Electronic commerce: supporting collaboration in the supply chain?

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Abstract

This paper examines the influence of electronic commerce technologies in enabling companies to pursue more collaborative relations with their suppliers. It is shown how electronic commerce is supporting more collaborative relations by describing a number of the key areas of collaboration, where electronic commerce is having a considerable impact. Electronic commerce is radically re-shaping traditional supply chain structures in many industries and reducing the costs of closely integrating buyers and suppliers. However, it is argued that electronic commerce has yet to achieve its full potential in creating a transparent network of supply chain members. In particular, it is argued that a culture change is required in order to establish real partnerships between buyers and suppliers in which information can be exchanged on a regular basis in an environment of trust.

Keywords: Electronic commerce; Partnership sourcing; Extranet; Intranet; Electronic data interchange

1. Introduction

Issues such as the trend towards increased outsourcing have led companies to become more dependent on their supplier network [1]. The trend towards more collaborative relations has led organisations to reduce the number of suppliers while at the same time fundamentally changing the way in which they do business with their remaining suppliers [2]. Companies are now pursuing more intensive and interactive relationships with their suppliers, impacting buyer-supplier relations in a number of key areas such as, supplier involvement in new product development activities and creating multi-functional teams in both the customer and supplier organisations to enable collaboration on a range of issues. One consistent theme throughout these interaction patterns between the customer and supplier is the enabling role of information technology. Electronic linkages in the supply chain are already fundamentally changing the nature of inter-organisational relationships [3]. For example, Grover and Malhotra [4] have argued that innovations in Internet technologies such as ‘intranets’ and ‘extranets’ are critical in integrating and co-ordinating cross-functional teams across organisational boundaries. Electronic commerce technologies such as the Internet have been most prevalent in business-to-consumer type trading exchanges. However, it is argued that the greatest potential for the application of electronic commerce technologies lies with business-to-business transactions [5].

The objective of this paper is to examine the influence of electronic commerce technologies in enabling companies to pursue more collaborative relations with their suppliers. An overview of the relevant literature is presented on collaborative buyer-supplier relationships. An outline is then presented on how electronic commerce is facilitating greater collaboration in the supply chain by describing a number of the key areas of collaboration where electronic commerce is having a considerable impact. It is shown how electronic commerce is radically re-shaping traditional supply chain structures in many industries and reducing the costs of closely integrating buyers and suppliers. The impediments to electronic commerce-enabled supply chain collaboration are identified. It is argued that electronic commerce has yet to achieve its full potential in creating a transparent network of supply chain members. Finally, areas for future research are identified.

2. Collaborative buyer-supplier relationships

The collaborative buyer-supplier relationships adopted by Western companies have been adapted from the Japanese style partnership. The objective of Japanese partnerships is to
increase quality while minimising the total costs associated with adding value incurred by both the buyer and supplier. In short, the goal is to create a ‘see-through’ value chain where the costs and problems of both parties are visible. Dyer and Ouchi [6] define the Japanese style partnership as “an exclusive buyer-supplier relationship that focuses on maximising the efficiency of the entire business system (value chain)”. Due to the success attributed to Japanese style partnerships, and the emergence of Japanese transplants such as Honda and Nissan in the US and UK, Western companies have become interested in adopting many of the features of partnership sourcing. Ellram [7] defines a purchasing partnership as—“an agreement between a buyer and a supplier that involves a commitment over an extended time period, and includes the sharing of information along with a sharing of the risks and rewards of the relationship”.

Gadde and Hakansson [1] emphasise the need for organisations to move toward closer co-operation in the buyer–supplier relationship. Market pressures for increased product complexity and variety based on a wide range of developing technologies and response at higher levels of quality and reliability but declining cost have demonstrated that few, if any, organisations can do it all by themselves. They need to supplement their core competencies by alloying with other providers of complementary competencies to satisfy their customers. The real productivity, design and quality improvements are not obtainable unless the suppliers in the partnering arrangement innovate to the best of their abilities in conjunction with the buyer organisation. This, however, requires a major shift in mind-set or operational paradigm, from what Sako [8] terms arms-length contractual relation to obligatory contractual relation. Hence, there are a number of intangible and tangible factors that must be present for a partnership to be successful. The intangibles are regarded as senior management commitment, trust, flexibility, teamwork and patience. The tangibles are reduced costs, adopting total quality management, zero defects as a quality target, on time payments, joint research and development, electronic data interchange, faster time to market; on time deliveries with JIT if necessary, the reduction/elimination of stock.

3. The implications of electronic commerce for supply chain collaboration

3.1. Change in supply base structure

One of the most prominent indicators for a move towards partnerships is the rationalisation and consolidation of the supplier base [9]. The underlying reason is that reducing the number of suppliers is a prerequisite for improved and a deepened supplier relationships. Reducing the immediate supply chain has led to a changing of the structure of the chain and the number of tiers in it. These purchasing companies are buying assembled systems or complete sub assemblies rather than individual components, thus introducing another level into the supply chain. Information technology has a key role to play in managing such an inter-organisational network of supply chain members. Electronic commerce can reduce the costs of closely integrating buyers and suppliers and through electronic networks firms can achieve an integration effect by tightly coupling processes at the interface between stages of the value chain [10]. The evolution of electronic commerce technologies is having a considerable impact on the communication patterns between the supply chain members.

Traditional electronic commerce such as electronic data interchange (EDI) transactions have been conducted over proprietary value-added networks (VANs) between the OEMs and tier one suppliers. However, Internet-based electronic communication is facilitating increased information sharing between members at lower levels in the inter-organisational network. For example, in an analysis of the buyer–supplier relations in the European automobile component industry, Hyun [11] found increasing communication exchange between the various parties involved like the OEMs, the sub-assemblers, and the sub-suppliers. The information flows are multi-directional within this supplier network. The degree of communication linkage between the three parties could vary depending upon the nature of collaboration. For example, in the new product development process, more communication and closer relationships between the sub-assemblers and OEMs is taking place.

Another trend radically changing the supply base structure that is being enabled by electronic commerce is the increasing use of distributors by OEMs in many industries. OEMs use distributors to manage the logistics process between their commodity type suppliers. The distributor acts as the interface between the OEM site and each component supplier maintaining and managing a store of items on the site. The operation of such an arrangement depends upon electronic commerce with limited intervention in the OEM. The distributor uses its distribution centre as the ‘hub’ for the items it purchases from the suppliers. The initial running of the system begins with the distributor receiving a forecast of usage for each component for the proceeding 6 months. Consequently, each week the distributor receives a revised forecast of usage for the next 4 weeks from the OEM’s manufacturing system. Based on this forecast the distributor ensures that the distributor’s on-site store has a stockholding equivalent to this forecasted 4-week usage. On receipt of the weekly forecast the distributor guarantees 24 h delivery to ensure necessary replenishment of the on-site store. The distributor then ‘owns’ the stock while it is in the on-site store. When the OEM’s manufacturing systems uses the stock from the store it then becomes the property of the OEM.

3.2. Delivery management

A crucial area in which electronic commerce is having a major impact is in the management and scheduling of product demand in the supply chain. A key requirement for an
effective delivery management system is a high frequency of information sharing between supply chain members. Timely and accurate information sharing is crucial in this process. The information sharing strategies of the trading partners is related to supplier performance [12]. Effective use of electronic commerce has the potential to improve the materials management process of both the buyer and supplier in areas such as inventory reduction, delivery lot-size reduction and purchase order and invoice reduction.

A key success factor in ensuring collaborative relations between trading partners is accurate customer demand forecasting. This is an area where electronic commerce technologies have had a major impact. One industry where supplier reliability and effective forecasting is crucial is the supermarket industry due to the perishable nature of most of the items on sale. Traditionally, the supermarkets operated EDI with their larger suppliers while traditional paper-based approaches have been used to manage smaller suppliers. However, large supermarket chains are now linking with smaller suppliers via the Web, taking advantage of the open standards technology of the Internet [13]. For example, Tesco has enabled remote suppliers to access everything from manuals on how to deliver goods to particular stores to a directory of Tesco staff and locations, news and service levels. Such 'links' allow suppliers to see how stocks stand within the different stores through exactly the same database as Tesco staff use. Chrysler has also used information technology to improve relationships with its suppliers by using a computerised on-line system that transfers delivery and quality to suppliers in real time [14]. The implication of this evidence is that electronic commerce not only benefits the customer, but there can be benefits to the supply chain as well. Such a situation creates a higher level of dependency in the relationship with both partners being more willing to make shared investments in information technology in order to reduce costs.

At this stage it is worthwhile considering the various electronic commerce technologies which support different types of purchased items. A significant point is that EDI has tended to be exclusively used by large companies because of its complexity and relatively high cost of implementation. Also, there have been problems with implementing EDI in many industries. For example, in the UK car industry suppliers are frustrated by the different implementations of EDI employed by the vehicle manufacturers, and appear to be unable to cope with the inconsistency of business information. EDI has not been well implemented in the industry over the past decade and some suppliers do not believe it is worth the effort—given the alternatives of fax messages, electronic mail—despite the apparent benefits available from EDI in terms of improved data accuracy. The EDI industry has now turned to the Internet to extend its reach and make it easier and cheaper for small firms to use [5]. Such a trend has enabled large companies to have different 'electronic links' with their suppliers depending upon their size and level of sophistication. Even though companies may have had EDI links with their large suppliers, the predominant means of communication with their smaller suppliers may have been fax or telephone message. One such company that has exploited the use of Web technology is Daimler-Chrysler (DC). DC trades with its small suppliers via the Web with each supplier being able to hook directly into DC's system [15]. The ordering, invoicing and payment process is carried out electronically with transactions being more accurate and small businesses getting paid more quickly.

3.3. Collaboration in new product development

Increased buyer-supplier collaboration has led to increased supplier involvement in the design process with the customer. One strategy that is facilitating the effective implementation of new product development is concurrent engineering. Concurrent engineering makes use of multi-functional teams and these may be part of the infrastructural features for the supply chain, involving both internal and external representatives [16]. The importance of having all the internal representatives, such as research and development, engineering, purchasing, production, and logistics in the process is recognised. Concurrent engineering is being facilitated through Internet technology as evidenced by Caterpillar and its suppliers. Caterpillar has adopted an 'open' standards approach with its suppliers which enables partners to access spreadsheets, charts, documents, scheduling charts, databases and computer-generated drawings electronically [17]. Such an approach is vital for Caterpillar with large and small suppliers having instant access to mutually shared information. This reduces time-to-market and creates a lot of value that can be shared between the buyer and supplier.

A further example is provided by Huang and Mak [18] who describe the application of Extranet technology within a multinational electronics company, which embraces not only the design sites within the organisation, but also includes designers at key suppliers. The Intranet module developed has been beneficial in a number of areas to the designers in the customer and supplier organisations:

(i) Developing specifications—assists in changing, revising and modifying tolerances, features and specifications.

(ii) Interchangeable parts—provision of parts and components that have commercially available specifications that can be used interchangeably to produce the same product without impairing the intended product utility or function.

(iii) Part standardisation and simplification—identifying components which could be standardised and hence the greater availability and abundance of supply sources has led to a reduction in production lead time, resulting in lower product and inventory costs.

(iv) Part exclusions—bringing attention to specified items that had a long or unstable lead-time. Any shortages of
such items can seriously hamper line balancing, resulting in costly delays and inefficient use of resources.

From a management perspective the Web-based design tool has improved the communication linkages between the customer and the supplier. Feedback between the customer and supplier on ongoing designs can occur on a continuous basis. In addition, within the electronics industry product development times are measured in months and companies need to find innovative ways of compressing the time-to-market in order to enhance their speed of response to the final customer. The system assists product development by bringing the suppliers organisation into the project at an earlier stage. This helps in minimising design changes (and consequently reduce costs) later on in the process. At the same time, the close communication between designers in both companies as well as other members of the multi-functional procurement team, has enhanced the relationship between the two organisations.

3.4. Re-engineering the buyer–supplier interface

A key capability of electronic commerce is the automation of routine and clerical tasks at both the buyer and supplier interfaces. Therefore, electronic commerce technologies are eliminating activities traditionally carried out by the relevant participants in both the customer and supplier. Such a change provides both a challenge and an opportunity to the relevant participants. With electronic commerce technologies automating the transaction type activities, the participants at both the buyer and supplier interface are now able to focus on ‘value adding activities’ as illustrated in the following areas:

(i) On the customer side, the role of the purchasing professional is moving from being involved in clerical type activities, such as invoice processing and expediting, to include activities such as integrating suppliers into their new product development processes and joint involvement in total cost analysis. For example, Wang and Seidmann [19] have found that the successful implementation of IT at the buyer–supplier interface can reduce costs and allow purchasing personnel to have greater time and ability to engage in more sophisticated vendor evaluation programmes and value analyses, build closer relationships with key suppliers and rationalise their supply bases. In this way, it is possible for the purchasing function to make the transition from being a transaction-oriented operation to one that has a strategic focus.

(ii) On the supply side, with the customer service function having limited involvement in handling routine order queries they are able to focus more of their time on activities such as managing and building the relationship with their key customers. For example, the use of electronic commerce has enabled Nortel, a strategic supplier of BT, to devote more time to improvements in the product launch process and in dealing with queries to enable faster provision and product installation. This provides Nortel with the opportunity to add value as part of collaboration by increasing end customer service and product utilisation [3].

The implementation of electronic commerce cannot only add value at the buyer–supplier interface but can also enable the trading partners to build a closer relationship with the end-consumer. For example, in the retail industry, information technologies are enabling retailers to identify trends and target individual consumers. Using relational databases and data mining techniques retailers are able to identify customer requirements and shopping habits. One company that has successfully employed this technology is Wal-Mart. Wal-Mart stores data on point of sale, inventory, products in transit, market statistics, customer demographics, product returns and supplier performance [20]. The data is used for three broad areas of decision support: analysing trends, managing inventory and understanding customers. In particular, Wal-Mart has been able to build up ‘personality traits’ of each customer by analysing relationships and patterns in customer purchases. Such innovations provide greater forward demand visibility throughout the value chain by knowing which consumer buys which products where and at what time of the day.

Small to medium-sized companies can also benefit from applying Internet technology to increase value along the supply chain [21]. A trading firm in Hong Kong, which deals directly with retailers in the US has identified the Internet as an appropriate tool to link customers with suppliers as a means of achieving competitive advantage. The intermediary, known as Factory Network, supplies retailers in the US with simple commodity-type products, such as toys, clocks and Chinese porcelain. These products are provided by a network of approximately 50 small to medium-sized companies in southern China. In order to co-ordinate the activities of these enterprises along the value-chain, Factory Network has developed what is termed an inter-organisational information system (IOIS). This is an Internet site that facilitates the creation, storage, transformation and transmission of information across the organisational boundaries, between the parties involved in the relationship. The IOIS allows the retailers to shop for products and to place order requests and at the same time to check on the status of orders. The intermediary transfers the order requests to the relevant enterprises based on an analysis of current production schedules and available capacity, in order to meet the customer lead-time requests. The system has led to a number of benefits over the conventional distribution channels including:

(i) Improves internal efficiency since data is captured more quickly, leading to faster analysis and shorter response times.

(ii) Enhances inter-organisational efficiency by, for example, allowing customers to shop and check order status electronically, without tying up customer service representatives.
Much of the evidence presented has shown how companies can exploit the open standards technology of the Internet to link up with suppliers that they have traditionally traded with manually. However, there is still the significant problem of incompatibility of the systems of the trading partners. There is evidence to suggest that closed network problems can also affect the Internet with business-to-business electronic commerce running up against application interfaces, which inhibit the operation of a fully transparent environment between trading partners. For example, the Midland Bank has found that the absence of standards has meant that not all the trading partners have the same technical systems [24]. Related to technical considerations is the issue of security. In particular, with the Internet using ‘non-secured’ lines there are understandable fears in relation to the transfer of funds and transmission of sensitive information.

Historically, there has been a lack of information systems in organisations that enable cross-location, cross-company information transfer in planning. Within organisations different functions or departments often have incompatible systems and objectives. Externally, supply chains with customers and suppliers are not homogeneous. Participants often have different communication infrastructures, with language, currency and cultural barriers and legislative differences. In the context of developing effective supply chain management systems, this is a significant [25]. Recent evidence suggests that the barriers to the adoption of such technologies do not lie primarily with the technology but with the business processes [21]. Even in the most successful companies there are few processes that are fully integrated horizontally. Effective implementation of electronic commerce to support supplier relationships and to optimise the supply chain requires that electronic commerce is fully integrated into both the business architecture and technology infrastructure of both the customer and the supplier. The redesign of processes must not only include internal organisational processes but must include the wider business network. An organisation is just one entity in a value system carrying out processes that extend beyond the boundaries of the organisation into both its customers and suppliers. While companies may have often successfully focused on individual processes, systems and departments, and optimised such activities, they have not considered the whole chain and identified activities and links that are adding most value. MIT’s ‘Management in the 1990s’ research project has shown that a clear distinction now exists between business process re-engineering (BPR) and what is usually referred to as business network redesign (BNR) [26]. While BPR has clearly focused on the redesign of internal organisational processes, BNR is concerned with the wider business network. The underlying premise is that the firm is just one entity in an industry value system. Business network processes are those processes that extend beyond the boundaries of the organisation into suppliers, customers, regulators and alliance partners.

4. Impediments to electronic commerce-enabled supply chain collaboration

So far, the evidence presented would seem to indicate that electronic commerce has been successfully and universally applied to customers and their suppliers. However, there are considerable barriers to the implementation of electronic commerce in the supply chain. Successful implementation of electronic commerce at the buyer–supplier interface requires collaboration among customers and their suppliers [3]. However, both customers and suppliers have had extreme difficulties with embracing this new ethos of openness, trust and collaboration. Collaborative buyer–supplier relations are often perceived as the optimum approach to achieving supply chain improvement through the development of more effective customer-supplier relationships. Evidence has shown that this is an area where rhetoric seems to be moving well ahead of reality. New and Barnes [22] conducted an empirical study of the benefits to be gained from collaborative buyer–supplier relationships. They found that the distribution of the costs of improvement activities were biased towards suppliers, rather than customers. McIvor et al. [21] present evidence to suggest that procurement personnel have found it difficult to adapt to the new ethos of openness with suppliers. In addition, suppliers are expected to embrace a collaborative relationship, after many years of operating in a system in which trust was the last thing they expected.

This evidence poses problems in the following areas:

(i) On the supplier side, there may be an unwillingness to share information on prices or costs fearing that the customer might use such information to erode margins or disclose costs to competitors. In many cases, cost information is not used for mutual benefit, thus gaining a poor reputation because of its use as ‘just another weapon in the customer’s arsenal’ [23].

(ii) On the customer side, in a retail environment, the retailer may not wish to disclose information to suppliers concerning sales promotions and product sales fearing that the supplier might disclose such information to competitors. Clearly, if electronic commerce is to lead to the ‘seamless integration’ of supply chain partners then a culture change is required to establish real partnerships in which information can be exchanged on a regular basis in an environment of trust.

(iii) The provision of unique product features, since it improves customer service by identifying and reporting problems more quickly.

(iv) Reduces search related costs, since the IOIS suggests alternative product specifications that reduce customers’ costs or improve customers’ performance and alerts customers to opportunities to obtain volume discounts by altering order patterns.
5. Conclusions

This paper has shown how electronic commerce radically re-shaping traditional supply chain structures in many industries and reducing the costs of closely integrating buyers and suppliers. There is clear evidence to show how electronic commerce is enhancing the customer’s information management and transaction processing efficiency, that in turn is improving demand forecasting and fosters closer relationships with suppliers. These changes are having implications for the traditional roles of the functions involved in managing the inter-organisational interactions. For example, with the participants at both the buyer and supplier interface performing a more value-adding role, there are training and development implications. Electronic commerce technologies can be used as a very powerful means of integrating and co-ordinating cross-functional teams across organisational boundaries. With electronic commerce technologies ‘blurring’ the traditional boundaries in the value chain, suppliers and manufacturers must continuously evaluate their established positions. Suppliers can add value to their customer’s business by implementing innovations in electronic commerce. These changes enable suppliers to move from that of having a passive role to that of being a strategic resource for the company. However, a cultural change must occur to establish real partnerships between buyers and suppliers in which information can be exchanged on a regular basis in an environment of trust. Such a change is essential to creating an effective integration of supply chain members. Closed network problems can also affect the Internet with business-to-business electronic commerce running up against application interfaces that inhibit the operation of a fully transparent environment between trading partners. This necessitates considerable resource allocation to ensure the compatibility of systems between the trading partners.

An important issue for further research and investigation are the change management implications of implementing electronic commerce technologies. Processes that extend across organisational boundaries need to be jointly designed and managed. Electronic commerce facilitates information exchange and enhanced communications between organisations and can also reduce costs, risk and uncertainty while also increasing interdependency and joint investment. The level of adaptation and cooperation that is becoming necessary in the supply chain means that electronic commerce takes on an increasingly critical role. An understanding of how electronic commerce can be deployed by firms to exchange information and to maintain and build relationships is important as it may impact on their ability to participate in a particular supply chain. Therefore, electronic commerce needs to be viewed in the context of its wider impact in enabling business process redesign, the opportunities it offers for exploiting information, the challenge of integration with internal systems and its implementation through supporting technologies and applications.

References