Leveraging Traditional EDI Investment Using the Internet: A Case Study

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Abstract
For many large retail companies with many suppliers, the utopian vision of total paperless trading offered by traditional Electronic Data Interchange (EDI), with its attendant efficiencies, has not been realized. Many small but operationally important suppliers, lack enthusiasm for traditional EDI because it is expensive, complicated and they stand to gain little from it. This non-compliance prevents the large organization from realizing some of the most significant tactical benefits of EDI such as advanced supply chain reforms. This paper presents a case study of a large retail organization which is approaching this problem by integrating Internet-based EDI with its existing traditional EDI systems using an “intelligent gateway”. The case study is used to generate propositions about the future significance of Internet EDI.

1. Introduction

Many large retail companies have enthusiastically pursued Electronic Data Interchange, EDI, with their suppliers for the reduced transaction cost, increased accuracy, and timeliness that it offers [1,2]. Many have even reached the stage where a large proportion of their replenishment transaction value is controlled by EDI. But the familiar Pareto principle applies: 20% of their suppliers, by number, account for 80% of the transaction value. However, a large proportion of suppliers, by number, usually small to medium-size enterprises (SMEs) supplying small ranges of products, remain outside the electronic replenishment system. These suppliers often lack the computer expertise and resources to implement EDI through the traditional approach using the services of a Value Added Network (VAN), expensive translation software usually provided by the VAN, and private wide area networks [3-6]. Furthermore, with relatively simple business operations and a small number of trading partners, they have little to gain from the integration and connectivity that EDI offers [4]. This makes it difficult for the large customer to achieve 100% EDI compliance, leaving them supporting both electronic and paper-based systems, and creating a barrier to implementation of advanced supply chain and logistics management techniques. Evidently, the traditional approach to obtaining compliance by threatening “desourcing” [7] has not been effective with small suppliers.

These key EDI players are increasingly looking to the Internet as a means to solve this nagging problem. The Internet is a world-wide network of networks with excellent throughput capabilities. Internet transmission charges are low compared to those of a VAN and do not depend on the amount of data transferred. More importantly, the Internet provides simple and widely understood new methods for information exchange [8,9]. Non-EDI-enabled trading partners can use a web browser to fill in a form-based web page representing a business document, in order to comply with their EDI-enabled trading partner’s information requirements. To access the Internet, they need only a personal computer, a modem and an Internet Service Provider (ISP). They require little more computer expertise than is now becoming common knowledge.

The chief perceived disadvantage of the Internet as a medium for EDI is reduced security and reliability compared to the private wide area networks used in the traditional approach. Thus the Internet may not yet be suitable for mission critical data transfers which have high security and reliability requirements. In general, replenishment data for small suppliers does not fall into this category, so the Internet may be considered suitable for such transfers. However, it should also be noted that the latest Internet transfer protocols such as Secure HyperText Transfer Protocol (HTTPS) using Secure Socket Layer (SSL) employ data encryption, and in addition, have the security advantage of allowing point-to-point data transfer without hazardous data storage at third party sites which is characteristic of the traditional VAN mailbox systems. With the addition of password protection and simple document control measures to record the successful transmission of data via HTTPS, the Internet should be entirely suitable for low risk, non-critical data transfers with small suppliers.
The research reported in this paper addresses the issue of how the particular characteristics of the Internet can be used to draw small suppliers into a large retailer’s Electronic Commerce network, and what such an Internet based EDI system can contribute to the overall Electronic Commerce aims of the retailer. The paper reports a case study of Australia’s largest retail chain, Coles Myer Limited (CML), and its proposed new EDI infrastructure which is aimed at solving this problem. Recognizing that there is a significant investment in traditional VAN-based EDI with large suppliers, and also significant barriers to drawing small suppliers into this network, CML is proposing to adopt an “intelligent gateway” between its own diverse systems platforms and its suppliers, which will allow the flexible routing of electronic documents via various media (private VAN networks, Internet, Fax, direct lines) using various formatting standards (traditional EDI standards, flat-files, web forms, etc.), based on supplier characteristics. In this paper, ”web forms” denotes all forms of web-based message including those not formatted using traditional EDI standards. An important part of this new infrastructure is an Internet based document exchange system for use by small suppliers with little IT experience and at minimal cost to them. The idea is to use the Internet-based system not to replace the existing system, but rather, to leverage the investment in existing systems with the benefits of near 100% supplier EC compliance. The case study illustrates a number of decisions a company must make in choosing an Internet EDI strategy, based on the part it is expected to play in their total Electronic Commerce (EC) system, and the functionality it must support.

2. Case Study Methodology

Two major types of research activity were undertaken in this case study:

1. A semi-structured interview (and follow-up communications): this was conducted with CML’s Electronic Trading Coordinator, Mr Dave Botherway, to establish the business problems within CML’s current EDI infrastructure, the requirements of their new EDI infrastructure, and the proposed solution.

2. Participatory research: one of us (HCM) participated in CML’s “Proof of Concept” project as an observer, and in the product and Internet EDI strategy evaluation for CML’s front-end Internet EDI system as an independent evaluator. For the “Proof Of Concept” project, CML was working with software vendors to evaluate a number of EDI products with which to implement the proposed EDI infrastructure, in order to prove that their proposed EDI infrastructure is feasible, and to determine which product best satisfies their business and technical requirements.

Data collection for the case study was based on interviews and e-mail discussions with Mr Botherway, study of company documents, participation in the “Proof of Concept” project as an observer, and participation in product evaluation for the front-end Internet EDI system.

Whenever a case study is conducted, there is a concern about whether the findings are supported by enough data, so that they can be applied to other businesses and industries [10]. There is no point in conducting case study activities if the results are too specific and cannot be generalized. There are various options for case study activity [11], such as a multiple case study (or a multiple company survey) or a single in-depth case study. In this case study, the single in-depth case study option was chosen for the following reasons:

1. A detailed single case study can provide deep access to real business problems, which a less detailed multiple case study may not.

2. At the time of this case study, there were not sufficient Australian companies in the position of developing Internet EDI systems, to conduct a multiple company survey.

3. CML is a leading-edge company in this area, due to their extensive involvement with EC. They were in the process of designing a new EDI infrastructure to leverage their existing EDI systems at the time of the study. Given the company size and the scope of their electronic commerce implementation, CML is in a unique position to provide significant and reliable data.

Thus, the in-depth case study and participatory research method was chosen to gain deep access to the practices of a significant industrial player, and in keeping with the limitations of this research method, it has been used mainly to generate novel propositions concerning the role of the Internet in Electronic Commerce which should be tested empirically in future research.

3. Coles Myer Limited Profile

Coles Myer Limited (CML) is Australian owned, and is the largest retailer in Australia. CML’s head office is located in Melbourne, Victoria, and operates eleven retail brands over 1,800 stores in Australia and New Zealand, including Coles, Bi-Lo, Myer Grace Bros, Myer Direct, Kmart, Target, Fosseys, Liquorland, Red Rooster, Katies and Officeworks. It is Australia’s largest non-government employer with over 148,000 staff, and annual sales of over $A19 billion. CML spends over $A15 billion each year on buying merchandise and services [12]. It has more than 15,000 suppliers (including merchandise and
service suppliers): 1,800 suppliers use the traditional EDI approach, while the rest use conventional paper-based document processes via regular mail, phone calls or fax, to exchange business data with CML. With the proposed new EDI infrastructure, CML expects to handle all their merchandise suppliers (approximately 10,000 suppliers) through a single centralized EC system.

4. CML’s Current EDI Infrastructure

CML has various business applications for different retail brands, running on different system platforms. Different types of suppliers require different message formats. CML uses multiple EDI translators to translate the various types of flat files generated by their in-house business applications into EDI formatted documents, and to transmit the formatted data to their EDI-enabled suppliers on a store and forward basis via a third party VAN. For their non-EDI-enabled suppliers, CML has to run a parallel manual process to exchange paper-based business documents. A typical document exchange process in the manual system is that CML sends a Purchase Order (PO) to their non-EDI-enabled supplier by regular mail or via fax. The supplier sends back a delivery docket with the goods. CML then manually enters the data from the delivery docket into their in-house receiving application. Figure 1 shows the current EDI infrastructure for CML.

5. Problems with the Current EDI Infrastructure

There are four types of problem with the current EDI infrastructure: internal problems; external problems; control problems for non-electronic document exchanges; and tactical problems.

5.1 Internal Problems

Since CML must use a manual system to exchange business documents with their non-EDI-enabled suppliers, they have to re-enter delivery docket sent from these suppliers into their in-house business applications. This delays the business process and may increase document processing errors. Besides supporting the manual system, CML uses a number of different EDI translators for their various types of business applications. Therefore, they cannot use a single EC/EDI system to manage data exchange centrally with all their suppliers.

5.2 External Problems

Small suppliers lack the technical, financial and human resources to develop a traditional EDI system to handle all the functionality that CML requires. According to Mr Botherway, the conventional VAN-based EDI development cost for small suppliers, including the costs for purchasing an EDI translator and communication software, is in the range of $A5,000 to $A20,000. Transferring 10 kilobytes of data via a VAN might cost an SME, at list price, $A4 per document, plus a $A100 monthly VAN subscription fee. While these costs may be justifiable for a larger supplier who can gain mutual benefit from the investment, small suppliers generally have primitive in-house business systems (often manual) and cannot use the potential benefits of application-to-application transfer of data which the
traditional VAN-based EDI approach promises, to justify the decision. With very few customers, they also gain little from the global connectivity of traditional EDI. Therefore, the cost and lack of supplier benefits has been a large barrier to CML bringing their small suppliers into their EC network within the traditional VAN-based approach.

5.3 Control Problems for Non-Electronic Document Exchanges

Using the manual system, it is very difficult for CML to obtain high standards of data integrity for the delivery dockets received from small suppliers. Small suppliers can alter the ordered quantity, price, or even the ordered item in the PO, intentionally or by mistake, when they are preparing a delivery docket manually. For CML, this may cause internal system accuracy problems, increased costs and business disruption.

5.4 Tactical Problems

While small suppliers may not create significant transaction value, their use of manual systems tends to make it difficult for CML to reap the potential benefits of advanced supply chain reforms. With the manual system, stock cartons delivered to CML’s main distribution center must be manually verified and entered into the computer system at the distribution center, before they can be delivered to other stores. With a fully computerized system, the details of the delivered stock could be updated into the computer system automatically once an electronic Advance Shipment Notice (ASN) is received. Using the EAN standardized Serial Shipping Container Code (SSCC), each carton can be given an unique bar coded shipment number, which associates it with an ASN. By scanning this bar code, CML can re-direct a specific carton into an appropriate truck shipping to a specific store, without manual intervention in their carton sortation process at the distribution center. This process is known as “Cross Docking”. For it to work effectively with SSCC numbers as shipping labels, 100% adoption to electronic ASNs would be required.

6. Business Requirements for the New EDI Infrastructure

6.1 Support of the Current EDI Infrastructure

Because CML and their EDI-enabled suppliers have invested large amounts of money and are obtaining good benefits from their traditional EDI systems, they want to retain traditional EDI operation for these parties. Moreover, a large volume of stock and sales data is being processed by the traditional EDI systems, which might not easily migrate into other EDI or EC infrastructures. The VAN-based approach may well be the most efficient and cost effective way of reliably transferring mission critical application to application data anyway.

6.2 One Centralized System

Instead of using multiple EDI translators, CML is seeking to use one single centralized system to perform data translation, while maintaining trading partner profiles and supporting multiple transmission media such as the Internet, VAN, direct connection and fax.

6.3 Use of the Internet

Since most of the small suppliers have no use for the application-to-application EDI approach, CML is offering alternative methods for their small suppliers. The Internet provides a medium for transferring data at a very low cost. According to Mr Botherway, the incremental cost of transferring a 10 kilo byte message is about $A0.50, which is mainly associated with the telecommunications costs, such as telephone call charge, plus typically, a $A25 monthly subscription fee for an Internet Service Provider (ISP). Small suppliers could use a CML provided web-form Internet application as a data entry system, not necessarily using the traditional EDI standard format needed for application-to-application data transfer.

Since the data transfers covered by the proposal exclude mission-critical transfers, the security and reliability offered by the traditional VAN approach using private wide area networks is not a requirement of the system. Nevertheless, the security of Secure HyperText Transfer Protocol (HTTPS) using Secure Socket Layer (SSL), which enables point-to-point data transmission without storage at the ISP site, together with the password protection and document control facilities provided routinely by third-party Internet EDI development software, will provide a secure and reliable transport mechanism for these web forms and other file types, and may eventually provide a low cost alternative transport system even for standard EDI files.

6.4 Simple and Low Cost Set-Up for Small Suppliers

Based on feedback from SMEs, CML has projected that the system set-up cost for each small supplier should
be less than $A500 for a manual entry system, or $A1,000 when bar code scanning facilities are also included. The monthly running cost should not be greater than $A25 for an Internet Service Provider (ISP) subscription plus phone calls. Assuming small suppliers have a PC, modem and telephone line, they can then simply use a web browser or a simple front-end system incorporated with a web browser and Internet connection to exchange their E-form business documents with CML.

6.5 Requirements for Electronic Turnaround Documents

A turnaround document is a document requiring a reply using information provided by the sender. A familiar example of a manual turnaround document is a service bill which includes a preprinted remittance section, including account number and so forth. Since this data is sourced from the billing company, it is more likely to be correct than if the customer produced a separate reply. CML wishes to apply this concept in electronic form, to the proposed Internet EDI document exchange system in order to maintain data integrity. Initially they will use turnaround PO/ASN documents, later possibly adding turnaround quality control documents.

CML will send a Purchase Order (PO) using the Internet EDI system to their supplier with the details of ordered items, such as product name, International Article Number (i.e. EAN-13), product price and quantity ordered. The supplier will then send back an Advance Shipment Notice (ASN), when the shipment is ready. The front-end data entry program only allows the user to base the ASN on shipment details data from the PO. If all the ordered items in one specific PO cannot be contained in one shipment, the supplier may need to prepare subsequent ASNs for further shipments when they become available. The data flow for turnaround PO/ASN documents is shown in figure 2.

After the small supplier receives a PO from CML, their web-browser or front-end system should be able to generate an ASN based on the data in the PO. In order to enhance data accuracy, when a small supplier is filling in the ASN, a bar code reader may be used as an input device to scan the bar codes directly from the product and shipping cartons into the ASN. After CML receives the ASN, it can then automatically update their in-house business applications. The turnaround ASN data entry should have built-in intelligent data checking to validate the supplier’s input, and be able to lock certain fields to prevent unintentional data entry from suppliers. For instance, the “order quantity” and “price” fields (see figures 3 and 4) should not be altered, and the “total quantity in this carton” field should not be greater than the order quantity. This will ensure that CML receives error free ASN documents and help enable advanced distribution initiatives such as Cross Docking with only minimal inspection.

6.6 Off-line Processing

In keeping with their desire for greater data accuracy, CML expects that the ASN data will be entered by the supplier into the front-end system directly during packing, preferably using bar code scanning. To keep ISP
connection cost within the specified bounds, this requirement implies that it should be possible to use the front-end data entry facility for extended periods without being connected to the Internet. Connection should only be required during document download and upload.

7. CML’s Proposed New EDI Infrastructure

CML’s proposed EDI infrastructure adopts the “Intelligent Gateway” concept, using a central EDI gateway system to perform bi-directional “any to any” translations. The intelligent EDI gateway will accept flat file formats generated by CML’s in-house business applications, and translate the flat files into various formatted messages, such as EDI formatted messages, fax-based messages, e-mail messages and E-form messages based on their suppliers’ requirements, and vice versa. The central EDI gateway system will also support multiple transmission media for transferring formatted messages to CML’s suppliers, such as the Internet, VAN, Fax, or direct connection, using a trading partner profile database to make routing and translation decisions. The proposed infrastructure is shown in figure 5.

An important part of the new infrastructure is the subsystems devoted to transferring data to small suppliers using the Internet (shown shaded in figure 5). There are many products now available for exchange of business documents over the Internet using a wide range of approaches, which have been extensively reviewed by the authors in previous publications [4,13]. These approaches differ mainly in their use, or non-use, of traditional EDI standards, whether they involve third party Internet sites, and whether they force the use of software from the same provider at both the sender and receiver sites. The choice between these various options should be made on the basis of the degree of system integration (application-application or application-to-person) and the degree of connectivity (global or hub-spoke) required of the Internet EDI system [2]. On the basis of their evaluation process and “Proof of Concept” project, CML has chosen an approach which uses software from a single provider to create both the CML hub and the small supplier front-end data entry application. This allows for document exchanges not structured using traditional EDI standards, and facilitates the participation of SMEs in the EC network, without needing full EDI translation facilities.

Given the limited requirements of their small traders, CML has chosen an Internet EDI system based on client-server technology, which was determined to be most appropriate for application-to-person system integration with hub-spoke connectivity [2]. Using this software, CML will create a centralized Internet hub server, interfacing via the intelligent gateway to existing applications, and performing the transmission and receipt of Internet business documents. Small suppliers can then use low-cost client software incorporating a web browser for document display and data entry. CML will produce customized form-based document templates using tools provided by the software vendor, and these will be distributed with the suppliers’ front-end program.

Having chosen to use a client server approach, a business selecting an Internet EDI system must then choose between products that use so called “thick client” or “thin client” approaches. In the thin client approach, nearly all the data processing operations are performed by the server (hub) program and the client software may consist of little more than a web browser. In the thick client approach, the client program performs data editing without having to refer back to data stored at the hub. This would generally result in duplicate storage of data at the hub and client. It can therefore be...
argued [2], that a thick client approach is more suitable when the business running the client program wishes to use the exchanged data in their own applications, because in this case the well known problems that attend data duplication might be justified. Hence, we would normally associate the choice of thick client approaches with a desire for application-to-application system integration.

However, CML had an additional requirement that the small suppliers should be able to perform much of their data entry off-line, that is, while not connected to their ISP. This was considered necessary to limit the connection costs incurred. Consequently, motivated by the desire for a high standard of data integrity, CML has chosen to adopt a thick client approach in order to enable extensive data editing to be performed while processing off-line. While not a primary requirement, this choice also reserves the opportunity for suppliers to integrate their in-house applications with the front-end data entry system by re-using the local database or exporting the data from the front-end system.

A typical document exchange sequence is; the CML hub system translates business documents from the gateway system into the web-form file format used for the data exchange and stores them on an Internet server part of the hub. Using the front-end provided, the supplier then retrieves these files from the CML hub through the Internet using Secure HyperText Transfer Protocol (HTTPS). The front-end application stores this data in a local database and allows it to be displayed using the predefined templates. In the creation of a turnaround document, editing rules specified in the template will be enforced by the front-end software using data stored locally. Upon completion, the turnaround response is translated into the appropriate exchange format and transmitted back to the hub server. The gateway software then translates this data into the appropriate flat file format required by the in-house application to update the central databases. This thick client approach to data editing is fairly straightforward for “once only” document exchanges, where the transferred record is only used for editing and can then be discarded. Data synchronization problems are more severe however, if several ASNs are allowed for a single Purchase Order, because then the database records at the client site must be updated to record partial delivery information, and retained for the duration of the Purchase Order.

8. Conclusions and Research Implications

The case study raises some interesting issues concerning the place of the Internet in the wider Electronic Commerce scene and suggests some propositions that could be the subject of future work.

Firstly, it suggests that both system developers and researchers should recognize possible synergies between traditional VAN-based and Internet-based EDI. CML does not consider Internet EDI to be a replacement for their traditional EDI systems; instead they view it as a way to leverage their current EDI investment. CML wants to maintain their traditional EDI approach with EDI-enabled suppliers, but also to include small suppliers in the total system for the benefits that 100% EDI usage can bring. Mission critical data exchanges with high security and reliability requirements will continue to be transmitted in the traditional way. A relatively small extra investment by CML in providing a tailored document exchange system to their small suppliers, which does not include functionality that these suppliers would not use, provides the potential for much greater returns from their existing investment. We argue from this case study that, while new EDI players may adopt Internet EDI strategies from the start, given that traditional EDI has already been effectively implemented by many large manufacturers and retail organizations and their large trading partners, this leveraging role for Internet EDI may be its main economic significance in the near future. This proposition is potentially testable using more quantitative research methods such as multiple case studies or survey. In particular, the relationship between the use of non-traditional approaches to EDI and the success of advanced distribution techniques is suitable for empirical inquiry.

For the small suppliers, whereas the traditional EDI approach was viewed as an imposition with greater costs than benefits, Internet EDI may prove be a palatable point of entry into Electronic Commerce with subsequent benefits. With a working familiarity of electronic exchange of data, initially through an application-to-person approach, the benefits of transferring data directly to a simple accounting package way become apparent. Knowledge gained through the use of a single customer EDI system might be leveraged by a small suppliers to provide a first mover advantage over their peers with other customers. Internet EDI may play the role for Electronic Commerce that graphical user interfaces played for end-user computing. Again, these propositions are potentially testable as Internet EDI adoption grows.

Finally, the case study suggests that more complex and realistic approaches to the functionality and connectivity aims of Electronic Commerce networks are emerging. In the traditional approach, the universal adoption of internationally regulated formatting standards was supposed to provide unlimited connectivity between trading partners and to facilitate application-application data transfer between diverse application platforms. Although using the Internet as a transport
medium does not preclude this traditional standards-based EDI approach, the proliferation of Internet EDI software [4,13] which does not use traditional standards appears to pose a challenge to the concept of global, application-to-application connectivity associated with traditional EDI. When Internet EDI plays the kind of supportive role described in this paper, the relaxation of traditional standards requirements by these products may not be a backward step. It provides greater flexibility to the large players to develop systems quickly that meet their particular needs. Because application-to-application and global business connectivity are not particularly important to small trading partners, web-form formats can be used by them in a hub-spoke configuration, without compromising the global nature of the main network, or substantially undermining the original aims of standards-based EDI. In addition, Value Added Networks (IVANs) operating Internet sites which accept these web-form formats and provide gateways to the traditional EDI private networks are also providing an alternate solution to the connectivity problem [4]. The concept of intelligent gateways, either at a trading partner site or at a third party site, seems to be emerging as an additional solution to the platform compatibility problem, which in the traditional EDI vision was supposed to be solved through the universal use of international standards. The emergence of the intelligent gateway concept also shows an increasing recognition that there are different ways of achieving EDI, each suitable to a particular scale of trading partner, all of which may need to be supported for a large trader in order to achieve its Electronic Commerce objectives. Again this observation from the case study suggests empirically testable propositions for future research. It would be interesting to investigate the adoption of non-standards-based EDI, and the ways in which large players incorporate it within their total systems, through a survey or case study research project with a larger sample of companies in the retail sector.

Acknowledgment

The authors would like to express their gratitude and appreciation to Mr Dave Botherway, the Electronic Trading Coordinator of Coles Myer Limited Australia, for his invaluable cooperation during the case study, for offering an opportunity to one of us (HCM) to participate in CML’s Proof of Concept project as an observer and in the Internet EDI product evaluation as an independent evaluator, and for providing significant information for the case study.

References


