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Defining the Range of B2B E-Commerce Formats

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Abstract

Much has been written about the potential decline of Electronic Data Interchange (EDI) as a result of the Internet. Developed in the 1960s, EDI was the original embodiment of business-to-business (B2B) e-commerce prior to the advent of the Internet. However, with the advent of the Internet, new opportunities and threats for EDI have emerged The aim of this paper is to examine whether EDI has a role to play in the world of internet based B2B E-commerce, and what form this role will take. Existing research is examined in order to evaluate the impact of the Internet on EDI, and to define how EDI is, and will continue to be incorporated into B2B e-commerce in new forms. A B2B Options matrix is presented that places EDI in context against B2B e-marketplaces, enabling companies to evaluate how/whether EDI has a role to play in meeting their e-commerce requirements.

Introduction

Much has been written about the potential decline of Electronic Data Interchange (EDI) as a result of the Internet. Developed in the 1960s, EDI was the original enabler of B2B e-commerce prior to the advent of the Internet, enabling companies to achieve one-to-one, fully automated exchange of electronic information, such as purchase orders and invoices. To date, EDI has been limited to larger companies who have with sufficient transaction volume to justify the heavy set-up and

running costs of EDI. The Internet now offers companies new ways of leveraging their existing EDI investments, and new alternatives to using EDI for meeting their B2B e-commerce requirements.

The paper aims is to address the following questions:

- Can companies leverage their existing EDI investments in the new Internet world?
- What alternatives to EDI are available to companies who wish to trade electronically?
- How does EDI fit against the context of B2B e-marketplaces?

To answer these questions, the research has been structured as follows: firstly, the paper discusses the various types of B2B trading relationships, and the levels of automation that may be achieved between two trading partners – as a pre-cursor to understanding the role of EDI in meeting e-commerce requirements. The impact of the Internet on the role of traditional, Value Added Network (VAN) based EDI is then examined. New forms of EDI, such as Web-EDI and EDI over the Internet are assessed. The growth of XML as an alternative or complementary technology to EDI is also examined. Finally, the author presents an options matrix that clarifies the positioning of EDI against the developments in B2B e-marketplaces.

B2B e-commerce – relationships and automation

The purpose of this section is to discuss the nature of B2B relationships and their level of automation, as a pre-cursor to examining the role of EDI and other Internet technologies in supporting B2B e-commerce.

B2B relationships

B2B trading relationships differ radically from those involved in Business-to-consumer. The norm for B2B relationships is for longer term trading relationships to be established. The purchasing process usually involves tendering, credit and quality checks, the placement of a contract to supply goods over a period of time and then repeat order/invoice/payment cycles (Jones & Unitt, 1999).

However, in the new world of mass customisation and quick response operations, companies who do not know each other need to be able to transact business without prior bilateral agreement (Kalakota & Whinston, 1999). A buying company may simply enter a new supplier's website and place an order. The business relationship may expand to further purchases or may be limited to that single once-off purchase. Similarly, Jones & Unitt (1999) point out that there is a move to more fluid relationships where a company may invite quotes/tenders for the supply of goods by publishing their requirements on the Internet.

Jones (2001) comments on another scenario, where companies regularly trade but may need to vary the information that is exchanged (e.g. changes to trading conditions, or purchase order formats). Such companies are limited by up front agreement of and adherence to a messaging standard if they have committed to a rigid trading mechanism such as EDI (Jones 2001).

The above information indicates that there is a spectrum of B2B relationships based upon stability, where stability indicates the level of commitment to trade within an agreed trading arrangement. These can range from the longer term, contract based, "stable" relationships described by Jones & Unitt (1999) to the short term, ad-hoc relationship described by Kalakota & Whinston (1999). Clearly, there may be many points along the spectrum, encompassing the various trading models in use between businesses today. However, a simple summary illustration is shown in Figure 2.1

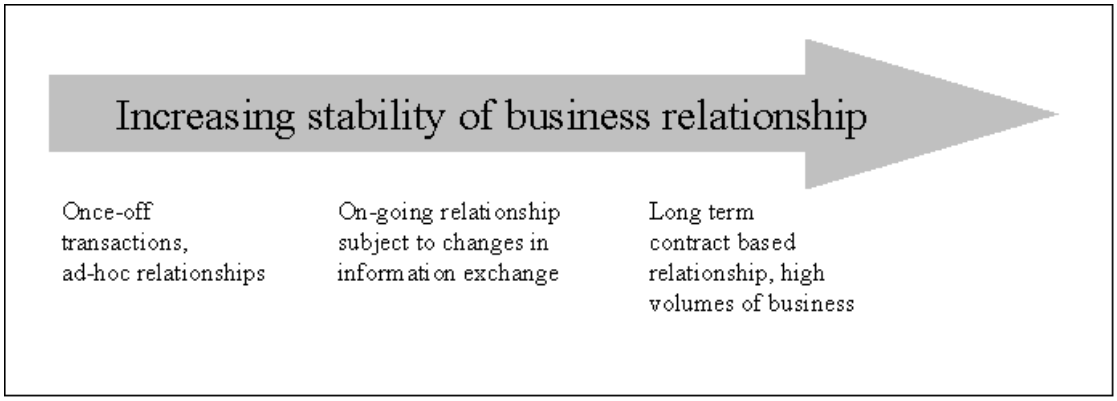

Figure 2.1: *Spectrum of B2B relationship stability*. Source: Author

B2B – Level of Automation

Electronic trading between businesses may be transacted via a B2B e-marketplace or it may take place as a private, one-to-one arrangement between two companies, potentially without any web-based marketplace activity - as is done in a traditional EDI set-up. Research resources distinguish between fully automated application-to-application transactions (Jones & Unitt, 1999) versus trading that requires some manual processing or application-to-human interfacing (Hopeman *et al.*, 2000) in order to complete the transaction.

To understand the role of EDI and subsequent Internet technologies in enabling B2B transactions, it is useful to classify B2B e-commerce by level of automation, allowing for each of the permutations of application/human transactions, as outlined in Table 2.1.

	Abbreviation	Name	Description
1	**A2A**	**Application to Application transactions**	Occurs where applications in two different companies can automatically transmit and receive transactions, without any human intervention (Jones & Unitt, 1999). Once established, this type of trading is fast and efficient. Example: one-to-one EDI
2	**H 2A**	**Human to application transactions**	Company 1 manually submits transactions (e.g. orders) that are then automatically processed by the receiving application in company 2. Company 1 also has to manually capture the order in their own in-house applications. This scenario can also occur in reverse with application to human (A2H) transactions. Example: buyer owned website, enabling invoice entry by supplier, with

			integration of website to buyer's backend invoice system
3	**H2H**	**Human to human transactions**	Trading between two companies is not automated. Transactions are processed manually by the sender and receiver e.g. phone, e-mail, fax (author). Example: order sent by buyer to supplier by fax, based upon selection from the supplier's paper catalogue.

Table 2.1 *B2B – levels of automation.* Source: Author

Adoption of traditional EDI

EDI is largely used by large corporations and their satellite suppliers working together over a private network, called a Value Added Network or VAN (Kosiur, 1997). VAN-based or traditional EDI can be extraordinarily cost effective for very large companies such as Sears, Walmart and General Motors Corporation which act as hubs for thousands of suppliers (Radosevich, 1997). Although used by just 300,000 companies worldwide (Hopeman *et al*, 2000), it is used by 95% of the Fortune 500 companies (Jones, 2000).

The key to adoption of traditional EDI is the transaction volume, as opposed to the value of the underlying trades (Jones & Unitt, 1999). For this reason, EDI has to date been limited to larger companies that can justify the investment required based on the volumes of inter-organisation transitions processed. According to the U.S Chamber of Commerce, the costs for a typical initial installation of an EDI system average at least $50,000 U.S. (Buxmann *et al*., 1999). Likewise, running costs are high, with significant VAN charges for message transmission and service management (Hopeman *et al*., 2000). However in some cases, the pressures on smaller suppliers to preserve their relationship with the company promoting EDI has forced them to deploy it (Jones & Unitt, 1999).

EDI using VANs is poorly suited to the formation of rapidly changing partnerships, which are becoming the norm in present-day business (Kosiur, 1997). For traditional EDI, the vast majority of EDI transactions are negotiated and established via trading partner agreements that specify data

interchange on a one-to-one basis (Kosiur, 1997). This rigid type of A2A implementation does not lend itself to ad-hoc document exchange, as required by once-off or short-term B2B relationships.

EDI and Internet

Research resources indicate conflicting views on the future of traditional EDI as a result of the new opportunities and threats offered by the Internet. Given that the Internet offers a way to reach thousands of new suppliers and buyers who have nothing more complicated than an Internet connection and a web browser, it is questionable whether expensive, one-to-one VAN based EDI implementations are appropriate. Kalakota & Whinston (1999) for example, point out that VAN-based EDI is not suitable for the world of mass customisation and quick response operations, due to the long implementation times and lack of flexibility. Likewise, Jenkins (1999) suggests that VAN-based EDI is incapable of meeting the demands of electronic commercial transactions, as they are 'now wider than those managed by EDI'. At the same time, companies that have already invested in EDI will be reluctant to relinquish their investment (Gartner, 2001), aiming to leverage their investment when communicating with the many business partners who do not currently use EDI (Jones, 2001).

Capitalising on existing EDI investment

Those companies that *have already committed* to EDI need to consider how the most relevant parts of EDI can be exploited to take advantage of the opportunities offered by the Internet (Jenkins, 1999). Review of relevant literature in this area can be summarised by separating the EDI transaction into two parts:

- The *transmission* of the EDI message. i.e. instead of using a private network operated by a VAN, transmit the message over the Internet instead, subject to meeting security concerns. This opportunity is being addressed with the emergence of **EDI-to-EDI over the Internet.**
- The *standardised format* of the message. In traditional EDI, standardised message formats enable A2A processing as discussed in section 2. However, with the Internet, a message

can be sent or received to or from a web browser **(Web-EDI)**, thus opening up the opportunity of H2A and A2H transactions.

EDI-to-EDI over the Internet

Some VANs are now introducing TCP/IP services to enable their services to utilise the Internet (Jones & Unitt, 1999). Other new entry competitors, such as Internet Commerce Corporation an ADX are offering secure EDI message transfer services at a fraction of the cost of VANs (Karpinski, 2002). Instead of the traditional complex VAN pricing model based on transaction times and sizes, Internet-based exchange providers can charge predictable monthly fees as low as fifty dollars (Bednarz, 2002). ICC has been capturing customers from established EDI VANS, offering discounts as much as 80% by utilising the Internet rather than VANs as the conduit for electronic document exchange (Karpinski, 2002). To counteract this competition, EDI VAN operators GE Global eXchange Services and Sterling Commerce have recently terminated interconnect agreements with ICC (Karpinski, 2002) - such forced disconnects have been unheard of in the VAN industry and serve as a good illustration of the threat to VANs of alternative operators offering EDI transmission over the Internet.

Web-EDI

Web-EDI refers to the use of EDI using a web-based form, where either the sender or receiver processes the EDI message manually via a browser (Buxmann *et al*., 1999). In the view of Kalakota & Whinston (1999), the new forms based Web-EDI represents the future for EDI. There are two types of Web-EDI (Buxmann *et al*., 1999):

*EDI-to-Web***:** Companies using EDI can transmit EDI messages to a web server, for collection by their trading partners who do not have EDI. EDI-to-web enables larger companies to utilise EDI with their smaller suppliers who have not/cannot invest in full EDI integration. Clearly, EDI-to-web does not represent true A2A interfacing due to the manual intervention required by suppliers to retrieve information (Jones & Unitt, 1999). In the view of Gardner (2001), EDI-to-Web is poised to experience widespread acceptance soon, as an increasing number of market segments are starting to pressure tier two and tier three suppliers to implement EDI capabilities to push supply

chain costs down. EDI-to-Web could be used, for example, in a buyer-led B2B marketplace to allow an EDI-enabled buyer to distribute their orders automatically from the buyer's systems into the buyer's web based marketplace for collection by their smaller non-EDI enabled suppliers.

*Web-to-EDI***:** Similar to EDI-to-Web, this use of EDI enables smaller companies who have not invested in EDI to communicate with fully EDI enabled companies. The typical implementation involves web based ordering whereby orders are entered on a company (buyer/supplier) website and converted into EDI documents for integration into the company's business systems (Gardner, 2002). A sample scenario may involve a seller-led B2B marketplace, whereby a large EDI enabled supplier allows smaller non-EDI buyers to place orders via the marketplace, with full back end integration into the supplier systems.

A summary of the options for EDI over the Internet are shown in Table 3.1

Scenario	Description	Relevant to:
EDI-to-EDI	Two companies who trade with EDI use the Internet for message transmission, resulting in lower network costs	Companies that already trade using EDI.
Web EDI:		
EDI to Web	Receiving company can processes EDI messages without integrating EDI into their business application.	Enables companies who do not have EDI (e.g. smaller suppliers) to receive EDI messages (e.g. orders) from large trading partners who already use EDI.
Web-to-EDI	Sending company can send EDI messages without integrating EDI into their business applications.	Enables companies who do not have EDI (e.g. smaller buyers) to send EDI messages (e.g. invoices) to trading partners (e.g. large supplier) who wish to receive using EDI.

Table: 3.1 *Summary of types of EDI that utilise the Internet*. Source: Author

EDI over the Internet and Web-EDI allow companies who have already invested in EDI to lower their running costs and to expand out the services to their smaller trading partners. However, this analysis does not adequately address the future of EDI for *new* customers i.e. if a company with no history of electronic trading wishes to set up an electronic B2B relationship, will EDI be an attractive consideration? What are the other options available?

Alternatives to EDI for B2B e-commerce

In considering alternatives to electronic data interchange, the author identifies two types of alternatives:

- Alternatives *business processes* that can achieve the same goal as an automated EDI connection between two companies, but without achieving full A2A integration
- Alternative *technologies and standards* that can achieve A2A integration.

Alternative business processes

B2B e-marketplaces enable trading, but generally require some or all of the B2B transaction to be completed manually. B2B marketplaces do not replace EDI – the relationship is a complementary

one, where EDI may or may not be the supporting technology used to deliver the marketplace functionality (Ovum, 2001).

Unlike EDI-VAN services, marketplaces can provide a 'zero-cost' entry and maintenance option through the use of a web browser. This opens up the marketplace trading to the smallest and remotest of SMEs (Ovum, 2001). In addition, they can offer a 'no-commitment' option, enabling the commitment or business relationships to be as long or as short as is appropriate for the trading task (Ovum, 2001).

B2B e-marketplaces can be classified along several dimensions, but the author has selected the following categorisation based upon categorisations from Fletcher & Videlo (1999) and Meeker & Phillips (2000) – each type of marketplace can act as private, restricted access zone or open it's services to all companies, depending upon the marketplace owner objectives:

- Buyer-led marketplaces
- Seller-led marketplaces
- Third party independent marketplaces

Each of the marketplaces described provide ways for companies to transact electronically with each other, but *may or may not* rely on EDI as the enabling technology and standard. For example, a buyer-led marketplace could by implemented using Web-EDI, whereby suppliers can submit invoices and other information within the buyer's private "marketplace". However, because of the association of EDI with the 'old order' there is a tendency for marketplace operators to be reticent about its use (Ovum, 2001).

Alternative Technologies and Standards

As an alternative to traditional EDI, companies may aim to achieve A2A integration by using an alternative technology and/or messaging standard.

XML: Extensible Mark-up Language is frequently touted as the replacement technology to EDI for B2B trading, as mentioned by Gardner (2002). Because both buyer and supplier applications can

easily process XML documents, it is in theory possible to automate the entire supply chain, from the buyer's core systems to those of the seller (Phillips, 1999). Self-describing XML messages may ultimately replace one-to-one EDI, but their initial use is oriented towards interactive or human-to-application exchanges (Rawlins, 1998). In the view of Gao *et al*. (2000), XML is not expected to replace EDI, but rather to complement it. Likewise, Hopeman et al (2000) acknowledge that XML should not be interpreted as the end of EDI. A combination of XML for document or message description (using information gathered or displayed by web forms), and EDI as the messaging standard may be the way forward (Jenkins, 1999). This is effectively a form of Web-EDI as described previously. However, even if XML is used as the mark-up language to describe the contents of a B2B transaction, the buyer and the seller must still agree on the structure and content of the business document or transaction (Phillips, 1999), as is done on EDI.

To this end, a range of consortia has formed to provide industry wide standards for B2B document exchange that companies can easily adopt (Gao *et al*., 2000). The work has resulted in many technical standards including Open Buying on the Internet (OBI), eCo, RosettaNet, commerce XML (cXML), ebXML and BizTalk. The issue with these standards, and the many others, is that they are incompatible. In Gao et al's (2000) view, the e-commerce community still needs an all-encompassing, robust universal framework that integrates the various facets of B2B transactions. Likewise, Jones (2001) argues that while XML has potential as a universal standard for the exchange of transaction related document over the Internet, the main obstacle is the lack of standardisation. It appears that XML, often regarded as the panacea for all the ills of complex EDI standards, is a victim of a proliferation of standards that lack interoperability.

It is outside the scope of this paper to explore B2B transaction standards in detail. While such incompatibilities between new standards exist, EDI continues to be the most widely used B2B messaging standard in use today (Jones, 2001).

Custom EDI set-ups: Companies may establish their own proprietary A2A electronic trading interfaces, based on XML or another technology, but without adhering to a particularl standards body (Jones, 2001). While such a set-up does not involve EDI as the messaging standard, it is

nevertheless a one-to-one electronic data interchange set-up. The companies will still need to establish how to structure the data in an agreed format, and then transmit their transactions from application to application over an electronic network (most likely the Internet). For the purposes of distinguishing this type of implementation from an EDI standard based set-up, the author will refer to this as "custom" EDI.

This section discussed the alternative options to EDI for B2B transactions. One option involves using *alternative business processes (*that are not based upon EDI A2A integration in order to transact) - such a scenario is served by a B2B e-marketplace where some or all of the transaction may be completed manually. A second option consists of using A2A trading, but using an *alternative messaging technology or standard*. Alternatives to the EDI messaging standards are still not clear. There is a multitude of XML based business document standards, but no single universal standard. Companies may opt to set up their own customer-EDI link between their applications, using a proprietary standard instead of EDI as the messaging standard.

B2B Options Matrix

In this section, the author presents a new matrix that enables EDI to be viewed in context against alternative and complementary B2B trading formats. A secondary benefit is that the matrix can provide companies with a useful tool for evaluating which B2B e-commerce trading formats they can/should use to meet their trading requirements.

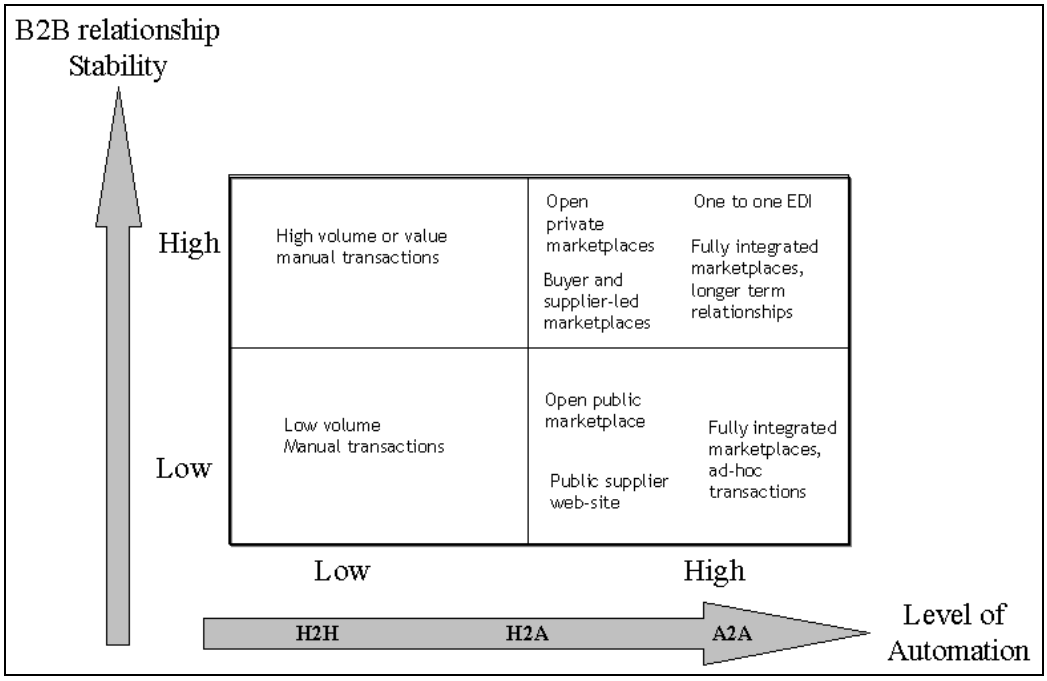

Figure 6.1 *B2B Options Matrix.* Source: author

The matrix is shown in Figure 6.1. Along the horizontal axis, the spectrum of B2B transaction automation is displayed, ranging from low automation (fully manual H2H transactions) to high automation (A2A transactions). On the vertical axis, the stability of the B2B relationship, starting at low stability (once-off relationships) through to high stability (long-term contract based relationships) is shown.

Reviewing each quadrant:

LOW stability, LOW automation - this quadrant consists of H2H transactions, where transactions are carried out manually (e.g. e-mail, phone, fax), for ad-hoc transactions between two trading companies. Technology does not play an important role in this section. Companies that transact in this quadrant consider migration of these relationships towards e-marketplaces in order to reduce costs, as an increasing number of companies start to trade online.

LOW stability, HIGH automation – contains low commitment relationships that are carried out with the support of enabling technologies such as Web-EDI and XML:

- Public supplier web-site, or supplier-led marketplace, used by buyers to place ad-hoc transactions, such as purchase orders
- Third party marketplaces, whereby a buyer or a supplier can access an open online marketplace and transact with new trading partners, using web based ordering.
- Also in this category is the concept of a "fully integrated" marketplace for ad-hoc transactions, whereby buyers and sellers can trade via the marketplace, with full integration between each company's relevant application systems. The author describes this as an aspiration rather than an actual option, as no examples of such marketplaces could be found. In the view of the author, the difficulties of standardising business transactions, under a universal XML standard (or other) are still in place.

HIGH stability, LOW automation – companies that trade regularly in an ongoing B2B relationship are more likely to benefit from automation, as is the case with EDI. Therefore, companies who have B2B transactions in this category (manually processed, stable relationships) have an opportunity to benefit from trading via a marketplace or one-to-one B2B technology.

HIGH stability, HIGH automation – contains high commitment, high transaction volume relationships that are carried out with the support of enabling technology and business formats such as a one-to-one EDI arrangement or private marketplaces:

- Buyer-led and seller-led marketplaces are towards the lower automation side of this division, whereby *established* relationships can be conducted via private marketplaces, using partially automated transactions with web based data entry.
- A2A implementation of EDI (VAN-based EDI, EDI-to-EDI over the Internet and custom EDI) are in this category, reflecting the use of one-to-one EDI for high volume, committed trading relationships.
- Fully integrated marketplaces, as described for low stability-high automation quadrant will, at a future stage, be in this category, subject to finding acceptable universal standards for connecting many companies' application systems.

Use of the Matrix

Companies can use the matrix to help define their B2B e-commerce opportunities by doing the following:

- Classifying their various trading relationships into each of the four quadrants of the matrix
- For the relationships that fall into each of the low automation quadrants, evaluate the options in the equivalent high automation quadrant to determine which trading relationships can/should be migrated to marketplaces or one-to-one automation.
- For the relationships that fall into the high automation quadrants, consider whether the optimum business format is being used.

Discussion and Conclusion

In an effort to develop a clear view of the future of EDI within B2B e-commerce, research focussed on Internet enabled EDI technologies, and on alternatives to using EDI. This resulted in a B2B options matrix, enabling EDI to be viewed in context against alternative and complimentary B2B trading formats.

Although research sources indicate that traditional EDI set-ups are challenged by Internet based trading, the Internet can offer companies that have already invested an EDI the opportunity to lower their running costs and to expand their audience of EDI trading partners. Transmission of EDI messages over the Internet (using an existing VAN or new Internet market entrant) can dramatically lower the running costs of an EDI implementation. Likewise, web-EDI technologies enable existing EDI users to further reduce supply chain costs by enabling smaller trading partners to access EDI information via a web browser.

For companies who have not already invested in EDI, they have a number of alternative options in order to trade electronically. Using an alternative business process to the A2A process offered by EDI, companies can use B2B e-marketplaces to exchange information, albeit with manual processing required on at least one end of the exchange. Equally, the use of alternative technology and messaging standards can enable companies to establish their own proprietary A2A links. While XML is frequently touted as a replacement to EDI, the lack of a universal standard for XML based documents limits its likelihood in replacing EDI in the short term. Indeed, it is likely to act as a

complimentary technology, using EDI as the messaging standard, and XML as the message definition language.

The B2B Options indicates the various trading formats available to companies who are looking to increase the level of automation of their trading relationships. While one-to-one EDI is a possible option for high commitment relationships, e-marketplace options are more appropriate for less stable, lower commitment trading relationships.

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