoring of an ISP's proprietary order-taking and fulfillment software to enable the client's specific e-commerce activities over the Internet
- All subsequent application system enhancement, modification and testing
- Web server acquisition, configuring and implementation
- Communications connectivity from the Internet through to the client's business processing environment
- Telecommunications security
- Internal firewall configuration, maintenance and monitoring
- Maintenance of a secure e-commerce processing environment
- Maintaining the confidentiality of client information" (AICPA/CICA 1999b).

In an effort to address the risks surrounding these various components, the AICPA/CICA divides the risks into four broad areas: (1) business and information privacy practices, (2) availability of service, (3) security and privacy, and (4) service integrity. To receive the WebTrust-ISP certification, an entity must correspondingly (1) disclose its business and information privacy practices and provide service in accordance with the disclosure, (2) maintain effective controls to provide reasonable assurance of service availability, (3) maintain effective controls against unauthorized physical and electronic access to the ISP's systems and applications and to customer information, and (4) maintain effective controls to provide assurance that customer messages, transactions, and service requests are accurately and completely processed. Hence, akin to WebTrust for web-based commerce, we also see an emphasis on systems reliability and security, application user support, and general business practices in the ISP certification process described above.

As noted previously, Harbinger Inc. (http://www.harbinger.com) is another entity that provides information to other organizations on the EDI capability of various firms. Thus, their product is similar in information content to what is provided to the market via assurance reporting. To date, Harbinger has focused on the automotive industry and the generation of reports that highlight the EDI capability and the degree of integration with underlying business processes of various SMEs that serve as suppliers to the major U.S. auto manufacturers. The reports, which are only provided to customers of Harbinger (a major EDI VAN that now provides similar VAN services via the Internet), help automotive manufacturers identify potential suppliers that are most likely to be able to operate in the just-in-time manufacturing environments of the major auto manufacturers. The reports provide a broad overview of the technical and business capability of the SME's EDI operations (Yost 1999).

## PRELIMINARY B2B ASSURANCE SERVICES FRAMEWORK

The prior discussion of the existing assurance services for both business-to-consumer and business-to-business electronic commerce provides a foundation for the initial development of a generalized model for assurance services. Similarly, the corporate EDI information currently being provided by Harbinger provides some evidence of demand (at least in one niche market) for information on vendors' EDI capability and integration. As such, there appears to be a likely market for business-to-business electronic commerce assurance.

In formulating our preliminary model, we use the term “assurance services” as defined earlier in the introductory section of this paper. In view of the various existing electronic commerce assurance products, we propose a generalized model of EDI assurance services in the form of three service categories*: Application-User Level, Business Level,* and *Technical Level* assurance services (refer to Table 1 and Figure 3). Each of these three levels are further defined and explained in the following subsections.

**Table 1. B2B Assurance Services**

| Category of B2B Assurance | Purpose of Assurance Service |
|---|---|
| Application-User Level | The services at this level will focus on assuring that trading partners trust and use EDI for conducting business-to-business commerce. This may include assurance issues relating to establishing relationships with new trading partners, developing “good business practices” and related policies. In addition, this level also includes relating to overcoming education and training related challenges of EDI and/or other B2B technologies. |
| Business Level | The services at this level will focus on assuring that business processes, internal controls, and policies are amenable to EDI adoption and that the processes are altered to allow for seamless integration with the EDI application. This will include addressing legal, privacy of data, and administrative issues for conducting reliable, secure, and safe electronic commerce with trading partners. In addition, this level also includes issues relating to transmission security and managing auditability of B2B (EDI) transactions. |
| Technical Level | The services at this level will focus on assuring that all technical elements of EDI are in place and that EDI is seamlessly integrated with internal applications. This will include issues relating to transaction integrity, choice of applications, expansion of trading partner base and transaction volume, system reliability, data security (risk assessment) and encryption, and transmission error management. |

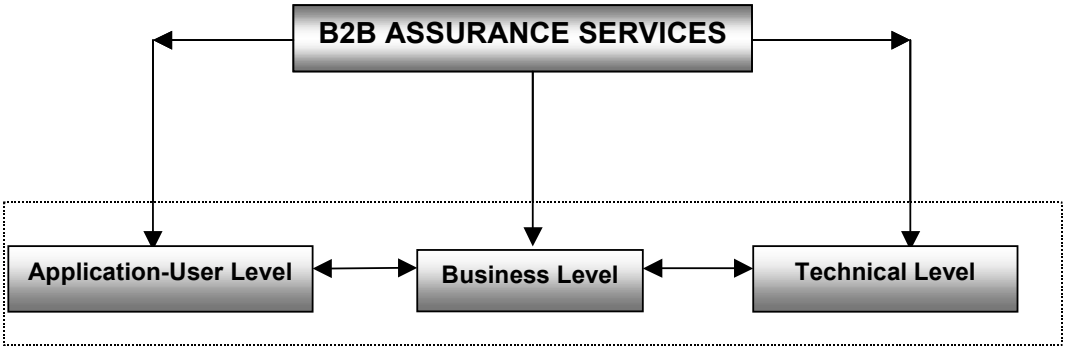



**Figure 3. B2B Assurance Services**

***Application-User Level EDI Assurance Services***

The application-user level category of EDI assurance service deals with assisting decision makers in ensuring that their choices and rationale for EDI implementation are appropriate. Thus, activities in this category might include understanding potential benefits of EDI, assessing the current business environment and internal processes, obtaining general information about EDI, assessing organizational readiness for adopting EDI, investigating end users' and customers' reliance on paper-based transactions, assisting with overcoming the impersonal nature of EDI, and conducting pilot tests of transactions to ensure their reliability. Accordingly, a review should also be conducted of all education and training programs to determine the adequacy in preparation of an organization's staff for handling the aforementioned issues.

Such services will most likely be in demand by SMEs attempting to either adapt to the demands of a primary customer or attempting to improve their integration based on existing systems that have been ineffectively and/or inefficiently implemented. Larger organizations that have not yet ventured into electronic commerce from an EDI perspective may also be ideal candidates.

The aforementioned services are predominantly voluntary assurance services. Major EDI implementers such as WalMart and the major players in the auto industry may also consider demanding that suppliers use such services. The impetus behind such demands is likely to arise from dissatisfaction with suppliers'

ability to effectively implement EDI systems and provide the reduced cycle time that partially motivates the move to EDI.

### *Business Level EDI Assurance Services*

The business level category of EDI assurance service deals with assisting decision makers in ensuring that appropriate changes in traditional business processes have been undertaken to incorporate this new method of conducting business and that appropriate controls are in place. The services in this category could also include ensuring appropriateness of EDI for the business itself, assessing whether potential direct/indirect EDI benefits are being realized, addressing legal issues (electronic orders, signatures, legal trading partner agreements, etc.), managing data and transmission security and auditability (e.g., incorporating dynamic or continuous auditing modules, audit trails, etc.), and reassessing work-flow procedures for efficiency improvements. These changes in business processes will also require review of the concurrent changes in internal control systems to assure privacy of data, reliability of systems, and secure electronic transmission.

Again, such assurance services may be internally motivated or externally mandated. Clearly, this is an area where the organization implementing EDI may desire assurances that the implementation has been properly completed and that transactions are secure. In particular, when such systems include electronic funds transfers, efficient business processes and complete transaction recording are imperative. In this area, an organization may gain the greatest benefit from having procedures and business processes analyzed for inefficiencies in an effort to drive improvements.

This may also be the most marketable to external organizations. If a major driver behind the push to EDI is to shorten the periods between ordering and receiving goods in order to facilitate just-in-time manufacturing and/or quick response retailing, a major concern may be the efficiency of suppliers' underlying business processes. Available assurance services evaluating the tightness of

integration, effectiveness of internal control systems, and the efficiency of business processes would have strong potential for becoming a standard requirement for suppliers of large organizations such as retail chains and major automakers.

### *Technical Level EDI Assurance Services*

The technical level category of EDI assurance service deals with assisting decision makers in ensuring that the necessary technical B2B elements are in place and that integration with external and internal applications is feasible given the availability of financial and technological resources. This category could include a variety of technical services such as determining appropriate internal applications to apply EDI (accounting, manufacturing, requirements planning, etc.), implementing multiple trading partners, mapping customer/supplier data for direct use in internal applications, ensuring that the business transaction process works and includes all necessary EDI transactions, and selecting the means of communications and vendors for VAN and EDI software. The review should also assure that this integration is accomplished through reliable back-office systems integration that ensures the integrity and security of the data captured through EDI transactions.

Technical level EDI assurance services may be the most desirable form of voluntary assurance, while being an unlikely candidate for external mandate. Such services will primarily aid SMEs that have been forced to adopt EDI for transactions with one partner to maximize the benefit of their EDI investment through broader integration. Additionally, analysis of controls over data integrity and security should significantly reduce the likelihood of business partner and/or legal disputes over failures to safely maintain business data. The potential benefit of such services will, in the majority of cases, significantly exceed the related costs based on our observations of the current state of integration in most such organizations.

## Table 2. Summary of Key Characteristics/Requirements of B2C/B2B Assurance Services by Provider

| Category of B2B Assurance | Assurance Providers | | | | |
|---|---|---|---|---|---|
| | **BBB** | **Veri-Sign** | **TRUSTe** | **ICSA** | **WebTrust[a]** |
| **Application-User Level** | • BBB membership, complete information on ownership and management, operational for one year, on-line advertising guidelines, dispute resolution guidelines | • Third party confirmation of business entity's information, domain name, confirmation, verification of trading partners involved in a transaction | • Respond to customer complaints, third party site compliance reviews | | • Transaction integrity, service integrity |
| **Business Level** | | | • Privacy policy disclosure standards, on-line statement on privacy practices | • Privacy policy | • Disclosure of business practices and privacy policies, internal controls on access to customer information, security practices |
| **Technical Level** | | • Export controls with regard to encryption, transmission security via Veri-Sign's encryption products | | • Test of security procedures, practices, and security devices | • Transmission security, physical and logical security, communications connectivity, web server configuration |

[a]We have included the characteristics of the B2B assurance product provided by WebTrust for Internet Service Providers (ISPs).

Table 2 summarizes the key features of the five assurance products, discussed previously, in the context of the three levels of our proposed framework for B2B assurance services. A visual inspection of this table illustrates the need for a generalized assurance services framework akin to the one proposed in this paper. The many empty cells and especially the absence of emphasis in the current assurance products on business level issues provide further impetus for the objectives of this paper.

## EDI IMPLEMENTATION CONCERNS AMONG SMEs

Given the initial formulation of the generalized assurance services model, the next stage in the grounded theory approach used in this research was to turn to an alternative source of empirical data to provide an evidentiary basis for the proposed dimensions of the model. Pertinent results of a survey of 353 EDI-capable SMEs conducted to empirically examine the organizational impact of EDI on SMEs was used to substantiate the various aspects of the generalized assurance services model.[2] Preliminary interviews followed by the final survey and follow-up were conducted in late 1997 and early 1998.

Various measures were taken to reduce non-response rates.[3] A cover letter printed on university letterhead was included to emphasize the importance and non-

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[2]This was the total sampling frame for the study consisting of EDI-capable businesses in Kentucky. The research study was limited to Kentucky businesses because one of the authors was partially funded by a grant from the Kentucky Cabinet for Economic Development. It should also be noted that the survey was designed to identify a broad range of EDI related data. As such, a significant portion of the data collected is not relevant to the current study.

[3]Non-response rates and non-response bias can be reduced in various ways. The strategies used in this study to minimize non-response bias and increase participation—multiple follow-up calls, promise of confidentiality, non-profit nature of project, sharing of results, prepaid return envelopes, etc.—are recommended by various authors (see, for example, McDaniel and Gates 1993; Sproull 1988 ). Further, summarizing studies on non-response bias, McDaniel and Gates assert that higher response rates are a means to reducing non-response bias. They also report that "of all the studies that have looked for differences between non-respondents and respondents (or early or later respondents) of mail surveys, **none** has been reported that found meaningful, practical differences between respondents and the entire sample or between early respondents and respondents as a whole" (McDaniel and Gates 1993, p. 233, emphasis added).

profit nature of the research project. In a similar vein, the name of the Kentucky Cabinet for Economic Development coupled with a statement about the importance of the research to the SME community in Kentucky was used to appeal to candidate companies. Although the letters were generated using a mail-merge facility, each letter was signed by the Project Director to demonstrate some degree of "individualized" outreach. A week to 10 days after mailing the survey forms, all non-respondents were contacted over the phone using three trained volunteers. A second follow-up call was also made after another two weeks. The volunteers making follow-up calls successfully utilized a previously established "telephone follow-up protocol." Additionally, replacement copies of the survey instrument were mailed to interested SMEs identified during the follow-up phone calls. Other steps that were taken to reduce non-response rates included writing clear directions for each survey question, limiting the use of descriptive and open-ended questions, and stating in the letter and in follow-up phone calls that only 15 to 20 minutes of the respondent's time were required to complete the survey. In addition to these steps, responses were structured so that respondents could answer and complete the questionnaire quickly and easily, and the tone and formatting of the survey and cover letter were designed to convey an impression of credibility and professionalism (Sproull 1988). Eventually all of these efforts contributed to a substantially higher response rate than comparable survey research efforts. A copy of the instrument is presented in Appendix A.

Approximately 418 follow-up phone calls were completed. These included 338 companies called once, 79 called twice, and one that was called three times. The first follow-up was two weeks after the initial survey mailings. After the first follow-up, a total of 59 completed survey responses were received, giving a response rate of 16.7%. Based on the first follow-up phone call, businesses that had expressly indicated an interest in participating were identified and called the second time around. Another 34 surveys were mailed again for various reasons

such as incorrect or bad addresses and discarded or misplaced original survey forms.

Of the 353 businesses contacted, a total of 90 responses were received including four blank responses, giving a response rate of 25.4%. Two of the blank responses had a letter attached describing EDI experiences at the business. The effective response rate for the survey based on 86 useful responses is 24.3%. Key demographics for the responding firms are displayed in Tables 3 through 6.

**Table 3. Industrial Sector of Sampled Firms**

| Industry | Frequency | Percent |
|---|---|---|
| Manufacturing | 49 | 57.0% |
| Wholesale Trade | 23 | 26.7% |
| Retail Trade | 6 | 7.0% |
| Services | 2 | 2.3% |
| Transportation and Public Utilities | 1 | 1.2% |
| Mining | 1 | 1.2% |
| Other | 4 | 4.6% |
| **Total** | **86** | **100.0%** |

**Table 4. Industrial Sector and EDI Experience (N = 85)**

| Industry Category | EDI Experience | | | |
|---|---|---|---|---|
| | *Less than 6 months* | *6 to 12 months* | *1 to 5 years* | *5 years or more* |
| Manufacturing | 1.2% | 5.9% | 29.4% | 20.0% |
| Wholesale Trade | | 2.3% | 15.3% | 9.4% |
| Retail Trade | | | 4.7% | 2.3% |
| Services | | | 1.2% | 1.2% |
| Transportation and Public Utilities | | | 1.2% | |
| Mining | | | 1.2% | |
| Other | | | 3.5% | 1.2% |
| **Total** | **1.2%** | **8.2%** | **56.5%** | **34.1%** |

## Table 5. 1997 Gross Sales by Industrial Sector

| Industry Category | 1997 Gross Sales (Estimated) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Less than $10,000* | *$10,000 to $50,000* | *$50,000 to $100,000* | *$250,001 to $500,000* | *$500,001 to $1 million* | *$1 million to $5 million* | *$5 million to $10 million* | *More than $10 million* | *Don't know* |
| Manufacturing | 1.2% | 2.3% | 3.5% | 1.2% | 2.3% | 5.8% | 3.5% | 27.9% | 9.3% |
| Wholesale Trade | | | | | 1.2% | 4.7% | 2.3% | 15.1% | 3.5% |
| Retail Trade | | 1.2% | | | | 2.3% | | 3.5% | |
| Services | | | 1.2% | | | | 1.2% | | |
| Transportation and Public Utilities | | | | | | | 1.2% | | |
| Mining | | | | | | | 1.25 | | |
| Other | | | | 2.3% | | 1.2% | | | 1.2% |
| **Total** | **1.2%** | **3.5%** | **4.7%** | **3.5%** | **3.5%** | **14.0%** | **9.3%** | **46.5%** | **14.0%** |

## Table 6. Organizational Size (Number of Full-time Employees) by Industrial Sector

| Industry Category | Number of Full-time Employees | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *Fewer than 5* | *5 to 10* | *11 to 20* | *21 to 50* | *51 to 100* | *101 to 250* | *251 to 500* | *More than 500* |
| Manufacturing | | 4.6% | 3.5% | 3.5% | 5.8% | 19.8% | 7.0% | 12.8% |
| Wholesale Trade | 2.3% | 3.5% | 4.6% | 4.6% | 3.5% | 7.0% | | 1.2% |
| Retail Trade | 2.3% | 2.3% | | | 1.2% | | 1.2% | |
| Services | 1.2% | | | | | | | 1.2% |
| Transportation and Public Utilities | | | | | 1.2% | | | |
| Mining | | | | 1.2% | | | | |
| Other | | 1.2% | | 1.2% | 1.25 | 1.2% | | |
| **Total** | **5.8%** | **11.6%** | **8.1%** | **10.5%** | **12.8%** | **27.9%** | **8.1%** | **15.1%** |

### *Application-User Level Issues*

Based on the previous analysis of extant B2C and B2B electronic commerce assurance services, one of the areas that was considered particularly important to

explore in the empirical study was that of application-user level issues. In Tables 7 through 12, the survey results relating to some key application-user level issues are presented. Notice that the primary reason for SMEs implementing EDI was "customer's or supplier's demand" with only a few survey respondents not rating this factor as a "major influence" (refer to Table 7). The heavy influence of customer's or supplier's demand is very likely correlated with the significant number of firms that did not bother to perform a cost-benefit analysis on EDI implementation. Thus, the decision to implement and continue to use EDI seems unrelated to internal efficiency or effectiveness, but rather is primarily a concession to one or more customers and/or vendors. This passive reaction may also indicate a limited approach to EDI use, which is focused on meeting minimum requirements resulting from external demands—and, therefore, potentially has little internal benefit. This is also further evidenced by the absence of cost-benefit analysis prior to EDI adoption (only 27% of firms reported conducting some kind of estimate as detailed in Table 8).

Another related issue relevant to this service level is the growth in the diversity and type of EDI transactions. As customers move all of their business documents to EDI or other electronic forms, they have generally required their suppliers to immediately do the same. This is demonstrated by the results in Table 9. A large number of the firms surveyed planned to implement additional EDI transaction sets. Also, a number of the firms appeared to be moving toward implementing a diversity of transactions including those for billing and payment such as receiving advice and electronic funds transfer. This has been a weak area for small firms in the past.

Closely associated with the above issues is the integration of new trading partners (in many instances, traditional business partners are being supplanted by new e-intermediaries in the value chain). A significant proportion of the firms surveyed planned to add between one and 10 trading partners in 1998 and 1999 (41% and 36% respectively, as shown in Table 10) and 13% planned to add more

than 10 trading partners in each year. Finally, most firms report a modest EDI transaction (document) volume per day at the time of the survey (Table 11), while a majority of firms expect this volume to grow between 10% and 50% (as shown in Table 12).

**Table 7. Some Key Reasons for EDI Implementation (Top Three Reasons Only)**

| Reason: | Mean Rating | No Influence at All (1) | Minor Influence (2) | Moderate Influence (3) | Major Influence (4) |
|---|---|---|---|---|---|
| Customer's or Supplier's Demand | 3.83 | 1.2% | 2.5% | 8.5% | 87.8% |
| Forges strong business relationships with partners | 2.95 | 13.6% | 17.3% | 29.6% | 39.5% |
| Improves communication with trading partners | 2.89 | 11.0% | 26.0% | 26.0% | 37.0% |

**Table 8. Nature of Cost/Benefit Analysis Conducted by Sampled Firms**

| Nature of Cost/Benefit Analysis | Frequency | Percent of Responses |
|---|---|---|
| No cost/benefit analysis was conducted | 62 | 72.9% |
| Rough estimate | 10 | 11.8% |
| Analysis of costs only | 5 | 5.9% |
| Analysis of costs and tangible benefits | 5 | 7.0% |
| Analysis of costs, tangible and intangible benefits | 2 | 2.4% |

## Table 9. Growth in Diversity and Type of EDI Transactions (Comparing Current and Planned)

| Type of EDI Transaction | Using Now (Frequency) | Plan to Use (Frequency) |
|---|---|---|
| **Purchasing/Order Management Administration** | | |
| Purchase Order (850) | 58 | 13 |
| PO Acknowledgment (855) | 38 | 16 |
| PO Change Request (860) | 17 | 15 |
| PO Change Acknowledgment (865) | 14 | 13 |
| Order Status Inquiry (869) | 5 | 11 |
| Order Status Report (870) | 10 | 11 |
| Price/Sales Catalog (832) | 7 | 9 |
| **Sales Analysis/Inventory Management** | | |
| Planning Schedule/Release (830) | 18 | 7 |
| Inventory Advice (846) | 6 | 6 |
| Product Activity Data (852) | 7 | 8 |
| **Billing/Payment** | | |
| Invoice (810) | 36 | 18 |
| Credit/Debit Adjustment (812) | 6 | 12 |
| Receiving Advice (861) | 8 | 7 |
| Payment Order/Remittance Advice (820) | 13 | 10 |
| Lockbox (823) | 1 | 4 |
| Application Advice (824) | 4 | 1 |
| Electronic Funds Transfer (EFT) | 11 | 13 |
| **Shipping/Receiving** | | |
| Advance Shipping Note/Manifest (856) | 25 | 16 |
| Shipping Schedule (862) | 11 | 7 |
| Shipping Status Inquiry (213) | | 6 |
| Carrier Shipment Status (214) | 2 | 4 |
| **Bidding/Quotation** | | |
| Request for Proposal or Quotation (840) | 10 | 9 |
| Award Notice (836) | 8 | 5 |
| Text Message | 17 | 4 |
| **Partner Information/Acknowledgment** | | |
| Organizational Relationships (816) | 1 | 4 |
| Functional Acknowledgment (997) | 28 | 4 |
| Other EDI Transactions | 18 | |
| Total Responses | 379 | 233 |

**Table 10. Number of Trading Partners Added or Planned Since EDI Implementation**

| Number of Trading Partners | Current (N = 85) | Planned for 1998 (N = 84) | Planned for 1999 (N = 82) |
|---|---|---|---|
| None | 12 (14.1%) | 22 (26.2%) | 19 (24.7%) |
| 1 to 5 | 37 (43.5%) | 30 (35.7%) | 21 (27.3%) |
| 6 to 10 | 9 (10.6%) | 5 (6.0%) | 7 (9.1%) |
| More than 10 | 24 (28.2%) | 11 (13.1%) | 10 (13.0%) |
| Don't know | 3 (3.5%) | 16 (19.0%) | 19 (24.7%) |

**Table 11. Volume of EDI Communications (N = 86)**

| Volume of EDI Documents (Messages) Exchanged | Frequency |
|---|---|
| Less than 1 transaction per day (or 24/month) | 18 |
| 1 to 10 transactions per day | 38 |
| 11 to 25 transactions per day | 17 |
| 26 to 50 transactions per day | 2 |
| 51 to 100 transactions per day | 4 |
| More than 100 transactions per day (or 2,400/month) | 7 |

**Table 12. Percentage Growth in EDI Document Volume in Next Two Years**

| Percent Growth | Frequency | Percent of Responses |
|---|---|---|
| Less than 10% | 23 | 27.4% |
| 10% to 25% | 32 | 38.1% |
| 26% to 50% | 15 | 17.9% |
| Nearly double | 11 | 13.1% |
| More than triple | 3 | 3.6% |

### *Business Level Issues*

The second area of concern in the preliminary model is the business level. Business level issues are more difficult to isolate in that the data collected at the business level often also has implications for either the technical level or the

application-user level—as suggested in the preliminary assurance model. In Table 13, the survey results on impediments to EDI implementation are presented, and in Tables 14 and 15 the survey results related to the level of internal and external EDI integration are displayed.

**Table 13. Impediments (N = 85)**

| EDI Impediments: | Mean Rating | Extremely Serious Challenge (3) | Somewhat Serious Challenge (2) | Not Serous at All (1) | Not an Impediment (0) |
|---|---|---|---|---|---|
| **APPLICATION-USER LEVEL ISSUES** | | | | | |
| **Education/Training-Related Challenges:** | | | | | |
| Obtaining general information about EDI | 1.37 | 9.6% | 28.9% | 50.6% | 10.8% |
| Learning new technology and methodology (e.g., trading partner's procedures) | 1.66 | 16.9% | 45.8% | 24.1% | 13.3% |
| Complexity of the technology itself | 1.46 | 9.5% | 39.3% | 39.3% | 11.9% |
| **Change Management Challenges:** | | | | | |
| Understanding potential benefits of EDI | 1.48 | 17.1% | 26.8% | 42.7% | 13.4% |
| Considering EDI as a natural extension of pre-existing internal operations | 1.39 | 12.0% | 28.9% | 44.6% | 14.5% |
| Availability of managerial time to expand EDI use | 1.59 | 20.7% | 32.9% | 30.5% | 15.9% |
| End users' and customers' continued reliance on paper-based transaction | 1.58 | 13.3% | 42.2% | 33.7% | 10.8% |
| **Operational Challenges:** | | | | | |
| Low volume for frequency of orders | 1.11 | 13.3% | 12.0% | 47.0% | 27.7% |
| Maintaining one system for EDI capable and another for non-EDI capable partners | 1.14 | 9.6% | 24.1% | 24.1% | 33.7% |
| Impersonal nature of EDI (e.g., lose touch with customers/suppliers) | 1.06 | 8.6% | 19.8% | 40.7% | 30.9% |
| **BUSINESS LEVEL ISSUES** | | | | | |
| **Organizational (Business-Specific) Challenges:** | | | | | |
| Increased responsibility for employees | 1.27 | 4.9% | 35.4% | 41.5% | 18.3% |
| Changing business processes (new way of thinking about and doing business) | 1.49 | 9.6% | 47.0% | 26.5% | 16.9% |
| Overcoming resistance to change | 1.33 | 7.3% | 36.6% | 37.8% | 18.3% |
| Small size of our business | 1.07 | 6.2% | 21.0% | 46.9% | 25.9% |
| Gaining management/stakeholder commitment | 1.07 | 3.7% | 25.6% | 45.1% | 25.6% |
| **Resource Challenges:** | | | | | |
| Availability of financial resources | 1.49 | 12.0% | 36.1% | 41.0% | 10.8% |
| High startup costs | 1.82 | 15.7% | 54.2% | 26.5% | 3.6% |
| High cost of integration and expansion of EDI use | 1.64 | 14.5% | 45.8% | 28.9% | 10.8% |
| Availability of technological resources | 1.49 | 13.3% | 36.1% | 37.3% | 13.3% |

| EDI Impediments: | Mean Rating | Extremely Serious Challenge (3) | Somewhat Serious Challenge (2) | Not Serous at All (1) | Not an Impediment (0) |
|---|---|---|---|---|---|
| **Trading and Communication Security Challenges:** | | | | | |
| Managing data and transmission security and auditability (e.g., lack of audit trails) | 1.12 | 4.9% | 30.5% | 36.6% | 28.0% |
| Exposure to ever-changing customer/supplier requirements about EDI system | 1.43 | 9.9% | 40.7% | 32.1% | 17.3% |
| Addressing legal issues (e.g., electronic orders, signatures, legal agreements) | 0.96 | 2.5% | 23.5% | 42.0% | 32.1% |
| **TECHNICAL LEVEL ISSUES** | | | | | |
| **Technology Adoption and Implementation Challenges:** | | | | | |
| Integrating multiple EDI systems and/or VAN connections | 1.12 | 10.8% | 21.7% | 36.1% | 31.3% |
| Dealing with multiple EDI formats | 1.26 | 11.9% | 31.0% | 28.6% | 28.6% |
| Absence of uniform EDI standards | 1.45 | 15.5% | 33.3% | 32.1% | 19.0% |
| Implementing multiple trading partners | 1.35 | 12.0% | 32.5% | 33.7% | 21.7% |
| Selecting means for communications with trading partners (e.g., choice of third party VANs) | 1.05 | 2.4% | 22.6% | 52.4% | 22.6% |
| **Technology-Business Integration Challenges:** | | | | | |
| Determining appropriate internal applications to apply EDI | 1.22 | 6.0% | 27.7% | 48.2% | 18.1% |
| Translating customer/supplier data for direct use in internal applications | 1.52 | 15.5% | 40.5% | 25.0% | 19.0% |
| Selecting the hardware to run EDI software | 1.00 | 3.6% | 20.2% | 48.8% | 27.4% |
| Ability to seamlessly integrate EDI with existing internal applications | 1.63 | 26.2% | 27.4% | 29.8% | 16.7% |

## Table 14. Stage of Internal Integration (N = 77)[a]

| Minimum | Maximum | Mean | Standard Deviation |
|---|---|---|---|
| 1 | 4 | 1.69 | .86 |

| Stage of Internal Integration | Frequency | Percent of Cases |
|---|---|---|
| Stage 1 | 41 | 53.2% |
| Stage 2 | 22 | 28.6% |
| Stage 3 | 11 | 14.3% |
| Stage 4 | 3 | 3.9% |

[a]According to Swatman and Swatman (1991, 1994), the *level of internal integration* can be categorized into four distinct stages. In the first stage, EDI is operated from a terminal or "stand alone PC," with manual keying of outgoing messages and printing of incoming messages, whereas in the last stage there is a "seamless integration" of EDI with internal applications and EDI and other information technologies are seen as an integral part of both the internal organizational context and external strategic orientation.

**Table 15. Degree of External Integration Measured in Terms of Type and Diversity of EDI Trading Partners (N = 84)[a]**

| Type of EDI Partner | Frequency | Percent of Cases |
|---|---|---|
| Customers | 61 | 72.6% |
| Wholesalers/Distributors | 27 | 32.1% |
| Manufacturers | 34 | 40.5% |
| Financial Institutions | 5 | 6.0% |
| Shipping Companies | 9 | 10.7% |
| Government | 13 | 15.5% |
| Other (e.g., Brokers, Warehouses) | 6 | 7.1% |

[a]The level of *external integration* refers to the number and types of trading partners in its value chain (e.g., customers, manufacturers, wholesalers, government agencies, financial institutions, etc.) with whom the organization transacts business through EDI.

When companies implement EDI, they face various challenges, hurdles, or difficulties. In order to understand the nature of impediments faced by the organizations surveyed, respondents were asked to assess the *seriousness* of a list of these barriers or impediments to EDI adoption and integration. The *five most serious* impediments faced by the firms are "high startup costs," "learning new technology and methodology," "high cost of integration and expansion of EDI use," "ability to seamlessly integrate existing applications with existing internal applications," and "availability of managerial time to expand EDI use." As shown in Table 13, all of the EDI impediments listed (31 of them) received mean seriousness scores of greater than "0," indicating that organizations surveyed did encounter these impediments, but with varying degrees of difficulty (Khazanchi 1999).

Over 50% of the responding firms found issues such as "translating customer/supplier data for direct use in internal applications," "ability to seamlessly integrate EDI with existing internal applications," "changing business processes," and "end users and customers' continued reliance on paper-based transactions" to be extremely or somewhat serious challenges (refer to Table 13). Furthermore, nearly 40% of firms found "understanding the potential benefits of EDI" and over one-third of the firms found "managing data and transmission security and

auditability" to be extremely or somewhat serious challenges. All of the results noted here indicate that SMEs have found it necessary to implement EDI technology, but seem to lack the expertise to acquire the efficiency and effectiveness gains that would help them and provide their customers and/or vendors with the benefits desired via EDI linkages.

Greater internal integration of EDI in an organization can result in shorter order cycle time and can decrease inventory carrying and servicing costs. Further, integrating EDI externally with both upstream and downstream firms in the value chain can allow a firm to achieve strategic advantages and capitalize on the investment made in EDI. For example, both Bergeron and Raymond (1992) and Swatman and Swatman (1991, 1994) found that the level of internal and external EDI integration significantly influenced the benefits obtained from EDI implementation. In terms of internal integration, the firms surveyed reported using EDI mostly for purchasing/order management, billing/payment, and shipping/receiving transactions. On an ordinal scale of 1 (low) to 4 (high), the average "level of internal integration" of a Kentucky small- to medium-sized enterprise was 1.69 (see Table 14). This finding is reflective of the fact that more than half of the firms (53%) used EDI to electronically receive and print transaction documents and key-in outgoing messages; another 29% also had their internal business applications linked with EDI. Only a minority (14%) of firms surveyed had achieved a near "paperless" environment by seamlessly integrating EDI with their internal business applications such as accounts/payable, inventory management, etc. Only three firms reported viewing EDI as a strategic asset and as being the driver for changing internal business processes.

The second aspect of integration concerns the degree of external integration as measured by the variety of trading partners in a firm's value chain that are linked to it through EDI (refer to Table 15). Being linked with a greater diversity of business partners such as customers, wholesalers/distributors, financial institutions, and shipping companies can allow a firm to truly capitalize on its EDI investment. The

principal EDI trading partners of firms surveyed are their customers (nearly 73% of the cases, as shown in Table 15). Manufacturers (41%) and wholesalers/distributors (32%) made up the other major type of EDI trading partner identified by the firms surveyed.

### *Technical Level Issues*

The final area of concern in the preliminary model is the technical side of B2B implementations. In Tables 16 through 23, the survey results relating to technical issues of EDI implementation are presented. Notice, first of all, that many SMEs implementing EDI must use multiple types of EDI connections for communicating with trading partners, while most use the nationally accepted ANSI X.12 EDI standard. However, the significant number of responding firms still using DOS and Windows 3.X based platforms at the time of the survey is indicative of a reluctance to maintain state-of-the-art systems that may provide the greatest efficiency and effectiveness gains. A majority of the firms are clearly planning to upgrade their EDI software in one to four years. Another indicator of a tendency toward minimizing the technical effort needed to implement and integrate EDI is reflected in the rather small investments that the surveyed firms made for *setting up* EDI and the minimal expenditure related to *on-going EDI activities* (refer to Tables 22 and 23). Furthermore, not surprisingly, a large number of firms utilize EDI along with other means such as e-mail and fax to exchange a large proportion of their EDI documents (refer to Table 21). In fact, only half of the firms surveyed used EDI to exchange one-third of their EDI documents at the time of the survey.

## Table 16. Type of EDI Standard (N = 79)

| Type of EDI Standard | Frequency | Percent of Responses | Percent of Cases |
|---|---|---|---|
| National/Regional (e.g., X.12) | 69 | 75.0% | 87.3% |
| Industry Protocol | | | |
| UCS | 6 | 6,5% | 7.6% |
| VICS | 2 | 2.2% | 2.5% |
| Not specified | 8 | 8.7% | 10.1% |
| Proprietary Format | 5 | 5.4% | 6.3% |
| International (e.g., EDIFACT) | 2 | 2.2% | 2.5% |
| **TOTAL** | **92** | **100%** | **116.5%** |

## Table 17. Means of EDI Communication (N = 86)

| Type of Connection | Frequency | Percent of Responses | Percent of Cases |
|---|---|---|---|
| Third-party EDI Network/Value Added Network | 75 | 72.1% | 87.2% |
| Direct Link or Point to Point Network | 23 | 22.1% | 26.7% |
| Internet | 5 | 4.8% | 5.8% |
| Other (Fax to EDI) | 1 | 1.0% | 1.2% |
| **TOTAL** | **104** | **100%** | **120.9%** |

## Table 18. EDI Platform (N = 84)

| Type of Platform | Frequency |
|---|---|
| DOS | 30 |
| WINDOWS | 13 |
| WINDOWS95 | 19 |
| UNIX or WINDOWS-NT | 11 |
| Other O/S | 11 |

## Table 19. Upgrade Plan for EDI Software (N = 80)

| Time Frame | Frequency |
|---|---|
| Never | 5 |
| Next 1 year | 56 |
| 2 to 4 years | 15 |
| 5 years and beyond | 4 |

## Table 20. Nature and Level of Trading Partner Support Received by Organizations Surveyed (N = 85)

| EDI Support Category | Mean Rating | No Support Received (1) | Modest Support Received (2) | Substantial Support Received (3) |
|---|---|---|---|---|
| Implementation | 1.76 | 38.8% | 45.9% | 15.3% |
| Education and Training | 1.64 | 48.2% | 40.0% | 11.8% |
| Software | 1.52 | 58.8% | 30.6% | 10.6% |
| Maintenance | 1.40 | 68.2% | 23.5% | 8.2% |
| Telecommunication costs | 1.29 | 75.3% | 20.0% | 4.7% |
| Hardware | 1.25 | 78.3% | 18.1% | 3.6% |

## Table 21. Means of Document Exchange (Frequency)

| Percentage of Documents Exchanged with Trading Partners | E-Mail | Fax | EDI |
|---|---|---|---|
| Less than 10% | 30 | 11 | 37 |
| 10% to 29% | 4 | 16 | 15 |
| 30% to 59% | 3 | 21 | 9 |
| 60% to 79% | 0 | 13 | 8 |
| 80% or more | 1 | 19 | 12 |

## Table 22. EDI Investment: EDI Setup Cost (N = 82)

| EDI Setup Cost | Frequency | Percent of Responses |
|---|---|---|
| None | 1 | 1.2% |
| Less than $1,000 | 7 | 8.5% |
| $1,000 to $3,000 | 22 | 26.8% |
| $3,001 to $5,000 | 19 | 23.2% |
| $5,001 to $7,000 | 10 | 12.2% |
| $7,001 to $10,000 | 9 | 11.0% |
| More than $10,000 | 14 | 17.1% |

**Table 23. EDI Investment: Ongoing Cost (N = 81)**

| Cost per Month | Frequency | Percent of Responses |
|---|---|---|
| None | 3 | 3.7% |
| Less than $100 | 24 | 29.7% |
| $100 to $500 | 37 | 45.7% |
| $501 to $1,500 | 6 | 7.4% |
| $1,501 to $3,000 | 9 | 11.1% |
| More than $5,000 | 2 | 2.5% |

Many authors advocate the use of incentives and subsidies to entice smaller firms to begin using EDI and to expand its use further. This advice has not always been heeded. Despite a general belief in the use of incentives and subsidies to entice smaller firms into using EDI, the results of this study clearly demonstrate that trading partners of these SMEs have not been proactive in providing such support. Rather, as shown in Table 20, a majority of firms surveyed reported receiving moderate to no support from trading partners in all of the support categories in which they were queried.

## REVISED FRAMEWORK

The empirical study reported here served two key purposes in the generation of the generalized framework for assurance services. First, the data provided confirmation for the proposed organization of various levels of concern in evaluating an organization's implementation of electronic commerce functionality in a business-to-business environment. Second, the data provided new insights as to the stages, or dimensions, for which assurance may be practical.

In analyzing the data and speaking with the various SMEs, it became increasingly clear that the first dimension of difficulty was simply at the *adoption stage*. Organizations approached adoption, not with the intent of improving their own business processes, but to facilitate the business processes of their vendors and/or customers. Consistently, the firms surveyed noted the technical difficulties

associated with implementation and integration of EDI operations. Furthermore, other than keeping certain suppliers and vendors satisfied, the sampled-firms were unable to identify any tangible or intangible benefits of having implemented EDI. Indeed, the general sentiment was that the sole benefit was in the information processing costs reductions for the vendors and/or suppliers mandating EDI use. External help in analyzing the potential of EDI may have improved the understanding of benefits accrued from adopting B2B electronic commerce technologies such as EDI. In addition, external assistance could have alleviated some of the technical challenges of implementing EDI.

The second dimension that emerged from the data was that of *EDI integration*. The data reflected a consistent theme that organizations had extreme difficulty integrating EDI processes with their internal business processes. This suggests an opportunity for assurance to the external customer that would provide information on the level of integration of its supplier and, therefore, the supplying organization's ability to meet just-in-time demands through well-integrated systems. Additionally, the organization of concern could also benefit from the assurance process through the direction such a process would provide in achieving strong integration of EDI with internal business processes and information systems. The third and final dimension was in the area of assessing *EDI outcomes (benefits)*. Given the inability to really provide any evidence of successful implementation and actual benefits from such implementation, various stakeholders are likely to have an interest in validating the benefits of EDI adoption and integration. These stakeholders may range from the vendors and customers to stockholders, parent companies, or senior management. In each case, there appear to be benefits in attaining assurance on the benefits of EDI adoption and integration.

The result of the previous analysis is the *generalized assurance services framework* displayed in Figure 4. In addition to including the fundamental assurance levels presented earlier in Figure 3, the revised model extends beyond the three levels of concern by incorporating the three dimensions of EDI implementation

discussed in this section of the paper. As indicated in the model, each assurance level will also incorporate concerns relating to each of the three dimensions discussed here. This relationship between the three assurance levels and the three dimensions of EDI implementation is presented in Table 24 as intersections in the grid between each level and each dimension. It should also be reiterated that the assurance levels are interrelated as reflected in Figure 3, while the dimensions (or stages) are sequential in nature as reflected in Figure 4.

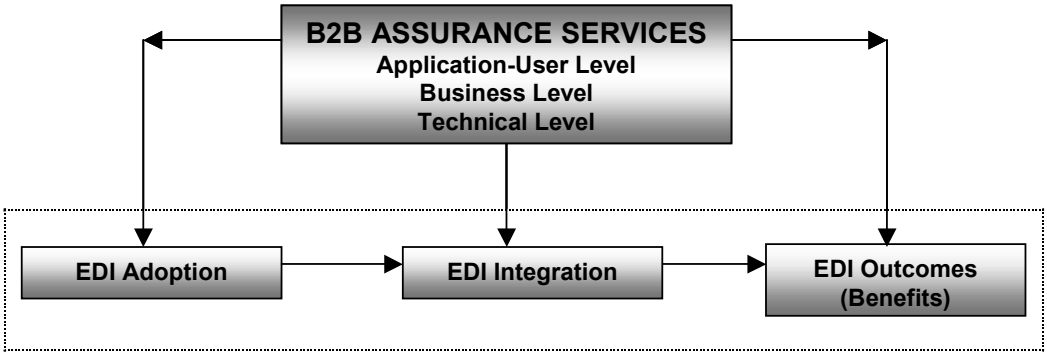


**Figure 4. B2B Assurance Services and the EDI Implementation Process**

## Table 24. Generalized Framework for B2B Assurance Services[a]

| | Application-User Level | Business Level | Technical Level |
|---|---|---|---|
| **EDI Adoption** | • Education and/or training about EDI, EDI standards and EDI transmission options<br>• Understanding potential impediments of EDI adoption<br>• Assessing firm readiness or "fit" for EDI adoption<br>• Identifying (new) transactions to implement | • Business process reengineering (aligning business processes for EDI adoption)<br>• Legal and administrative issues of B2B e-commerce<br>• Authentication (e.g., third party confirmation) of expanding trading partner base, especially with regard to new players in the value chain<br>• Transmission security and transaction auditability issues including encryption and dynamic auditing<br>• Assessing resource (financial and technological) availability and capabilities<br>• Obtaining trading partner support<br>• Gaining management/stakeholder commitment<br>• Assessing and formalizing customer/supplier transaction requirements for B2B applications | • Preparing for EDI implementation<br>• Assessing current IT infrastructure and architecture<br>• Determining appropriate transaction formats (e.g., ANSI, X12, EDIFACT, or industry-specific)<br>• Conducting risk assessment and determining types and levels of encryption required<br>• Selecting appropriate means for transmission with trading partners (e.g., Internet, Direct, and/or VAN)<br>• Determining appropriate applications to apply EDI<br>• Translating or moving non-EDI based transactions (such as e-mail or fax-based processing) to forms that are amenable to EDI<br>• Selecting the hardware to run EDI applications<br>• Conducting pilot testing and transaction integration |
| **EDI Integration** | • Understanding change and overcoming change management impediments<br>• Understanding the relationship of EDI with pre-existing internal operations<br>• Expanding the diversity and type of B2B transactions | • Changing business processes and traditional thinking about conducting business<br>• Human resource change management; redefining job descriptions and work processes; overcoming resistance to change<br>• Security and transaction auditability issues | • Integrating multiple EDI formats and communication systems<br>• Integrating multiple trading partners<br>• Integrating greater volume of document exchange as number of trading partners and diversity and type of transactions increase<br>• Seamlessly integrate EDI with internal and external operations |

| | Application-User Level | Business Level | Technical Level |
|---|---|---|---|
| **EDI Outcomes (Benefits)** | • Understanding potential setup and ongoing costs<br>• Understanding potential benefits (e.g., operational/tactical benefits such as improved cash flows, reduced inventory levels, increased operational efficiency, etc., versus strategic benefits such as increase in a firm's ability to compete and enhanced relationships with trading partners)<br>• Establishing baseline policies for privacy of data and "good" business practices<br>• Establishing benchmarks for success | • Assessing auditability of transactions<br>• Assessing security of e-commerce applications<br>• Assessing strategic benefits<br>• Assessing performance compliance and adherence to good business practices<br>• Assessing change in operational/tactical and strategic benefits realized<br>• Assessing costs and benefits of integration and expansion of EDI use<br>• Comparing with benchmark outcomes | • Assessing EDI transaction success<br>• Assessing success in translating customer/supplier data for direct use in internal applications<br>• Assessing physical security<br>• Assessing change in operational efficiency, effectiveness, and productivity |

[a]NOTE: The list of activities in each cell is not meant to be exhaustive. We provide illustrative assurance services that could be targeted within each intersection of assurance level and implementation stage.

## IV. CONCLUDING REMARKS

Many companies are finding that their traditional supplier and customer networks are no longer an efficient and cost-effective way in which to conduct business. Rather, virtually every organization must pair with new business partners that are prepared and active in B2B electronic commerce. Unfortunately, this means organizations are partnering with organizations they may never have heard of before. How secure are the new partners' B2B systems? Can the new B2B suppliers truly provide increased efficiency in the supply chain through tightly coupled, EDI-enabled business processes?

The results of the study reported in this paper indicate that small- and medium-sized enterprises (SMEs) are achieving only low levels of EDI integration. Phone interviews and discussions with many of these entities confirmed this perception and highlighted the difficulties such entities have encountered in meeting the EDI demands of suppliers, customers, and others in the value-chain. Reporting entities indicated that nearly 73% had never performed a cost benefit analysis before implementation and, indeed, virtually all noted that the demands of suppliers, customers, and others in the value-chain were a major (and, in most cases, primary) reason for the decision to implement EDI systems (refer to Table 8). Further evidence of this is the 53% of organizations that admitted that they received EDI transactions, only to print out the transactions, re-enter into the organization's internal systems, and then re-enter the data into the EDI system when the business process is completed. These problems are further confounded by a culture that still demands paper-based transactions. SMEs participating in the reported study noted that 54% of users still demand paper printouts for transaction processing.

Companies that have required other organizations (or plan to) in their value-chain to participate in EDI should consider the implications of these results. Namely, if the move to EDI was (or is) intended to not only save the organization in information processing cost, but to also cut down supplier cycle time and facilitate just-in-time and/or quick response retailing, then simply requiring organizations in

the value-chain to adopt EDI may not be sufficient to achieve targeted goals. Rather, such companies may wish to require other entities in the value-chain to acquire assurance reports that cover the underlying business processes that support EDI transactions. Additionally, companies requiring partners to use EDI may also want to consider the security and integrity of the information being transmitted to and from these partners. Is this information at risk during transmission? Is it at further risk during storage in the partners' systems and/or while being used in internal business processing activities? Provision of assurance services that help relieve these risks for organizations venturing into the B2B marketplace would seem to be ideal for information systems and accounting professionals who are already providing similar types of services for B2C commerce. The framework presented in this paper provides a comprehensive model for providing a full range of services that meet clients' needs and have tremendous potential for revenue generation.

This framework also provides fertile ground for researchers interested in electronic commerce assurance services. First, most of the organizations involved in the current study have emphasized difficulties in implementing EDI technologies. Research focusing on how some SMEs have successfully integrated EDI may provide both insights for best practices recommendations in assurance engagements and insights as to whether the anticipated benefits for large organizations using EDI-enabled SMEs has materialized when SMEs have successfully integrated the technology with their internal business processes. Second, there are cells in the proposed framework (i.e., pairwise combinations between service category level and stages of EDI implementation) for which there is no existing assurance product coverage. Research identifying the means for establishing reasonable measurement criteria for assessing EDI success in these cells could spur new areas of electronic commerce assurance practice. Third, as with any grounded theory approach, as more evidence is gathered, models often continue to evolve. Future research studying the components of the generalized electronic commerce assurance framework put forth in this paper may lead to an improved model over time.

In considering the results of this study, certain limitations should be considered. First, the sample of organizations surveyed represented the known population of EDI organizations in only one state—Kentucky. However, there is no reason to believe that such organizations would not be representative of the many SMEs across the continent that are being required by vendors, suppliers, or others in the value-chain to participate in EDI-based transactions. Second, the nature of grounded theory is such that the researchers' lens for examining and observing the phenomena of study may not be completely unbiased. However, the researchers in this study pursued the investigation with no prior expectations of findings and, consistent with the advocated approach for grounded theory studies, focused on allowing the observed phenomena to drive the perceived relationships in the framework. As such, the authors believe the proposed framework should be useful to practitioners and researchers alike who are interested in the opportunities for electronic commerce assurance services.

## V. ACKNOWLEDGMENTS

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## VI. REFERENCES[4]


AICPA/CICA. W*eb Trust*SM/TM *Principles and Criteria*, Version 2.0. American Institute of Certified Public Accountants, Inc., and Canadian Institute of Chartered Accountants, 1999a (http://www.cica.ca/cica/cicawebsite.nsf/public/EDOEDElectronicCommerce).

AICPA/CICA. *WebTrust-ISP*SM/TM *Principles and Criteria for Internet Service Providers in Electronic Commerce*, American Institute of Certified Public Accountants, Inc., and Canadian Institute of Chartered Accountants, 1999b (http://www.cica.ca/cica/cicawebsite.nsf/public/SPASWebTrust).

Banham, R. "The B-to-B Virtual Bazaar," *Journal of Accountancy* (190:1), July 2000, pp. 26-30.

Bergeron, F., and Raymond, L. "The Advantages of Electronic Data Interchange," *Database* (23:4), 1992, pp. 19-31.

Brown, M. E., Dalton, R. E., Desai, M. A., and Harris, S. A. "Developing a Business Case for Electronic Commerce in Small- and Medium-Sized Enterprises," Industrial Technology Institute, 1999 (http://www.iti.org; as of December 2000, this document is available through the Center for Electronic Commerce, Environmental Research Institute of Michigan (ERIM), URL: http://www.erim.org/cec/papers/ecots2Final.html).

Elliot, R. K. "Assurance Services and the Audit Heritage," *The CPA Magazine* (68:6), 1998 pp. 40-47.

Elliott, R. K., and Pallais, D. M. "Are You Ready for New Assurance Services?" *Journal of Accountancy*, June, 1997a, pp. 47-51.

Elliott, R. K., and Pallais, D. M. "First, Know Your Market," *Journal of Accountancy*, July 1997b, pp. 56-63.

Elliott, R. K., and Pallais, D. M. "To Market, to Market We Go," *Journal of Accountancy*, September 1997c, pp. 81-86.

Glaser, B. G., and Strauss, A. L. *The Discovery of Grounded Theory: Strategies for Qualitative Research,* Chicago: Aldine Publishing Company, 1967.

Greenstein, M., and Feinman, T. M. *Electronic Commerce: Security, Risk Management and Control*, Boston: Irwin McGraw Hill, 2000.

Khazanchi, D. "The Nature and Structure of Impediments to EDI Adoption and Integration: A Survey of Small- and Medium-Sized Enterprises," *Failure & Lessons in Information Technology Management* (3), 1999, pp. 101-110.


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[4]Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers with the ability to access the Web directly or are reading the paper on the Web can gain direct access to these linked references. Readers are warned, however, that

1. these links existed as of the date of publication but are not guaranteed to be working thereafter.
2. the contents of Web pages may change over time. Where version information is provided in the References, different versions may not contain the information or the conclusions referenced.
3. the author(s) of the Web pages, not AIS, is (are) responsible for the accuracy of their content.
4. the author(s) of this article, not AIS, is (are) responsible for the accuracy of the URL and version information.

Khazanchi, D. "Spoke Enterprises: A Preliminary Assessment of Expectations and Performance of EDI," *Proceedings of the Twenty-Fifth Annual Decision Sciences Institute Meeting,* Boston, November 22-25, 1995.

McDaniel, C., and Gates, R. *Contemporary Marketing Research*, St. Paul, MN: West Publishing Company, 1993.

Mohan, S. "EDI's Move to Prime Time Stalled by Cost Perception," *Computerworld*, February 20, 1995 (http://www.computerworld.com/cwi/story/0,1199,NAV47_STO13915,00.html, accessed July 21, 1997).

Nagel, K., and Gray, G. *Electronic Commerce Assurance Services: Electronic Workpapers and Reference Guide*, San Diego, CA: Harcourt Brace and Co., 1999.

National Federation of Independent Business. "Small Business: An Economic Powerhouse," 1997 (http://www.nfib.com/about/powerhouse.html)

SBA. "Small Business Vital Statistics," Small Business Administration, 2000 (http://www.sba.gov/aboutsba/ accessed November 10, 2000).

Swatman, P. M. C., and Swatman, P. A. "Integrating EDI into the Organization's Systems: A Model of the Stages of Integration," *Proceedings of the Twelfth International Conference on Information Systems*, J. I. DeGross, I. Benbasat, G. DeSanctis, and C. M. Beath (eds.), New York, December 1991, pp. 141-152.

Swatman, P. M. C., Swatman, P. A., and Fowler, D. C. "A Model of EDI Integration and Strategic Business Reengineering," *Journal of Strategic Information Systems* (3:1), 1994, pp. 41-60.

Sproull, N. L. *Handbook of Research Methods: A Guide for Practitioners and Students in the Social Sciences*, Metuchen, NJ: The Scarecrow Press, Inc., 1988.

Yost, P. "E-Business Web Portals and Their Role in Supply Chain Management," Presentation at Idea to Action: Numetrix '99, Atlanta, September 1999.

Wilson, T. "EDI is Alive and Kicking, Study Says," *InternetWeek* (801), February 21, 2000, p. 25.

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# APPENDIX A

## THE KENTUCKY EDI EXPERIENCE SURVEY

Please take a few minutes to complete and return this survey in the attached prepaid reply envelope. **All data about your organization will be kept strictly confidential.**

1. What is your organization's primary product or service? (e.g., Manufacturing parts for the automobile industry)

2. In which one of the following major industry groups is your primary business?

○ Manufacturing
○ Wholesale Trade
○ Retail Trade
○ Services (e.g., computer, accounting, TV repair)
○ Construction
○ Transportation and Public Utilities
○ Agriculture Services, Forestry and Fishing
○ Finance, Insurance and Real Estate
○ Mining
○ Other (Please specify):

3. What is your position in the organization?

○ Owner/Major Stakeholder/President
○ EDI Specialist/EDI Supervisor
○ IS Manager/EC Manager
○ Business Manager/General Manager
○ Other (Please specify):

4. How long has your organization been using EDI?

○ Less than 6 months
○ 6 to 12 months
○ 1 to 5 years
○ 5 years or more

5. What means of communication are you using for EDI?

○ Direct Link or Point-to-Point Network
○ Third-party EDI Network/Value Added Network (VAN)
○ Internet
○ Other (Please specify):

7. Do you plan to use EDI for International trade?

○ Not applicable (Do not import or export goods/services)
○ Yes, very likely
○ Perhaps, somewhat likely
○ No, unlikely
○ Don't know

8. What (if any) was the nature of cost/benefit analysis conducted by your organization prior to adopting EDI?

○ No cost/benefit analysis was conducted
○ Rough estimate
○ Analysis of costs only
○ Analysis of costs and tangible benefits
○ Analysis of costs, tangible and intangible benefits

9. Which of the following commercial EDI transactions do you currently use or plan to use? Please check all that apply.

| Transaction name (ANSI X.12 Transaction number) | Using Now | Plan to Use |
|---|---|---|
| **Purchasing/Order Management:** | | |
| Purchase Order (850) | ○ | ○ |
| PO Acknowledgment (855) | ○ | ○ |
| PO Change Request (860) | ○ | ○ |
| PO Change Acknowledgment (865) | ○ | ○ |
| Order Status Inquiry (869) | ○ | ○ |
| Order Status Report (870) | ○ | ○ |
| **Administration:** | | |
| Price/Sales Catalog (832) | ○ | ○ |
| **Sales Analysis/Inventory Management:** | | |
| Planning Schedule/Release (830) | ○ | ○ |
| Inventory Advice (846) | ○ | ○ |
| Product Activity Data (852) | ○ | ○ |
| **Billing/Payment:** | | |
| Invoice (810) | ○ | ○ |
| Credit/Debit Adjustment (812) | ○ | ○ |
| Receiving Advice (861) | ○ | ○ |
| Payment Order/Remittance Advice (820) | ○ | ○ |
| Lockbox (823) | ○ | ○ |
| Application Advice (824) | ○ | ○ |
| Electronic Funds Transfer (EFT) | ○ | ○ |
| **Shipping/Receiving:** | | |
| Advance Shipping Note/Manifest (856) | ○ | ○ |
| Shipping Schedule (862) | ○ | ○ |
| Shipment Status Inquiry (213) | ○ | ○ |
| Carrier Shipment Status (214) | ○ | ○ |
| **Bidding/Quotation:** | | |
| Request for Proposal or Quotation (840) | ○ | ○ |
| Award Notice (836) | ○ | ○ |
| **Partner Information/Acknowledgment:** | | |
| Text message (864) | ○ | ○ |
| Organizational Relationships (816) | ○ | ○ |
| **Other; Please Specify** | ○ | ○ |

10. When companies implement EDI they face various challenges, hurdles or difficulties. Please indicate how serious were each of the following impediments for your organization.

| EDI Implementation Impediments: | Not Serious at All | Somewhat Serious Challenge | Extremely Serious Challenge | Not an Impediment for Us |
|---|---|---|---|---|
| **Technical Challenges:** | | | | |
| Low volume or frequency of orders | ○ | ○ | ○ | □ |
| Impersonal nature of EDI (e.g., lose touch with customers/suppliers) | ○ | ○ | ○ | □ |
| Maintaining one system for EDI capable and another for non-EDI capable partners | ○ | ○ | ○ | □ |
| Translating customer/supplier data for direct use in internal applications | ○ | ○ | ○ | □ |
| Complexity of the technology itself | ○ | ○ | ○ | □ |
| Selecting means for communications with partners (e.g., choice of third party VANS) | ○ | ○ | ○ | □ |
| Determining appropriate internal applications to apply EDI | ○ | ○ | ○ | □ |
| Ability to seamlessly integrate EDI with existing internal applications | ○ | ○ | ○ | □ |
| Absence of uniform EDI standards | ○ | ○ | ○ | □ |
| Implementing multiple trading partners | ○ | ○ | ○ | □ |
| Integrating multiple EDI systems and/or VAN connections | ○ | ○ | ○ | □ |
| Dealing with multiple EDI formats | ○ | ○ | ○ | □ |
| Selecting the hardware to run EDI software | ○ | ○ | ○ | □ |
| **Organizational Challenges:** | | | | |
| Changing business processes (new way of thinking about and doing business) | ○ | ○ | ○ | □ |
| Small size of our business | ○ | ○ | ○ | □ |
| Increased responsibility for employees | ○ | ○ | ○ | □ |
| Gaining management/stakeholder commitment | ○ | ○ | ○ | □ |
| Overcoming resistance to change | ○ | ○ | ○ | □ |
| Availability of managerial time to expand EDI use | ○ | ○ | ○ | □ |
| Addressing legal issues (e.g., electronic orders, signatures, legal agreements) | ○ | ○ | ○ | □ |
| Exposure to ever-changing customer/supplier requirements about EDI system | ○ | ○ | ○ | □ |
| Managing data and transmission security and auditability (e.g., lack of audit trails) | ○ | ○ | ○ | □ |
| **Resource Challenges:** | | | | |
| High startup costs | ○ | ○ | ○ | □ |
| Availability of financial resources | ○ | ○ | ○ | □ |
| High cost of integration and expansion of EDI use | ○ | ○ | ○ | □ |
| Availability of technological resources | ○ | ○ | ○ | □ |
| **Education/Training-related Challenges:** | | | | |
| Learning new technology and methodology (e.g., trading partners' procedures) | ○ | ○ | ○ | □ |
| End users' and customers' continued reliance on paper-based transactions | ○ | ○ | ○ | □ |
| Obtaining general information about EDI | ○ | ○ | ○ | □ |
| Considering EDI as a natural extension of pre-existing internal operations | ○ | ○ | ○ | □ |
| Understanding potential benefits of EDI | ○ | ○ | ○ | □ |
| **Other**; Please specify | ○ | ○ | ○ | □ |
| **Other**; Please specify | ○ | ○ | ○ | □ |
| **Other**; Please specify | ○ | ○ | ○ | □ |

11. Using the impediments listed in the previous question, please write below the top three impediments faced by your organization.

i)
ii)
iii)

12. Please identify all trading partners with whom your organization currently uses EDI to transact business.

○ Customers (e.g., Retailers, Supermarkets)
○ Wholesalers/Distributors
○ Manufacturers
○ Financial Institutions
○ Shipping Companies
○ Government (e.g., Customs)
○ Other (e.g., Agents, Brokers, Warehousing Companies; Please specify):

13. How many trading partners has your organization added since initial EDI implementation?

○ None
○ 1 to 5
○ 6 to 10
○ More than 10
○ Don't know

14. How many trading partners do you intend to add in the next two years?

| Number of additional trading partners | 1998 | 1999 |
|---|---|---|
| None planned | ○ | ○ |
| 1 to 5 | ○ | ○ |
| 6 to 10 | ○ | ○ |
| More than 10 | ○ | ○ |
| Don't know | ○ | ○ |

15. What percentage of documents exchanged with trading partners is currently transmitted and/or received by the following means? Check one response under each method.

| | EDI | Fax | E-mail |
|---|---|---|---|
| None | ○ | ○ | ○ |
| Less than 10% | ○ | ○ | ○ |
| 10% to 29% | ○ | ○ | ○ |
| 30% to 59% | ○ | ○ | ○ |
| 60% to 79% | ○ | ○ | ○ |
| 80% or more | ○ | ○ | ○ |

16. What were your company's (estimated) **1997 gross sales**?

○ Less than $10,000
○ $10,000 to $50,000
○ $50,001 to $100,000
○ $100,001 to $250,000
○ $250,001 to $500,000
○ $500,001 to $1 million
○ $1 million to $5 million
○ $5 million to $10 million
○ More than $10 million
○ Don't know

17. How many temporary or part-time employees work for your organization?

○ Fewer than 5 employees
○ 5 to 10
○ 11 to 20
○ 21 to 50
○ More than 50

18. How many full-time employees work for your organizaton?

○ Fewer than 5 employees
○ 5 to 10
○ 11 to 20
○ 21 to 50
○ 51 to 100
○ 101 to 250
○ 251 to 500
○ More than 500

19. What is the volume of EDI documents (messages) exchanged with your trading partner(s)?

○ Less than 1 transaction per day (or 24/month)
○ 1 to 10 transactions per day
○ 11 to 25 transactions per day
○ 26 to 50 transactions per day
○ 51 to 100 transactions per day
○ More than 100 transactions per day (or 2400/month)

20. What percentage of growth in EDI document volume do you expect in the next two years?

○ Less than 10%
○ 10% to 25%
○ 26% to 50%
○ Nearly double
○ More than triple

21. What were your **initial EDI implementation costs**? Please include all fixed, one-time, up-front, setup expenses relating to EDI adoption and implementation.

○ None
○ Less than $1,000
○ $1,000 to $3,000
○ $3,001 to $5,000
○ $5,001 to $7,000
○ $7,001 to $10,000
○ More than $10,000

22. What were your monthly **ongoing EDI operational and maintenance costs**? Please include all operational (e.g., VAN costs) and system maintenance expenses (e.g., upgrades, backup) relating to EDI use and integration.

○ None
○ Less than $100 per month
○ $100 to $500 per month
○ $501 to $1,500 per month
○ $1,501 to $3,000 per month
○ $3,001 to $5,000 per month
○ More than $5,000 per month

23. Under what *conditions* should businesses like yours consider themselves likely candidates for EDI implementation? (Or, When is an organization a candidate for EDI?). Please respond to this question by rating the importance of each circumstance listed below.

| Considerations for EDI adoption: | Not at All Important | Somewhat Important | Very Important |
|---|---|---|---|
| Loss of time due to paper flow is substantial | ○ | ○ | ○ |
| Management of paper flow consumes excessive personnel or financial resources | ○ | ○ | ○ |
| Tracking of specific sales or shipments or manufacturer's orders is essential | ○ | ○ | ○ |
| Cost of out-of-stock items is high or unacceptable | ○ | ○ | ○ |
| Trading partners are concentrated | ○ | ○ | ○ |
| Customer service expectations are high | ○ | ○ | ○ |
| Current internal systems are easily adaptable to EDI | ○ | ○ | ○ |
| Increasing use of EDI in your business sector | ○ | ○ | ○ |
| Volume or frequency of orders and other business transactions is high | ○ | ○ | ○ |
| Current state of computerization of your business is conducive to EDI implementation | ○ | ○ | ○ |
| Management is enthusiastic and supportive | ○ | ○ | ○ |
| Financial resources are available | ○ | ○ | ○ |
| A major customer or supplier wants you to implement EDI | ○ | ○ | ○ |
| Trading partner support and cooperation is available | ○ | ○ | ○ |
| Inventory carrying and servicing costs are high | ○ | ○ | ○ |
| Internal organizational situation (work flow procedures and employees) is amenable | ○ | ○ | ○ |
| Relationship with trading partners (e.g., potential to forge stronger alliances to create barriers to entry) | ○ | ○ | ○ |
| Fundamental way of doing business in your Industry is changing (e.g., Just-in-time, Quick retailing) | ○ | ○ | ○ |
| **Other**, Please specify | ○ | ○ | ○ |

24. For each of the following *support categories*, please indicate how much support or incentive your organization received from trading partner(s)?

| Support Category | No Support Received | Modest Support Received | Substantial Support Received |
|---|---|---|---|
| Hardware (e.g., Free or subsidized new hardware or upgrades) | ○ | ○ | ○ |
| Software (e.g., Free or subsidized EDI translation software, templates) | ○ | ○ | ○ |
| Education and Training (e.g., Seminars, manuals, white papers) | ○ | ○ | ○ |
| Telecommunication costs (e.g., Partner assumes a part of the cost) | ○ | ○ | ○ |
| Maintenance (e.g., Assistance with adding new partners, transactions, new standards) | ○ | ○ | ○ |
| Implementation (e.g., Assistance with installation, testing) | ○ | ○ | ○ |

25. Different organizations are at different stages in their use of EDI capabilities. Which one of the following descriptions best characterizes the current state of EDI use in your organization?

○ Incoming business documents (EDI messages) are electronically received and printed. A staff member is required to key-in outgoing messages. EDI software is runs on a standalone PC or terminal.

○ Incoming business documents are received electronically, stored in files, and can be printed on demand. Outgoing business documents are also created as files by internal applications and are electronically sent using EDI software. EDI software is either run on a PC or is based in the mainframe/mini-computer where internal business applications are run. This setup replaces the keying-in and printing-out of messages with files, speeding up the process and makes incoming messages particularly useful, since they do not require re-keying prior to use by another system (e.g., production scheduling or accounting).

○ EDI transactions are seamlessly integrated with internal business applications such as purchasing, order entry, production scheduling, inventory management, accounts receivable/payable, shipping, and so on. Business documents are exchanged internally and externally (with trading partners) in a nearly "paperless" environment with little human intervention.

○ EDI is viewed as a strategic information technology (IT) and is instrumental in reengineering (changing) internal business processes and functions with trading partner(s) and redefining organizational structure. EDI is seen as an integral part of the organizational context and is a major factor in strategic and information systems planning. Sharing databases, participating in just in time/quick response (JIT/QR) programs are examples of this top-down, organization-wide, strategic view of EDI and other technologies.

26. Please evaluate the impact of EDI implementation in your organization by indicating the extent to which each of the following benefits have been obtained by your enterprise. Select a response by assessing the change observed in the listed EDI benefit.

| Potential EDI Benefits Realized: | Substantially Deteriorated (or Decreased) | Slightly Deteriorated (or Decreased) | No Change | Slightly Improved (or Increased) | Substantially Improved (or Increased) |
|---|---|---|---|---|---|
| **Direct Benefits:** | | | | | |
| Quality of Information (e.g., Improve quality by increasing timeliness, accuracy, and accessibility of information) | ○ | ○ | ○ | ○ | ○ |
| Transaction Costs (e.g., Lower costs by eliminating paperwork, postage, faxing, and saving on labor) | ○ | ○ | ○ | ○ | ○ |
| Cash Flows (e.g., Improve cash flows by faster processing and exchange of information between trading partners) | ○ | ○ | ○ | ○ | ○ |
| Inventory Levels (e.g., Reduce inventory levels by shortening order cycle, reducing ordering costs) | ○ | ○ | ○ | ○ | ○ |
| **Indirect Benefits:** | | | | | |
| Relationship with Trading Partners (e.g., Enhance trust by sharing information, reduce errors, enable JIT/QR programs) | ○ | ○ | ○ | ○ | ○ |
| Operational Efficiency (e.g., Reduce lead time and costs, better information management, avoid re-keying of data) | ○ | ○ | ○ | ○ | ○ |
| Customer Service (e.g., Improve customer service by shorter lead times, timely information regarding transaction status) | ○ | ○ | ○ | ○ | ○ |
| Ability to Compete (e.g., Increase ability to reach new markets, provide better service at lower costs) | ○ | ○ | ○ | ○ | ○ |

27. Please indicate how influential each of the following criterion were in your organization's decision to implement EDI?

| EDI Decision Criterion | No Influence At All | Minor Influence | Moderate Influence | Major Influence |
|---|---|---|---|---|
| **Competitive/Strategic Factors:** | | | | |
| Customer's or Supplier's demand | ○ | ○ | ○ | ○ |
| Remain competitive (e.g., protect market share) | ○ | ○ | ○ | ○ |
| Pressure from competitors | ○ | ○ | ○ | ○ |
| Meeting industry standards | ○ | ○ | ○ | ○ |
| Improves customer service | ○ | ○ | ○ | ○ |
| Makes Just-In-Time (JIT) manufacturing possible | ○ | ○ | ○ | ○ |
| Forges stronger business relationships with partners | ○ | ○ | ○ | ○ |
| **Economic Factors:** | | | | |
| Increases sales revenues/Increases profits | ○ | ○ | ○ | ○ |
| Decreases transaction costs | ○ | ○ | ○ | ○ |
| Decreases administrative costs | ○ | ○ | ○ | ○ |
| Decreases manufacturing costs | ○ | ○ | ○ | ○ |
| Decreases procurement costs | ○ | ○ | ○ | ○ |
| Reduces number of employees | ○ | ○ | ○ | ○ |
| Reduces inventory carrying & servicing costs | ○ | ○ | ○ | ○ |
| **Operational/Tactical Factors:** | | | | |
| Quicker response and access to information | ○ | ○ | ○ | ○ |
| Improves accuracy of information (e.g., fewer clerical errors) | ○ | ○ | ○ | ○ |
| Improves communication with trading partners | ○ | ○ | ○ | ○ |
| Improves ability to control and coordinate data | ○ | ○ | ○ | ○ |
| Reduces paperwork | ○ | ○ | ○ | ○ |
| Ease of processing for order entry | ○ | ○ | ○ | ○ |
| Aids in accounting, billing, production scheduling, etc. | ○ | ○ | ○ | ○ |
| Ease of tracking shipments/Ease of tracking orders | ○ | ○ | ○ | ○ |
| Improves efficiency of business operations (e.g., shorter order cycle time) | ○ | ○ | ○ | ○ |

28. Which of the following operating systems do you use to run EDI translation and communications software?

○ DOS
○ WINDOWS
○ WINDOWS or WINDOWS95
○ UNIX or WINDOWS-NT
○ Other; Please specify:

29. When do you next plan to upgrade your EDI software?

○ Never
○ Next 1 year
○ 2 to 4 years
○ 5 years and beyond

30. Please indicate your preference:

☐ I am interested in participating in a follow-up interview.
☐ I am interested in receiving a copy of the study report.

31. In your opinion, what kinds of responsibilities should state and federal governments assume in an Electronic Commerce/ EDI environment? Please check all that apply.

○ Sponsor education, training, and general awareness of the benefits of emerging technologies like EDI
○ Provide financial assistance/incentives to small businesses
○ Provide incentives to large EDI users that support and integrate their small business partners in a positive manner
○ Centralize vendor registration (government procurement)
○ Establish requirements for EDI hub systems and third party value added networks (VANs)
○ Enable adoption of uniform EDI formats (standards)
○ Promote the use of EDI and provide leadership for the expanded use of EDI
○ Other; Please specify:

○ Other; Please specify:

32. Please provide any other comments/suggestions that could be helpful to businesses like yours that are considering implementing EDI:

We appreciate your taking the time to complete this questionnaire. Please fold and return the survey in the enclosed prepaid reply envelope. Thanks.

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