



# Identifying Supply Chain Management and E-Commerce Opportunities at PaperCo Australia

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## EXECUTIVE SUMMARY

Established supply chain management techniques such as Quick Response (QR) or Customer Relationship Management (CRM) have proven the potential benefits of reorganizing an organization's processes to take advantage of the characteristics of electronic information exchange. As the Internet and other proprietary networks expand, however, organizations have the opportunity to use this enabling infrastructure to exchange other, more varied types of information than traditional electronic data interchange (EDI) messages. This is especially true of companies with global operations and interests, which lead to a more diverse set of trading activities.

This case presents the experiences of a large Australian paper products manufacturer in implementing an electronic document exchange strategy for

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supply chain management, including the drivers for change which spurred their actions, and describes the issues associated with trying to support existing and future requirements for document exchange across a wide variety of trading partners. The experiences of PaperCo will be relevant to organizations with diverse trading partners, especially small to medium enterprises (SMEs).

## THE ISSUES ON HAND

While looking beyond established schemes for more creative and opportunistic exchanges of information with trading partners offers promise of new benefits, the proliferation of potential document exchange types and mechanisms involved have two implications: they demand a more sophisticated technological infrastructure and require a strategy for the coordinated management of the information flows themselves.

Such a strategy is especially important to organisations operating in Australia, for the following reasons:

- Australia has a very large proportion of SMEs, with a comparatively low uptake of traditional EDI ([Parker, 1997](#)), supply chain management (SCM) schemes and technologies such as the Internet, email and the Web (Pacific Access, 2000)
- While smaller businesses have had a low e-commerce adoption rate, Australia has one of the highest overall rates of IT adoption in the world, with Internet penetration ranking well ahead of comparable nations such as the UK, Taiwan, Korea, Germany and Japan. *“At 36% of the total population accessing the Internet, Australia is only behind Sweden and Canada, which are both at 43% and the U.S. at 41%. Australia is among the world leaders in accessing the Internet, whether it is measured by households or population”* (NOIE, 2000).
- The country’s geographic isolation increases the population’s dependence on communications and computer technologies.

The potential for less structured, less formalized (and less expensive) uses of document exchange to improve trading partner linkages in such an environment is high. Although Australia has a particular need for improved document exchange mechanisms, this situation will potentially face any large organization with a diverse set of (especially smaller) trading partners. A company in this position is faced with obvious concerns: how do we identify the types of document exchange which might be involved? How do we identify where they might occur: which parts of the organization are involved, and which processes might be improved? What is involved in the development of a document exchange strategy? How can we build a supporting

infrastructure for Electronic Document Exchange (EDE)? What are the potential success factors, the functional criteria?

This chapter describes the experiences of a large Australian company which has been through this process, and presents the results of their experiences. The case description is focused around the following questions:

- *What kind of e-commerce environment do Australian or international organisations face in Australia?*
- *How might an organization find opportunities for process improvement, either internally or with regard to inter-organizational processes, by focusing on non-standardized data and document exchange, rather than by focusing on established SCM initiatives?*
- *What kind of infrastructure is required in order to enable both current and future such opportunities, given their discovery may be ad hoc, and the nature of the exchange may not be predetermined?*
- *Are multinational companies, with more complicated intra-organizational structures, or those, which engage in global commerce, with more complicated inter-organizational links, more likely to benefit from a cohesive document exchange platform and strategy?*

## INTRODUCTION: EVOLVING TRADING PARTNER EXCHANGES

Organisations face constantly increasing pressure to reduce costs and to improve internal and external efficiencies so that they can remain competitive (Chatfield and Bjorn-Anderson, 1997). The inefficiencies associated with intra- and inter-organizational trade can often be attributed to delays and errors in the exchange of the business documents and information associated with the goods and services being produced and traded (Wenninger, 1999).

Many organisations have found success and a competitive advantage, or at least “kept up with the Jones’s,” by putting into place industry-accepted and prevalent supply chain management (SCM) approaches (initially JIT, QR; later ECR, CRP etc.—see Table 1b for definitions). They have been driven primarily through the implementation of automated and standardized document exchange (EDI). SCM has generally included business process reengineering (BPR), to streamline an organisation’s value chain (Davenport and Short, 1990; Hammer and Champy, 1993; van Kirk, 1993), and the processes which connect the company and its suppliers and/or customers (Clark and Stoddard, 1996; Swatman et al., 1994).

But is simply adopting an underlying technology or choosing to seek out “industry best practices” as a blueprint for process change going to help an

**Table 1: Electronic Document Exchange Tools (a) and Approaches (b)**

(a)

EDE Tools	Description
Electronic Data Interchange (EDI)	The computer-based application-to-application exchange of standardised business documents such as orders and invoices, which in turn reduces errors and delays due to manual rekeying of data. EDI translation software converts these business documents between proprietary used by applications and a standardised format which is exchanged (Kalakota and Whinston, 1997).
Traditional EDI	EDI exchanges occur via a proprietary value-added network (VAN).
Internet EDI	EDI exchanges occur via the Internet.
Electronic Funds Transfer (EFT)	The transfer of money from one bank account to another bank account, which can be in the same or different banks (Kalakota and Whinston, 1997; Turban et al, 2000).
Electronic Fax (e-fax)	Electronic documents (including orders) are formatted in a readable form and are received by a trading partner's facsimile machine.
Electronic Forms (e-forms)	Often take the form of web-based (as opposed to paper-based) forms which are filled out online using a web browser and submitted.

organization determine opportunities for advantage or improvement that are unique to the individual company? These are now harder to find, and more likely to involve non-standardized (non-EDI) business document exchanges.

Numerous examples of (mostly large) organisations which have implemented successful EDI projects have been reported over the last decade (see, for example DeCovny, 1998; Emmelhainz, 1992; McMichael et al., 1997; Rochester, 1989; Shaw, 1995; Swatman, 1994). Despite the ability of EDI to reduce operating costs and lead times, however, the full potential of EDI for many users has not been realized because small and medium enterprises (SMEs) in particular have resisted calls to become EDI capable (NOIE, 2000; Steel, 1996; Wenninger, 1999). EDI users have often found it necessary to operate both EDI systems as well as traditional paper-based processes to support trading partner requirements (Farhoomand and Boyer, 1994; Iacovou et al., 1995), thus reducing the effectiveness of their reengineering programs (Wenninger, 1999).

A newer trend is for organisations to undertake more complex Electronic Document Exchange<sup>1</sup> (EDE) with their partners than the frequently cited purchase orders and Advance Ship Notices (ASNs). For example, companies are trying to utilize their internal databases to provide trading partners with information-based products such as order tracking for customers (Baker, 1999; Rayport and Sviokola, 1995) and forecasting details for suppliers (Baljko, 1999). Catalogue and purchase-cycle solutions are commonly sought. Other organisations are streamlining their product design process through the electronic exchange of design specifications with trading partners (McCubbrey and Schuldt, 1996).

(b)

EDE Approach	Description
Business Process Reengineering (BPR)	"A management approach that focuses on the analysis and redesign of organization structures and business processes in order to achieve improvements in cost, quality, and speed" (Kalakota and Whinston, 1997, p. 27).
Just-in-Time (JIT)	Involves the delivery of a manufacturer's materials and parts at the right time, quantity and quality for use in production, so that large quantities of buffer stock is not required. This inventory management approach relies heavily on such tools as EDI for the timely exchange of orders and advance ship notices (see <a href="#">Turban et al, 2000</a> ; <a href="#">Timmers, 1999</a> ).
Quick Response (QR)	QR is the retail industry's implementation of JIT, which involves the delivery of products at the right time, quantity and quality for directly replenishing retail shelves ( <a href="#">McMichael et al, 1997</a> ).
Efficient Consumer Response (ECR)	"... a management strategy which involves reengineering the entire grocery distribution chain to eliminate inefficiencies, excessive costs and non-value added costs for all supply chain participants" ( <a href="#">Harris and Swatman, 1997, p. 429</a> ).
Evaluated Receipt Settlement (ERS)	"Method for initiating payment to a supplier that replaces the invoice... First the price is agreed upon by a blanket or other purchase order. Next, a material release tells the supplier the quantity to deliver. An advance ship notice confirms the quantity actually being delivered, and payment is triggered upon receipt" ( <a href="#">ASMMA, 2001</a> ).
Continuous Replenishment Program (CRP)	"... manufacturers gain access to demand and inventory information for each downstream supply chain site [such as retailers] and make necessary modifications and forecasts for them" ( <a href="#">Handfield and Nichols, 1999, p. 32</a> ).
Supply Chain	"... encompasses all activities associated with the flow and transformation of goods from the raw materials stage (extraction), through to the end user, as well as the associated information flows. Material and information flow both up and down the supply chain" ( <a href="#">Handfield and Nichols, 1999, p. 2</a> ).
Supply Chain Management (SCM)	"... is the integration of these [supply chain] activities through improved supply chain relationships, to achieve a sustainable competitive advantage" ( <a href="#">Handfield and Nichols, 1999, p. 2</a> ), which relies heavily on (some of) the tools and approaches above.

All of these EDE alternatives must be achieved in an environment where trading partners often have quite different levels of e-commerce sophistication (including EDI, Web, email or even just facsimile capability). While small businesses are increasingly making use of Internet or Web commerce ([DFAT, 1999](#); [Poon and Swatman, 1999](#); [Pacific Access, 2000](#)), it is still likely to be some time before all of an organisation's trading partners are Internet capable ([ABS, 1999](#)). For this reason, many large organisations are investing in e-commerce gateway solutions ([Chan and Swatman, 1999](#); [Mak and Johnston, 1999](#)) which support this variety of EDE use.

This type of technology is also necessary to support any reengineering activities. [Broadbent et al. \(1999\)](#) and others suggest that organisations implementing BPR require a basic level of IT infrastructure (see also [Caron](#)

et al., 1994; [Dixon et al., 1994](#)). Indeed, EDI has often been seen as a necessary precursor to the successful implementation of BPR and SCM projects, due to its ability to integrate intra- and inter-organizational systems ([Swatman et al., 1994](#)). It is our contention that EDE, which includes the electronic exchange of EDI, order tracking, product design and a plethora of other document types, will also be an important component of such an enabling IT infrastructure for BPR and SCM.

So, how might an organization approach the identification and development of such initiatives? The following sections detail the experiences of an Australian organization faced with this situation, and describe their approach and conclusions. We begin by looking at our case organization, PaperCo, and its trading environment.

## CASE BACKGROUND

PaperCo is a paper products manufacturer and recycling company. It is one of Australia's largest producers of corrugated cardboard boxes, which are made from 100% recycled paper. Founded over 50 years ago, it is a privately owned, Melbourne-based international manufacturing company group employing more than 5,000 people in Australia, New Zealand and the USA, having group sales of over U.S.\$1.5 billion per year. The company operates six paper recycling mills in Australia, and three in the USA (in New York, Georgia and Indiana), as well as more than 40 corrugated cardboard-box-making factories across Eastern Australia, New Zealand and the Northeast, Southeast and Midwest of the USA. The company has three main operating divisions, in addition to a head office:

1. A recycling division collects waste material (primarily paper) for recycling.
2. A paper products division takes the recycled waste and makes packaging paper.
3. A box division makes and markets corrugated box products from the recycled packaging paper. This division contains a subdivision which produces specialist printed and non-printed packaging.

We were interested in looking at PaperCo as a 'revelatory' ([Yin, 1991](#)) case for the following reasons:

- Although it has both intra- and inter-organizational international links, many of the trading partners of PaperCo are Australian SMEs. Given the poor uptake of e-commerce within SMEs, both in Australia and overseas, we were interested in whether (and how) PaperCo planned to include these trading partner relationships in their future e-commerce and SCM plans.

- In terms of size and turnover, PaperCo is a very large company by Australian standards, and has few direct competitors of any size. We were interested in evaluating the factors which were motivating PaperCo to consider document exchange and SCM innovation, to discover whether they were internal or external, local or international.

Before describing PaperCo itself, it is useful to visit the general business environment in which Australian companies operate. This environment is summarized in Table 2.

This developing, but very active, e-commerce environment has led many Australian companies—of all sizes—to investigate ways in which they can use electronic linkages to improve their internal communications as well as their trading partner relationships.

### ***Case Analysis: Value and Supply Chain Interactions within PaperCo***

Although the three divisions of PaperCo are part of the same group of companies, they are effectively separate organisations which trade heavily with one another. Much of the product produced within each company is sold down the supply chain to other divisions: the paper products divisions, for instance, sends 80% of the paper it manufactures to the box division, and sources 50% of the raw material produced by the recycling division.

***Table 2: General Business Environment of Australia***

<b>Business Environment Category</b>	<b>Business Environment Overview</b>
Australian population	19 million inhabitants
Australian corporate structure	96.1% of Australian businesses are small to medium (SMEs) <sup>i</sup>
Large and medium company use of IT <sup>ii</sup> as at end June 1998	100% use computers 86% use LANs/WANs 98% had Internet access (ABS, 1999)
Medium business use of eCommerce as at February 2000	89% connected to the Internet 92% using email (Pacific Access, 2000)
Small business use of eCommerce as at February 2000	60% connected to the Internet 54% using email 25% had a home page – further 18% expect to have one in 12 months (Pacific Access, 2000)

*Note: i) According to unpublished Australian Bureau of Statistics figures for the 1998/99 financial year.*

*ii) Companies with 100 or more employees.*

In exploring the possible future applications of EDE that PaperCo might implement to gain either production efficiencies or generate value-added products, it quickly became apparent that PaperCo's value and supply chains were not separate in terms of information flow, but rather quite interconnected. This causes significant interdependence, as changes to document types and flows within a single division will affect the others.

The communication between the three divisions is a combination of intra-organizational documents such as memos and general ledger transactions (the company group has centralized financial systems) and inter-organizational documents such as invoices and purchase orders. The processes, and consequently the information systems, which support these document flows are both intra- and inter-organizational systems.

PaperCo had already been using EDI to exchange a few documents with some trading partners, but the scheme had been deemed unsuccessful because of a lack of internal integration and a lack of interest from the majority of their trading partners at the time. At the commencement of our study, however, the company was facing increasingly more complex EDE requirements from its trading partners, both in terms of the quantity of documents requested and in terms of the variety of documents needed. This increase in EDE interest from trading partners had been due in large part to the advent of and interest in the Internet, and was coming primarily from local trading partners. PaperCo was also simultaneously looking at its intra- and interdivisional processes, in addition to their links with trading partners, with a view to streamlining them. A further driver for change was the result of an independent survey, which reinforced the view that PaperCo's customers were interested in value-added services which would modernize their supply chains, centered around the increased provision of documents and information. Lack of customer information, poor delivery performance, long quote cycle times and average-to-poor service performance were identified as issues in customer service management which needed to be addressed. Some of the suggested changes PaperCo was considering to address these issues were also relevant to the development of a document exchange strategy, including:

- visibility of customer information across the group,
- improved reporting of delivery performance,
- ability to assess lead-time/availability,
- a simplified/automated quote process,
- a consistent customer management approach.

The types and quantities of the potential documents to be exchanged, both internally and externally, were diverse. The recycling division, for

instance, had approximately 15,000 active customers, all with similar needs—while the box division had approximately 8,000 active customers with diverse needs and differing levels of technical sophistication. There was also a variety in the identified uses for document exchange within divisions. The box division, for instance, had begun to implement electronic exchange of box design and artwork files, greatly speeding job turnaround time, while the recycling division saw potential in providing customers with an automated facility for querying recycling pickups over the Web.

This diversity, combined with the common needs of the various parts of PaperCo, led the organization to consider ways in which it might improve its internal and inter-organizational process by means of EDE.

### *Identifying Opportunities for (Process) Improvement*

Opportunities for EDE within PaperCo and with its trading partners were determined using two main approaches: a conventional analysis of existing document flows both internally to and externally with the organisation to identify opportunities for streamlining these flows using EDE; and a study of its trading partners to determine their EDE capabilities and requirements. The trading partner analysis was seen as especially important in the context of EDE, because the outcome of the study allowed PaperCo to ascertain the breadth of document types which would ultimately need to be supported by the EDE infrastructure. For this reason, the trading partner analysis for this EDE project was more complex than for traditional EDI projects, which tend to focus on such operational issues as (Shaw, 1995) the type of business document(s) to be implemented through EDI, and the variety of possible EDI standards used by their trading partners.

The analysis identified the following EDE types which would need to be supported:

- *facsimile*: including e-fax capabilities, but also support for clients with traditional fax;
- *email*: especially for the attachment of other electronic documents;
- *Web*: material made available by the company for customers/clients to download as they require over the Internet; the documents or information are therefore pulled by the client, where control over the access varies with the sensitivity of the data;
- *e-forms*: company-developed, structured input forms which are available to customers via the Web and which provide direct data input to PaperCo's software (which in some instances would be turned into EDI documents first); and
- *traditional EDI*.

Results from the trading partner analysis also suggested that customers were interested in value-added services which could modernize their supply chain relationships. The value-added services identified as desirable to their customers involved increased document and information provision and would therefore need to be supported by the EDE infrastructure.

An investigation of these potential value-added services, along with the internal document flow analysis, identified a number of opportunities for further EDE use within the different divisions of PaperCo:

#### *Recycling Division*

EDE use within the recycling division was limited to fax and email exchange, and the provision of recycling information on the Web. The primary users of Web material were schools, and customers seeking information. Future plans included the listing of catalogues and product information on the Web; the use of e-forms to structure requests/enquiries; EDI for exchange of invoices, purchase orders, etc., with trading partners; and increased use of email and e-fax to send/receive orders.

The most significant way in which a new EDE platform would affect the recycling division therefore would be in the ability it would give them to handle a wider range of document types, which matched its diverse customer base. It would allow them to provide commonly requested information to the community via the Internet, supporting an online marketing presence. Most additional document exchange types would centre around providing electronic (more formalized) responses to customer requests such as for scheduling and pickup information. Planned developments included the integration of recycling pickup requests submitted via the website with the scheduling system for the recycling fleet.

Historically, although they had a Web presence established, the recycling division had not been proactive in pursuing opportunistic uses for IT. This was largely because they had few people within the division with knowledge of how IT might be used; the IT requirements of the division were handled by the primary IT department of PaperCo, which is contained within the box division.

#### *Paper Products Division*

Within the paper products division, there was less variety in the uses seen for EDE, but higher volumes of a small number of document exchange types. Their document needs were based around standard business documents (invoices, orders, end-of-month statements) exchanged with a stable, smaller group of trading partners. The area of EDE expansion with the most potential

was therefore EDI, as their trading partners are large organisations with relatively homogeneous needs. Again, as with the recycling division, few employees with IT expertise and no exposure to the possibilities offered had resulted in minimal awareness of the diversity of electronic exchanges possible. There was an understanding of the potential of EDI, which was expected given the EDI trial which had been conducted, but the lackluster performance of that pilot had certainly not inspired enthusiasm, and may indeed have negatively affected the generation of process change ideas within the paper products employees.

#### *Box Division*

The box division had the most potential for diverse EDE types. Their current use is focused on fax for sending/receipt of orders, but has recently widened to cover the use of fax/email in the new product design cycle (exchanging artwork and box designs with customers via email), and also on marketing opportunities similar to those of the recycling division.

The box division had a more extensive history with e-commerce via an EDI pilot, and had had the greatest number of requests for support from trading partners, with a resulting higher level of awareness of EDE opportunities. This awareness was generated primarily through individual, non-IT-related, employees who understood their areas well and saw the possibility for process improvements in their domains. These individuals had been pursuing their ideas separately, and independently from top management or the IT department. In several cases PaperCo's central administration discovered the existence of these division-based approaches only when they themselves began to look for document exchange opportunities. This knowledge and enthusiasm generated by "champions," coupled with the variety of document types they could support via EDE, meant that the box division had gone further than the other divisions in identifying opportunities to reengineer internal business processes, having established potential for redesign in the following areas:

#### *Order Forecasting*

It would aid pre-planning of factory schedules if the company knew when their customers would be placing orders. This information could be obtained by accessing customer databases directly (raising the issue of confidentiality), or by having the customer send a message with the time the order is required. Such a message could be automatically produced by the customer's internal systems, or sent manually in the form of structured email template. Structured email would reduce rekeying within the company, and could be replaced with EDI in the future for EDI-capable customers.

### *Order Placement*

At the time of the study, orders were taken via fax, email and EDI (EDI messages were then printed and rekeyed). Further development of the company's website would enable e-forms to capture and structure this information. The installation and integration of an updated EDI gateway package would also allow EDI messages to be input directly into in-house systems, and eliminate rekeying.

### *Order Confirmation*

A variety of confirmation types were being used within the company for different customers, from functional acknowledgments to full Purchase Order Acknowledgments (POAs), although the responses in place were not flexible. The company wanted to be able to offer the same transfer mechanisms for confirmation as for placement (i.e., fax, email and EDI) and allow trading partners to receive confirmations via whichever medium (media) they could support.

### *Job Tracking*

PaperCo was considering altering internal job progress processes to provide customers with job-tracking facilities. Information on when an order placed would be ready was seen as highly desirable by customers engaging in tightly timetabled production schedules, and hence could provide competitive advantage. The company was weighing this advantage against the loss in flexibility in job scheduling.

### *Delivery*

Delivery of orders was an obvious application for Evaluated Receipt Settlement for the company. ERS would allow the company to eliminate invoices; customers would read/scan the pallets of bar-coded goods as they arrived, triggering an EDI acceptance message. An EFT payment would then be generated and sent to the bank. In general, the company operates on terms of 30 days. As invoices are generated at the end of the month, the average payment return is 47 days. ERS had the potential to save the company \$140,000 per month. For EFT-capable customers, the company would need to negotiate with their bank regarding detailed remittance advices associated with each electronic payment made to the bank, to ensure an adequate audit trail. For non-EFT-capable customers, invoices would still be issued (either by email or EDI).

The different opportunities identified above highlight the relatively small proportion of document exchange possibilities which are EDI-based.

While the instances where EDI could be used tended to have high-value returns (partly because a quantifiable cost-benefit analysis can be more easily done—data is more easily available), the number of uses in comparison to non-standardized electronic documents was low.

This comparatively wide variation in types and uses of documents leads naturally to the next question—that of the infrastructure required for electronic document exchange in a complex internal and inter-organizational environment.

### ***Building a Supportive Infrastructure for EDE***

What kind of infrastructure is required in order to enable current and future document exchange opportunities, given their discovery may be ad hoc, and the nature of the exchange may not be predetermined?

PaperCo approached determining the requirements for such an infrastructure in a fairly conventional way, by:

- establishing the constraints on and the success factors for the project;
- analyzing their internal and external environment to identify opportunities for streamlining business processes, using both conventional (EDI) and nontraditional electronic document exchange as focal points; and
- determining functional criteria on which to base their selection of an EDE solution.

We were primarily interested in EDE-specific aspects of these three phases, especially when compared to more traditional EDI-based projects, which would inform the development of our EDE Infrastructure Requirements Framework.

A range of factors were identified which were believed to be essential to the success and effectiveness of any EDE solution. These success factors matched the conventionally acknowledged factors suggested for any strategic IT initiative ([Chan and Swatman, 1998](#); [Frank, 1997](#); [Galliers et al., 1995](#)):

- without top management commitment, no major technological innovation can be successfully adopted by an organisation of any size (let alone an organisation as large and diverse as this one);
- equally important was the issue of trading partner commitment, as successful SCM initiatives tend to have a cooperative focus;
- top-down implementation was required to ensure that all parts of the organisation install and use the chosen solution in the same way;
- since innovation cannot be effectively implemented without a common strategy, top management support for EDE innovations was required;

- because of the complexity and variety of business documents being exchanged throughout the company, implementation teams would need to include both business people and technical experts;
- a pilot study of one application within one division to identify and scope the technical and organizational difficulties which are inevitable with such a major change to operating procedures was recommended;
- once the pilot study was successfully completed, a phased implementation of the complete EDE program was recommended to ensure sufficient time and effort be given to each part of the group; and
- training was needed for both internal staff and for those trading partners using the new systems.

The SCM objectives with which the EDE infrastructure was to be aligned were also identified from the outset of the project: to reduce direct and indirect costs by means of EDE, including reductions in document processing errors; to optimize internal and external document flows using EDE to improve their SCM; to improve trading partner relationships (for example, by enhancing customer service) through their use of EDE; and to support the varying types of document exchange requirements by trading partners and by their internal supply chain, including support for future EDE requirements. Having identified these success factors and EDE objectives, PaperCo then set about determining the most pressing constraints which were to be placed on the EDE infrastructure:

1. *Outsourcing*: The EDE infrastructure developed needed to be both flexible and modular, in order to support the rapid and spontaneous development of supporting IT systems once BPR/SCM initiatives had been identified and selected. This was particularly important because any such development was likely to be outsourced.
2. *Archiving*: Many of the documents PaperCo were intending to exchange with trading partners were associated with box work designs, which would be stored on an intranet accessible to their trading partners. The number of documents involved was substantial, and the EDE infrastructure was required to cope with this, as well as possible future policy changes regarding external access to data.
3. *Staffing implications*: PaperCo wanted a solution which would require a minimum number of new staff: where possible, retraining of existing staff was preferred.
4. *Common approaches to trading partners*: PaperCo wanted a consistent approach to trading partner exchanges, to minimize staff impact and maintenance, and to facilitate the easier development of future BPR projects.

5. *Future scalability and maintainability,*
6. *Support for internal (as well as external) work flows,*
7. *To avoid having separate strategies for internal and external EDE,*
8. *Assessing the security implications of the Internet as an EDE architecture.*

During the process of interviewing staff and observing processes throughout PaperCo's operations, however, it became clear that a number of additional constraints were at least (if not more) crucial than those initially identified. The first was to consider the appropriateness of using an ISP to carry commercial-in-confidence information. PaperCo did not make significant use of the Internet, apart from email messaging and from the recycling division providing marketing material on the Web, which was accessed primarily by school children (and thus low in commercial confidentiality). Interviews with IT personnel across the company, however, made it clear that there was considerable demand to extend Internet usage beyond this level, to include confidential information. With an ISP no longer an appropriate intermediary, staff with specific Internet skills would have to be hired to build and maintain the new Internet site. The EDE solution chosen therefore needed to minimize the number of additional staff required.

These constraints (and indeed objectives) might arise in any organisation, and are not PaperCo specific. We would argue that, with the possible exception of the outsourcing constraint, all the constraints (in addition to the success factors and SCM objectives) are likely to be relevant to any company considering the development of an EDE infrastructure. This gives rise to our final question—whether multinational companies, with their more complicated intra-organizational structures, or those which engage in global commerce, with more complicated inter-organizational links, are more likely to benefit from a cohesive document-exchange platform and strategy, as has been the case with PaperCo.

### ***Technical and Architectural Solutions***

Given an understanding of both the EDE types and processes (current and new) to be supported, any architectural solution would need to be compatible with both new requirements and existing business practices. PaperCo identified a set of functional and nonfunctional criteria for the assessment of any potential infrastructure solution. The functional criteria supports:

- *VAN-based EDI:* The company has existing EDI-enabled trading partners using VANs. Any solution chosen had to provide connection and support for VAN-based EDI messages.
- *Internet EDI:* Many of PaperCo's smaller customers or suppliers have access to the Internet but would be reluctant to pay for VAN services for

relatively few transactions. Increasingly, trading partners were demanding Internet EDI.

- *Email*: Many of PaperCo's transactions with customers already occur using email, and its use will increase substantially as an exchange mechanism for binary files, particularly for off-site sales staff who will be able to cut the iterative product design development process from several visits down to one. This is a significant benefit in the case of country customers, when the sales reps can spend days driving to sites.
- *E-forms*: The company expects to use e-forms to structure standard transactions involving the website, such as queries for marketing information, and intends to expand these services to provide additional value-added information, such as updated or confirmed delivery schedules for recycling trucks.
- *WWW access*: The company required a Web server integrated with the gateway solution as a whole. The Web server enables outside access to material on the website, such as marketing material, and will also be connected to internal systems which generate the information. Placement of the Web server was expected to be on an extranet, which would enable better control over confidential information while ensuring security.
- *E-fax*: Access to fax machines across the company is sometimes variable, and many faxes are electronic documents which have been printed for transmission. E-fax would allow all employees with access to the network to send faxes from their PCs.
- *Binary file exchange*: Business documents exchanged by the company are no longer solely text-based documents. The increased exchange of documents such as artwork design or palette specifications required binary file support.

It is interesting to note that these criteria go beyond the capabilities of traditional EDI systems, so that the traditional EDI software selection criteria were insufficient for EDE. Rather, corporate gateway systems are increasingly available from e-commerce software vendors (for example, Sterling Commerce, GE Information Services, Harbinger) or are being developed in-house by organisations ([Chan and Swatman, 1999](#); [Mak and Johnston, 1999](#)) to support the electronic exchange of the above document types.

In addition to the issue of whether each vendor could adequately support the functional EDI and Internet requirements of PaperCo, the company also had a set of business criteria to consider which are largely consistent with the criteria considered for most IT projects:

- *Adequate security*: Firewalls, extranets, levels of security and authentication, Internet and EDI.
- *Installation costs*: The company had set a relatively inflexible budget for any solution adopted, although the initial cost was of less concern than ongoing costs, and particularly possible additional staffing costs.
- *Configuration costs*: Configuration costs of different solutions varied enormously, depending on the number of document mappings required for EDI documents to be used.
- *Ongoing costs*: Included ongoing vendor and network provider charges.
- *Staffing impact*: Including not just staffing costs, but an assessment of the change in work practices of employees.
- *Service and support*: Including cost and degree of service provided, and response times.
- *Local presence*: Given its commitment to the EDE strategy, the company saw a local (within Australia) presence on the part of the vendor to be crucial.

These criteria were also largely in line with the EDE project constraints established earlier in the project, such as ensuring minimal staffing impacts.

## CASE DISCUSSION

The EDE opportunities PaperCo discovered ranged from accepted supply chain initiatives such as ERS to less common ideas such as the electronic exchange of box art designs with customers or the provision of recycling pickup schedules over the Web. The support of any of these ideas separately through IT would provide the organisation with a benefit. But an EDE infrastructure which allows easy future implementation of additional process change initiatives is a knowledge-based resource of additional value to the organisation.

We have described PaperCo's approach to establishing the requirements for such a flexible EDE infrastructure, which we believe is applicable to other organizations. Many of the elements of the PaperCo approach are common to traditional IT or EDI projects, and as such are likely to be procedurally familiar to most organizations.

As far as successfully identifying EDE opportunities goes, however, the PaperCo case shows that the source of many good ideas will be individuals throughout the organization who understand and can see ways to improve specific relationships with particular trading partners. In PaperCo's case these individuals had both managerial and nonmanagerial positions, but in all cases had regular contact with their trading partners. In some instances the trading partners themselves had suggested a change. Opportunities are not likely to

be uncovered with a “top-down” managerial investigation, but rather filter up/ across the organisation.

We investigated and have presented the issues which arose in the PaperCo case according to separate areas of literature and theory relevant to EDE. Initial investigations focused on strategic issues associated with SCM and BPR. The success and failure constraints derived for an EDE framework (see Table 3) show alignment with the strategic IT literature, suggesting that existing frameworks and models in this area are applicable to (at least this type of) e-commerce. The business criteria PaperCo had for an EDE approach also corresponded closely to the criteria considered for most IT projects.

At a more operational level, our investigation of the possible application areas for EDE involved process examination across all divisions of the company, and revealed functional criteria which go beyond the capabilities of traditional EDI systems, on which traditional organizational e-commerce studies have tended to focus. These findings suggest that:

- At a strategic or managerial level, the issues associated with development of an integrated EDE framework or architecture may be adequately addressed using existing BPR and SCM approaches.
- At an operational/functional level, the requirements of an EDE framework/architecture will vary from traditional EDI developments and will impact the systems development project(s) undertaken in implementing/integrating EDE, whether they are built or bought.

The findings of the PaperCo case are summarized below, presented as a framework of requirements for an overall EDE infrastructure (in terms of both data and process).

A further implication evident in the PaperCo case study is the increasing importance of using open standards within internal systems, and the “greying” of the line between internal and external application systems. Internal systems have traditionally been isolated from external connections, and the problems of translation associated with proprietary standards (whether document, transport, etc.) has generally been addressed by the use of corporate EDI gateways. As business document exchange progresses beyond the standardized and largely static nature of EDI, however, the issue of standards is once more becoming critical. With the identification of new, ad hoc exchanges of documents with trading partners, or between internal divisions, the number and types of document and application interactions will not only increase, but will be inherently unpredictable. The interconnectivity of internal systems with those of external partners will therefore become increasingly important.

**Table 3: Initial EDE Infrastructure Requirements Framework**

EDE Infrastructure Requirements Determination	Further Case Notes
<p><i>Verify that success factors are satisfied</i></p> <ul style="list-style-type: none"> <li>• top management commitment to EDE</li> <li>• trading partner commitment to EDE</li> <li>• EDE team includes technical and business people</li> <li>• an EDE champion</li> <li>• a pilot study is established to identify possible technical and organisational difficulties</li> <li>• a common company-wide EDE strategy is needed</li> </ul>	<p>PaperCo only felt ready to approach the idea of EDE-enabled process redesign when they had internal champions and when their trading partners pushed for new ways of working together. Several PaperCo employees with ideas for process redesign, however, were almost to the point of abandoning them. It is therefore important for a firm to recognise its EDE readiness and act in a timely manner. The pervasive nature of a consistent EDE approach/architecture, and the degree of inter-divisional cooperation needed to develop and sustain an effective platform also makes management support and input at the highest levels particularly critical.</p>
<p><i>Devise company-wide high-level EDE strategies</i></p> <ul style="list-style-type: none"> <li>• reduce direct/indirect document exchange costs</li> <li>• optimise internal/external document flows</li> <li>• improve trading partner relationships</li> <li>• support all necessary document types</li> </ul>	<p>While these high-level EDE strategies were specific to PaperCo, we believe that these strategies (and others) will most likely be applicable to all organisations trying to streamline their internal and external supply chain processes using EDE.</p>
<p><i>Determine EDE project constraints</i></p> <ul style="list-style-type: none"> <li>• minimise staff implications</li> <li>• common EDE approaches to trading partners</li> <li>• future scalability and maintainability</li> <li>• support for internal work flows</li> <li>• no separate internal/external EDE approaches</li> <li>• EDE solution must be secure (e.g. Internet)</li> </ul>	<p>We believe that these EDE project constraints identified by PaperCo are likely to be the same as those imposed by other companies embarking on such a project. These constraints suggest the need for EDE consistency both internally and externally to the firm, and that the EDE infrastructure must be able to support future growth.</p>
<p><i>Analyse internal and external document flows</i></p> <ul style="list-style-type: none"> <li>• Conduct a trading partner analysis to identify external EDE opportunities and requirements</li> <li>• Study internal supply chain for intra- and inter-division document exchange process changes</li> <li>• Identify value-added services which can be derived from information in internal databases</li> <li>• Encourage EDE ideas from all parts of the company rather than rely entirely on a centralised EDE strategy planning team</li> </ul>	<p>EDE opportunities identified by PaperCo ranged from well known initiatives such as ERS and EDI, through to emailing box designs and artwork. By focusing broadly on EDE rather than on specific approaches such as EDI or the Internet, PaperCo was able to devise a range of EDE initiatives based on externally and internally identified requirements. Indeed, the idea of artwork exchange led to the idea of developing an extranet on which their artwork catalogue could be stored, for easy retrieval or update by customers.</p>
<p><i>Evaluate EDE infrastructure business criteria (e.g.)</i></p> <ul style="list-style-type: none"> <li>• Adequate security</li> <li>• Installation, configuration and ongoing costs</li> <li>• Staffing impact</li> <li>• Service, support and local presence</li> </ul>	<p>While these business criteria for evaluating EDE infrastructure solutions were specific to PaperCo, they are sufficiently general that they are likely to form the basis for any organisation evaluating their own solutions.</p>
<p><i>Evaluate EDE infrastructure functional criteria (e.g.)</i></p> <p>The EDE infrastructure must support VAN-based EDI, Internet EDI, email, e-fax, e-forms, Web access, and binary file exchange.</p>	<p>These functional criteria devised by PaperCo were intended to support existing and future EDE needs of its internal and external supply chain. A further criteria in the selection of EDE solutions is its extendibility to handle new document types not yet envisaged. These functional criteria would constitute most of the likely EDE needs of most firms.</p>

## CONCLUSION

This chapter has presented a case study investigating the requirements associated with developing an EDE infrastructure to support SCM and BPR initiatives, particularly those connected to supporting future systems development. Such an infrastructure must facilitate the rapid and easy development of new systems which cannot necessarily be predicted far in advance, and must deal with a multitude of new document types.

There is a lack of e-commerce frameworks or models intended specifically to help organisations identify their EDE opportunities and infrastructure requirements, which might serve as an enabler of future BPR and/or SCM initiatives. Much has been written on the identification and development of such systems, but usually from a process point of view. We contend that a data-, or document-centric approach can be used to identify both new applications and a starting point for the improvement of existing processes.

We have presented a set of functional and nonfunctional criteria useful to organisations wishing to support process improvement initiatives, or simply manage a diverse document exchange portfolio, by identifying the strategic requirements of an infrastructure for the exchange of documents both internally and across their supply chain. Such an infrastructure will allow a company to support the variety of current and future strategies which may be in use across the organisation in a consistent manner (for example, cost minimization via EDI may be the focus of one division of a company, and reduced time to delivery via email exchange of product files another).

In particular, the issues identified within the PaperCo case may be helpful for large, multi-divisional organisations with disparate document exchange requirements. These are the companies most likely to benefit from EDE, and also the most likely to be in the position of exploring process redesign initiatives both internally and across their supply chain.

The analysis undertaken to develop this framework is not unique to e-Commerce but is an approach which has yielded benefits in many BPR cases (see, for example, [Davenport and Short, 1990](#)). Clearly, while there are elements of e-commerce which are unique, much of the analysis of business processes can be undertaken in a way which is already familiar to most of the companies considering the benefits of EDE. Although such an approach has been suggested by a number of authors working in the EDI environment (see, for example, [Emmelhainz, 1992](#); [Swatman, 1994](#); [Parker, 1997](#)), its extension to the wider field of EDE suggests that, in essence, the technologies supporting document exchange may well be less important than the process(es) implemented by the organizations or firms dealing with them.

As a single organisation, the PaperCo example can only be a revelatory case. Planned future work includes validation of our findings against other organisations in a similar position, and the extension of the EDE requirements framework to address more systems development-focused issues such as data/information architecture requirements and methodological support for developing and maintaining such an infrastructure. Government is already considering ways in which agencies can work together to maximize efficiency and minimize costs—EDE offers a potential way in which these goals may be obtained at comparatively minor cost.

## ENDNOTES

- 1 In searching for a term which covered all types of document exchange between organisations, we failed to find one in use. We are using the term Electronic Document Exchange (EDE) to refer to the electronic exchange between trading partners of both standardized and ad hoc business documentation.
- 2 According to unpublished Australian Bureau of Statistics figures for the 1998/99 financial year.
- 3 Companies with 100 or more employees.

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