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EDI and the Internet in the E-Business Era

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This article presents cost effective guidelines to assist hotels of all sizes with the usage of electronic data interchange (EDI) in the Internet e-business era. The evolution of web-based EDI makes it easier for hotels of all sizes to support their business processes with traditional EDI technology, but without the extensive capital outlay in computer hardware and software. This is an attempt to encourage investment in basic EDI technologies before implementing more sophisticated applications. The focus is to allow hotels of all sizes to improve their competitive advantage with successive EDI technological advances.

KEYWORDS electronic data interchange, Internet, value added network, e-business, extensible, markup language

INTRODUCTION

Electronic data interchange (EDI) is a mature technology with well-established standards. Competing EDI standards (ANSIX.12, EDIFACT, and industry specific standards) have caused data processing with EDI to be inflexible and costly for companies of all sizes (Deshmukh, 2006). The complexity and implementation costs of EDI technology in its traditional form makes it inaccessible to small and medium size companies (Albright, 2003; Deshmukh, 2006).

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EDI traditional technology was updated during the Internet/e-business era through the use of EDI/Internet (EDIINT) technology. EDIINT technology makes it feasible for business of all sizes to process transactions in a structured form by computer. EDIINT technology provides compatibility, open standards, analytical capabilities, and an ease of use through the format of eXtensible Markup Language (XML) while preserving EDI traditional structured standards (Batson, 1997). The purpose of this article is to illustrate that hotels of all sizes can use EDI in the Internet e-business era to conduct business with their trading partners in a cost effective manner.

EDI is define as an interorganizational and intraorganizational, computer-to-computer exchange of business documentation in a structured, computer-processable data format in a timely manner (Emmelhainz, 1993; Deshmukh, 2006). This definition distinguishes EDI information flow from the traditional information flow shown in Figure 1.

There are a number of key points in the definition that makes EDI a unique form of business data electronically transmitted (Emmelhainz, 1993; Deshmukh, 2006). *Interorganizational* means that EDI technology can be used for electronic processing and the communication of information between trading partners. *Intraorganizational* is the use of EDI within an organization to support internal business processes between individuals and departments. *Computer-to-computer* indicates a direct link between computer systems. *Business documentation* implies the use of official paper to

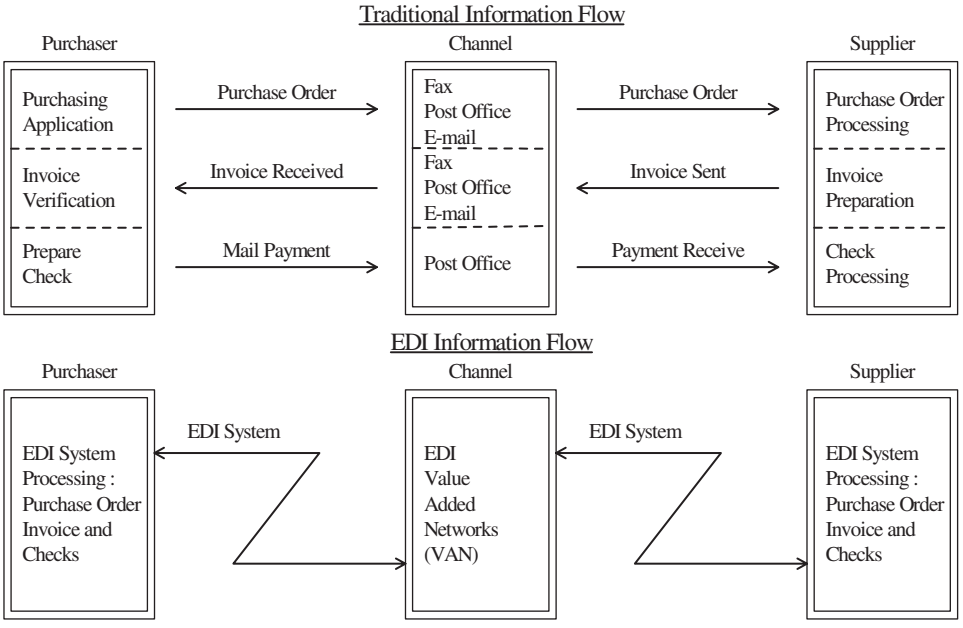


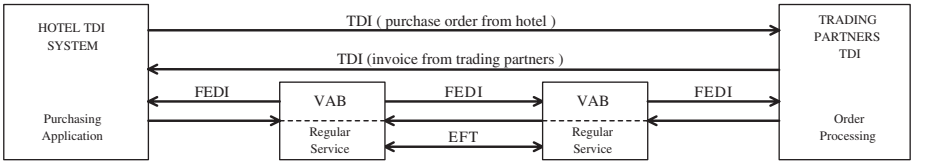
FIGURE 1 Traditional and EDI Information Flow.

Adapted from Emmelhainz (1993) and Sokol (1995).

support transaction flow. For example, items such as customer name, product number, quantity, unit price, and total value can be structured into an invoice or a purchase order document. *Structured* means that there should be no discrepancies between the data in a purchase order and the data in an invoice because of the agreed upon method used in presenting the data. *Computer processable format* means that the data must be in some pre-established structured format and can be read and understood by the computer without human interpretation (Emmelhainz, 1993).

This definition distinguishes EDI from other forms of e-commerce because of its structured format of data (Emmelhainz, 1993; Deshmukh, 2006). Paper documents, e-mails, and faxes do not have a specific, universally accepted data format (Emmelhainz, 1993). These forms of communication are handled using computers, manually, or by a combination of both methods. With EDI, data must be understood by the communicating computer systems. That means data must be preformatted and should be based on standards acceptable to the trading partners, and computers must be programmed to understand the incoming and outgoing data format (Emmelhainz, 1993; Deshmukh, 2006).

Figure 2 illustrates the four major groups of EDI applications that can be used in a hotel business environment (Emmelhainz, 1993). Trade data interchange (TDI) is the electronic transfer of trading documents such as purchase orders, invoices and acknowledgements between hotels and their trading partners. Financial electronic data interchange (FEDI) is the electronic transmission of payments deposits and remittance information between a payer, payee and their respective banks (Pushkin & Morris, 1997). Electronic funds transfer (EFT) is an automatic transfer of debits and credits between banks, in which funds flow directly from the payer's banks to the payee's



NAME	DESCRIPTION	DEFINITIONEFINITION	EXAMPLE	PARTICIPANTS
TDI	Trade Data Interchange	Tradingin formation flowing between the hotel and trading partners. No bank is involved.	purchase order invoice and remittance	Hotel-to-Vendor Vendor-to-Hotel
FEDI	Financial Electronic Data Interchange	The movement of payments and deposit of related information between the hotel, banks and vendors.	bank statement deposit notice and payments.	Hotel-to-Bank Bank-to-Vendor
EFT	Electronic Fund Transfer	The transfer of debits and credits between banks.	wire transfer	Bank-to-Bank
VAB	Value Added Bank	A bank that provides both TDI and FEDI service to the hotel in order to facilitate trading with vendors	bank processed hotel's trade data	Bank-to-Hotel Bank-to-Bank Bank-to-Vendor

FIGURE 2 Four major groups as EDI applications that can be used in a hotel.

Adapted from Emmelhainz (1993).

bank. Value added banks (VAB) are banks that act as communications and network intermediaries for their customers, combining both TDI and FEDI services (Emmelhainz, 1993; Deshmukh, 2006).

The next section examines the justification for using EDI technology in the hotel industry. It also takes into account conditions that favor conversion to EDI and the major important benefits of EDI for the hotel industry.

JUSTIFICATION FOR HOTELS TO USE EDI

In the hotel industry, there are three types of conditions that are definitely appropriate for conversion to an EDI system. These conditions are: a people-intensive business environment; conditions that require rapid information processing and speedy delivery of goods; and paper-intensive business processes (Sokol, 1995).

The hotel industry is a people intensive business that creates an amenable environment for conversion to EDI. Often in hotels, people are used as "paper pushers," performing somewhat rote tasks such as handling, reading, validating, and correcting information on paper documents. By eliminating paper documents while providing access to the same information from computer-readable and process file, a hotel positions itself to automate paper-pushing tasks. EDI can help hotels move people out of the paper loop and into the information loop in a user-friendly and productive way (Emmelhainz, 1993).

Hotels normally require rapid information processing and a speedy delivery of goods. Here EDI is a virtual necessity. Even in the most elementary form of EDI implementation, electronically transmitted and received transactions are processed in a more timely manner than their paper counterparts. EDI is more than a convenience; it is a necessity for doing business in many industries including retail, automotive, healthcare, banking, transportation, grocery, and hospitality (Sokol, 1995).

The business environment of hotels is paper-intensive. Figure 3 illustrates the traditional paper-based transaction systems. The traditional paper-based system requires a tremendous amount of repetitive effort because copies of paper documents tend to be distributed and used as separate entities by multiple department users within the hotel. Each functional area in the hotel, therefore, recreates the wheel. The purchasing department originates the purchase order, then the accounts payables department receives a copy to match with the vendor's invoice, and the receiving department uses another copy to ensure the proper shipment of the items. Here, each department will individually perform data entry to get the information into their various computer systems. The time and resources used for these process tasks, along with the numerous errors injected into the information at each turn, increase the average processing cost of outgoing paper documents (Emmelhainz, 1993). Figure 3 represents a typical traditional

paper-based system. The data is repeatedly keyed manually 22 times (Emmelhainz, 1993). It is estimated that 70% of all business transactions are re-keyed from one computer system to another (Kulkarni & Heriot, 1999). This is a time consuming and costly way of processing data.

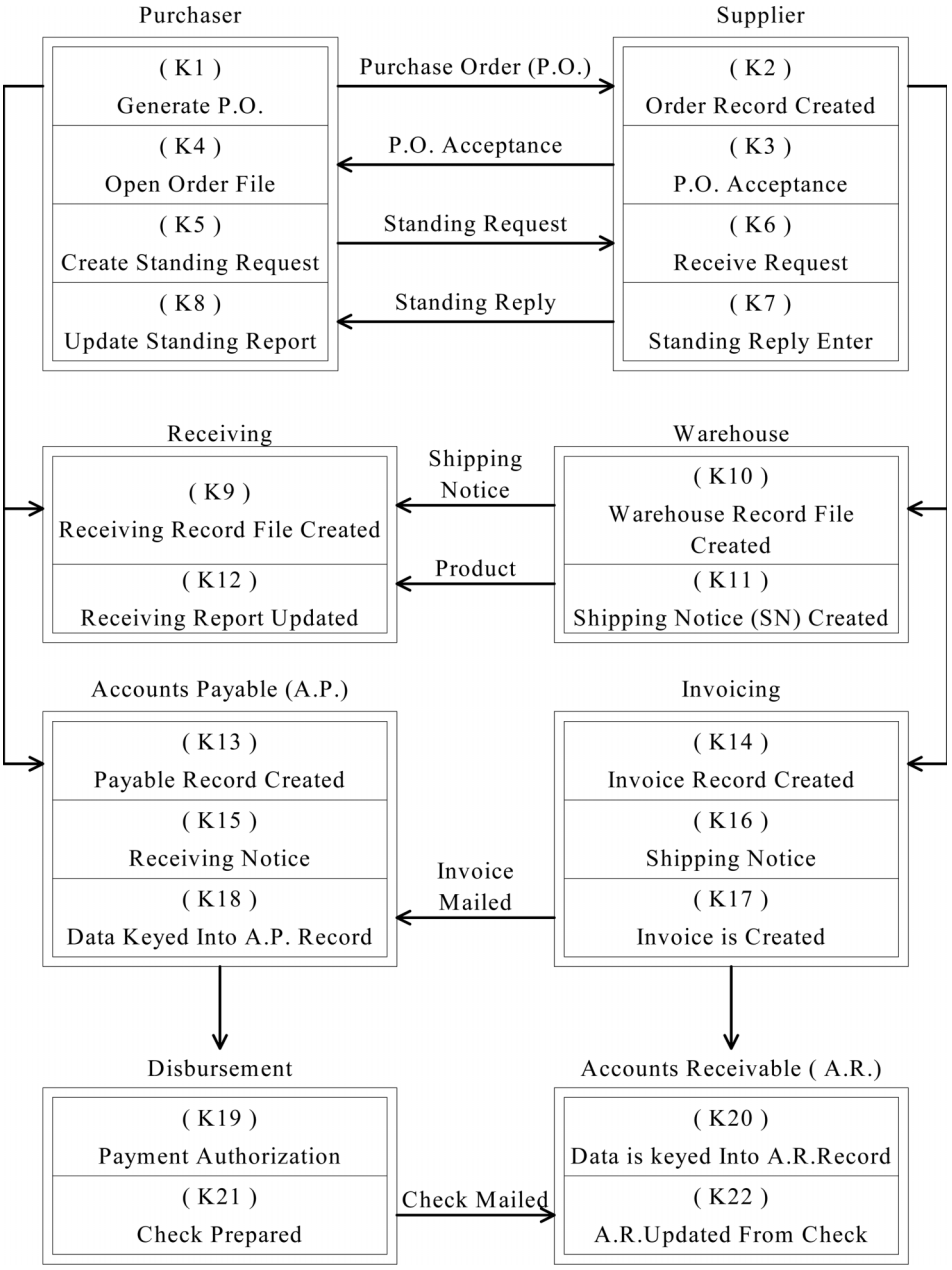


FIGURE 3 Traditional paper-based transaction flow.
Adapted from Emmelhainz (1993).

A hotel using EDI transaction flow (Figure 4) to process outgoing and incoming transactions receives information in electronic, machine-readable form. Information arrives faster and can be distributed automatically. In Figure 4, the data was keyed in manually only three times (KI, K11, and

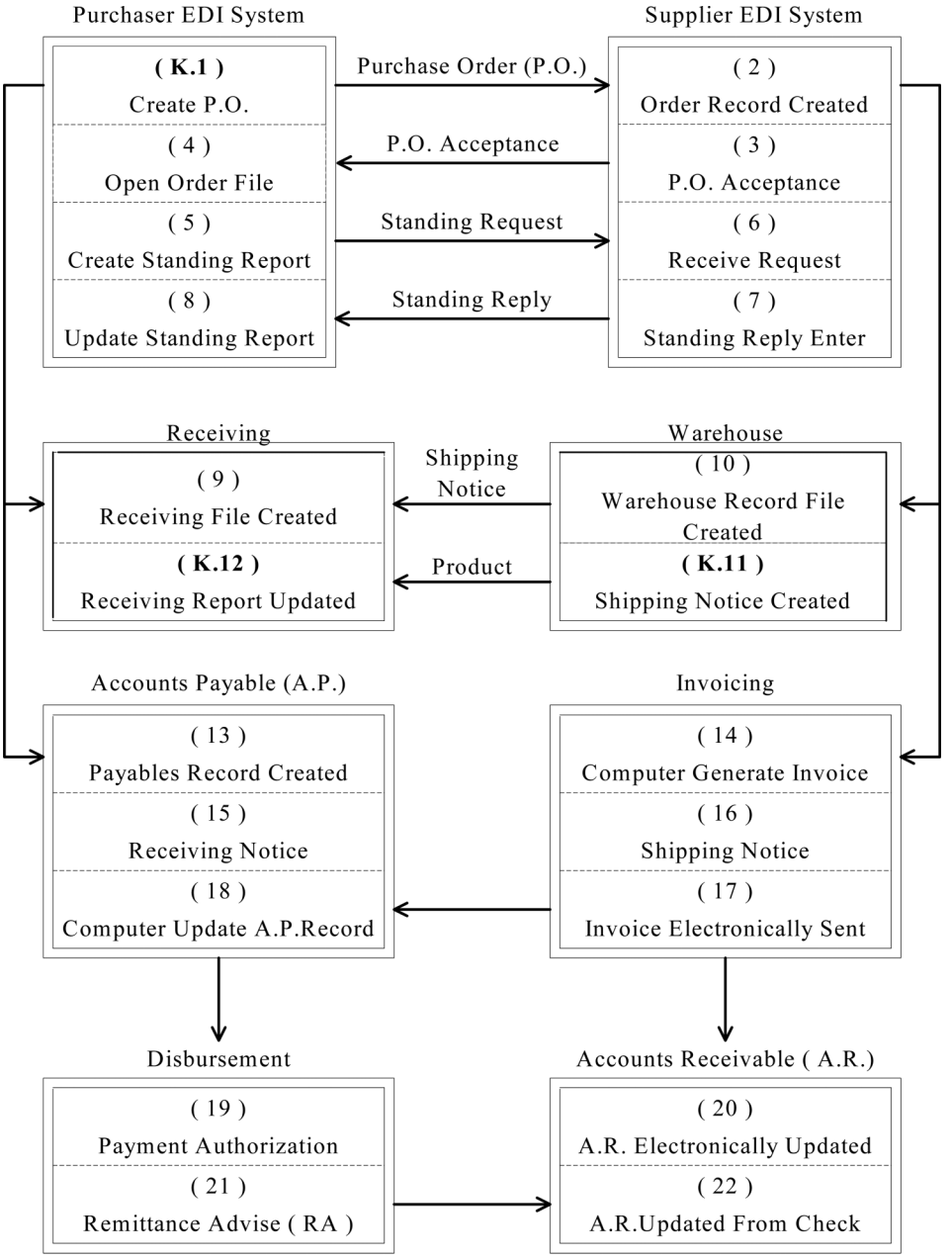


FIGURE 4 Electronic data interchange (EDI) Transactions Flow System.
Adapted from Emmelhainz (1993).

K12). This type of data processing is typically more accurate than that derived from traditional paper-based systems because they are verified for completeness and adherence to standard syntax prior to transmission (Emmelhainz, 1993).

There are three major reasons why EDI is important to the hotel industry. First, EDI can eliminate time delays associated with the mailing and processing of data common to traditional paper-based systems. Data is keyed manually 22 times in a paper-based system (see Figure 3), while using an EDI system data is manually keyed only three 3 times (see Figure 4). EDI can reduce the average paper-based system of procurement cycle from 6 to 3 days (Tobey, 1995). Second, EDI can produce significant cost savings. A survey of 1,500 EDI users found that companies can save between $1.60 and $5.20 per document processed (Tobey, 1995). Third, EDI creates an opportunity to increase the quality of information and service provided, while at the same time improving productivity (Sokol, 1995).

Traditional EDI technology uses an indirect connection known as value added networks (VANs). VANs are private network providers that move large and sensitive data files through specialized transaction software, which is costly (Emmelhainz, 1993). The complexity and cost of traditional EDI makes it difficult for small and medium size businesses to adopt this technology. Updating traditional EDI technology in the Internet/e-business era using XML preserves EDI traditional roots. XML's use of backward compatibility technology provides open standards and ease of use for business of all sizes (Harold, 2001). The following section explains EDI integration in the Internet e-business era.

EDI INTEGRATION IN THE INTERNET E-BUSINESS ERA

Prior to the development of the Internet, the most prominent technology used for business integration solutions was EDI. The EDI standard was developed in the 1960s with the intention of automating the routine flow of documents between various business support activities (UNEDIFACT, 2004). EDI works by providing a collection of standard message formats and element dictionary in a simple way for businesses to exchange documents via electronic messaging. While EDI provided several benefits such as a reduction in manual processing of business-to-business (B2B) documents, there were also several shortcomings. Companies adapting EDI required a significant investment in costly specialized technology (Lu, Tsai, & Chou, 2001).

The Internet e-business era presented an integration model called EDI-INT or web-based EDI (Scheier, 2003). The objective of using EDIINT is to reduce the complexities associated with traditional EDI data processing. EDIINT is popular and financially accessible to small and medium sized

firms. An example of this is Wal-Mart's successful implementation of its own EDIINT. It allows Wal-Mart to increase trading with smaller firms who are able to manage the set up costs associated with EDI/INT (Wilson, 2002). Similarly, MGM Mirage Corporation used EDIINT to improve its aging hotel management system and increase trading with its smaller trading partners (Kontzer, 2004).

The multi-vendor EDIINT services initiatives brought the concept of integration over diverse networks into reality (Chatterjee & Webber, 2004). The success of these initiatives relies on specifications that are built on XML. XML is a metadata language that can be transported and used by any hardware platform or delivery device, irrespective of the operating system or programming language (Hruska, 1995). An example of successful XML integration with EDI technology was accomplished at the Hilton Hotels. The Hilton Hotels were spending $500,000 to develop each trading partner interface using traditional EDI. However, with XML, these costs were reduced to $50,000 per trading partner interface (Booker, 1999).

XML is a document description language, used to define data fields and documentation presentation in an Internet environment. Similar to EDI, XML may also be used to exchange structured business data (purchase orders, invoices, remittance, and payments) between trading partners. Instead of using a "transaction set" to define the business data, XML users apply a document type definition (DTD) to specify structure and meaning. The software used in this case "parsers" may be used to interpret the meaning of a document (which function much like EDI translators), or XML documents may be interpreted by people, as XML is "human readable" and can be displayed in most browsers (Floyd, 2000; Marchal, 2000).

In its traditional form, EDI technology used VANs, which provided needed security and control features at high costs. However, EDIINT takes the traditional EDI messages and transports them over the Internet, simultaneously maintaining VAN level security and functionality (Marchal, 2000). The main objective of EDIINT is to increase the use of traditional EDI by enabling small and medium sized businesses to participate in EDI usage with their larger trading partners. This increase in EDI usage could be achieved by using the Internet in communicating EDI messages, simplifying implementation processes and making them cost-effective, and providing tools that make transfer of data transparent to the user (Marchal, 2001; Deshmukh, 2006).

The basic structure of traditional EDI messages is not changed by EDIINT protocol. EDIINT is a set of protocols that allows the exchange of structured data from traditional EDI messages over the Internet. The protocols define how an EDI message is wrapped into a multipurpose internet mail extensions (MIME) envelope, then encrypted and transmitted over the Internet. The MIME envelope allows for the transport of traditional EDI messages, proprietary file formats, or web documents formatted in HTML or XML. The encryption

is done using pretty good privacy (PGP) protocol or secure/MIME (S/MIME) protocols, and the transmission control protocol/internet protocol (TCP/IP) for data flow over the Internet. The method of connection can be: VAN or the Internet; dial-up; and, point-to-point (Goldfarb & Prescod, 2001; Deshmukh, 2006).

A rather simple aspect of the EDIINT scheme is to use web forms formatted for HTML or XML. This method is sometimes referred to as web-EDI or "lite" EDI. This variation is useful when trading partners are small and have no desire to invest in EDI. Here, the trading partner accesses the web server of the EDI-enabled partner. The web server contains several business documents, such as purchase order forms. These forms look like their printed counterparts. The web server can be accessed via a standard browser over telephone lines. The trading partner logs onto the web server and fills in the relevant forms. Once a form is submitted, the server side programs (generally written in JAVA or Active X) package the form in the EDI-type message. This message then moves on to the EDI translator and is translated into a proprietary format and processed by the accounting system (Emmelhainz, 1993; Deshmukh, 2006).

Dominant trading partners have the most significant investment in traditional EDI technology and therefore receive the most benefits (Emmelhainz, 1993). Small trading partners can conduct business with their dominant trading partners through the inexpensive EDIINT using browser and phone lines. The small trading partners generally do not have back-office integration with the EDIINT system like their dominant trading partners, therefore, they do not receive the full benefits of EDI technology. Also, small trading partners can lose some of their benefits from EDIINT technology if they combine EDIINT technology with manual processing. For example, small trading partners may process incoming orders by using a fax-to-EDIINT-to-fax type scenario, which can delay the document processing time and increase transaction processing costs (Emmelhainz, 1993; Deshmukh, 2006).

In order to bridge the gap between the lower volume small trading partners, some large trading partners (through their vendors) are now offering Internet-based EDI services, which were previously only available through the use of special software and a VAN connection. For example, Web-based EDI converts online forms data into EDI formats (suited for low volume activity), while Internet EDI supports file transfer over the Internet, bypassing the need for a VAN (better for high volume activity). Internet-based EDI may help to lower some of the B2B e-business barriers, particularly related to: transaction fees; transmission fees; service costs; network availability; IT infrastructure; and, data mapping/integration. These are some of the e-business barriers faced by small and medium size firms when conducting business with large entities using EDI (Harold, 2001; Deshmukh, 2006).

SERVICE PROVIDERS

IBM is one of the largest service providers of web-based EDI. IBM offers services to small businesses to become EDIINT capable through what is called web data transfer and forms exchange. Web data transfer allows for the exchange of EDI and non-EDI files between trading partners through a web browser and Internet connection. File formats such as EDI, binary, text, or XML can be exchanged, and proprietary file formats such as Excel can be automatically converted into EDI format (Cagliano, Caniato & Spina, 2005; Deshmukh, 2006).

Browser and Internet connections are used to exchange electronic forms that are EDI and XML formatted. Electronic forms comprised of data include: presentation forms such as purchase orders, invoices, and shipment notices that need to be viewed and printed; and turnaround forms, such as shipment notices generated in response to a purchase order. The trading partner can send and receive Web-based electronic forms, upload and download forms from accounting software (the service even supports QuickBooks and Peachtree), and respond to the trading partners (Caglino et al., 2005; Deshmukh, 2006).

IBM can provide the infrastructure and host the information exchange between trading partners. This infrastructure provide for the network translation of web-based forms into EDI, XML, or other formats as desired by the trading partners. Like VANs, IBM also provides mailboxes (in and out) to the trading partners. Information exchange is not only an EDI solution, but it also provides several e-business solutions, and provides a reliable infrastructure for those solutions (Kazmierczak, 2006; Deshmukh, 2006).

IBM pioneered the use of e-business as a core service area just before e-business became a buzzword. However, IBM is not the only solution provider in this area. The majority of enterprise resource planning (ERP) vendors have full e-business functionality built into their products. Even small and medium accounting software manufacturers have built-in EDI support (Soliman & Youssef, 2003).

The successful EDIINT combination in the Internet e-business era offers many benefits. First, it can increase connectivity with different networks and provide less reliance on VANs. Second, it provides easy access to EDI messages via browser and the Internet. Third, it offers an expanded character set and multilingual capabilities. Fourth, it promotes the elimination of translation software and a reduction in the need for trading partner agreements (Harold, 2004; Reimers, 2001).

CONCLUSION AND MANAGERIAL IMPLICATIONS

The conclusions reached have some important implications for hotels using EDI or planning to use EDI. Hotels should be aware of the interrelationships

that exist among traditional EDI technology and the various EDI web-based applications. Small and medium sized hotels that cannot afford traditional EDI technology could invest in the use of less expensive web-based EDI technology to improve efficiencies in their business operations. In this way, the learning process undergone with web-based EDI technology could diminish the perception of risk associated with related traditional EDI technology implementation.

XML is a cost effective tool for supporting overall e-business activities, especially when compared to traditional EDI. At a minimum, XML based e-business participation only requires Internet access and a web browser for appropriately enabled e-business sites. The XML support infrastructure is also evolving. Software vendors are providing readily available integration solutions, and some XML components, such as parsers, are freely available in the public domain (Floyd, 2000; Marchal, 2000). These facts appear to indicate a lower entry cost barrier for small/medium size hotels.

EDI technological environment is constantly developing, and therefore, the interrelationship that exists between systems varies according to their respective levels of complexity or innovation. The life cycle of EDI technology is getting shorter, meaning it is essential to understand which part of the investment will continue to be useful and which will become obsolete. As this takes place, it is critical for the hotel to accumulate benefits derived from the knowledge of EDI technology, as this knowledge may be reused for the implementation of new applications and, in addition, maintains the current value of the technology. In order not to lose the competitive advantage acquired, hotels should continually invest in this area, concentrating especially on the most important aspects and increasing the efficiency of their operations.

A general recommendation for hotels, therefore, is to encourage investment in basic EDI technologies before implementing other, more sophisticated applications, in order to provide their employees with the necessary experience. At the same time, they could create a corporate culture based on using EDI technology, which would allow hotels to improve their competitive advantage with successive EDI technological advances. Therefore, EDI technology can be considered not only a tool for today, but also as an investment in the future that could increase hotel competitiveness in the market place.

The e-business revolution has refined traditional EDI by using the Internet as a means for the communication of business documents and providing alternate means of EDI for small and medium size hotels. The influence of XML, other Web-based EDI and low-cost EDI solutions could have positive impact on the future of EDI in relationship to small and medium hotels. The use of XML has the most promise of changing the inflexible and static traditional EDI structures and making them flexible and responsive to hotels of all sizes.

The growth of EDI among small and medium-sized hotel is still a major concern. The browser-based or form-based solutions, as the one offered by IBM, are quickly becoming cheaper alternatives to traditional EDI. These alternatives offer EDI benefits to hotels of all sizes. The benefits of EDI include improved customer service, increased data accuracy, decreased cycle time, decreased transaction costs, and improvements in existing workflows. There are upfront costs such as hardware, software, changes in existing workflows, training costs and trading partner costs. There are also recurring costs, such as administration and maintenance. The estimates of upfront costs vary depending on the size of the EDI investments.

Traditional EDI is increasingly being transformed by applications of XML and the Internet. XML and the Internet make traditional EDI more accessible to small and medium sized hotels in a cost effective manner. XML and the Internet approaches are anticipated to have the most impact on the future of EDI. EDI in any format provides robust security features for: data integrity and confidentiality; verifications of transactions and backups; validity of transactions; and mutual authentication of identity. These features will continue to be significantly important in the e-business era for EDI users and potential users.

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