

Chapter 2

e-Business in Supply Chain Management

Claudia-Maria Wagner

Dublin Institute of Technology, Ireland

Edward Sweeney

Dublin Institute of Technology, Ireland

ABSTRACT

E-business is concerned with the use of the Internet to link companies with their suppliers, customers and other trading partners. As a business concept, it has evolved significantly since its introduction in the 1990's in parallel with the rapid rate of development of information technology (IT) during this period. Supply chain management (SCM) is fundamentally concerned with integration of activities both with and between organisations. IT plays a crucial role in SCM as a key enabler of supply chain integration (SCI). This chapter sets out the role of e-business concepts in the context of the supply chain challenges faced by firms. It specifically explores the role of e-procurement as an example of how e-business concepts have been applied to one key SCM activity, namely purchasing and procurement. In this context, the chapter examines the nature and evolution of e-marketplaces and goes on to identify key adoption drivers and benefits based on recent research. This research identifies key adoption drivers and benefits but also recognises that there are many barriers that ongoing research needs to address if the potential of e-business is to be fulfilled.

INTRODUCTION

In the past ten years, e-business, as an overarching business concept, has received increasing attention from academics and practitioners alike. The term 'e-business' was introduced by IBM in 1997. In its origins it is defined as "the transformation of key business processes through the use of Internet technologies" (IBM et al., 2000, p.1). Amor (2000) expands the definition by describing it as a secured, flexible and integrated approach in order to offer various companies values through the combination of

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systems and procedures and so being able to manage the core business procedures with the simplicity and penetration of Internet technology.

These two definitions of e-business both refer to using the Internet to link with customers, suppliers and other associated partners. However, the term also implies the transformation of existing business processes into more efficient ones. E-business has generally been pioneered by information technology (IT) companies, where demand is constantly changing and products have very short product life cycles and short order-to-delivery times as a result. Organisations successfully engaging in e-business are able to convert data from their back-end systems into a common readable format and thus are able to share information and conduct electronic transactions with their business partners via the Internet. It also encompasses the adoption of innovative business concepts, such as dynamic pricing through auctions/reverse auctions, co-opetition via purchasing consortia and direct online sales to customers. E-Commerce can be regarded as a subset of e-business. While e-business refers to the whole spectrum of online information exchanges, e-Commerce only encompasses online transactions.

The power and properties of information and communication technology (ICT) can be leveraged in several ways across functional domains, with online selling to customers constituting only a fraction of the potential possibilities engendered by e-business (Wu, Mahajan and Balasubramanian, 2001). Companies are increasingly incorporating e-business concepts as an integral part into their strategy in order to achieve competitive advantage. In particular, vertical Business-to-Business (B2B) applications and systems have enabled companies to interact in a dynamic, innovative and real-time environment and, as such, allow superior supply network integration.

This chapter describes and critically assesses developments in e-business that have impacted supply network integration strategies. It starts with a summary of supply chain management (SCM) definitions as a proper understanding of the concept of SCM is a critical component in determining appropriate e-business applications and systems. SCM is recognised as a strategic weapon, by which business operations can be streamlined and overall competitiveness enhanced. It is widely accepted that a large proportion of the total cost base of companies is tied up in the supply chain. For example, Presutti (2003) estimated that 70% of a firm's sales revenues are spent on SC related activities. Supply chain integration (SCI) plays a critical role insofar it represents the extent to which all activities within an organisation, as well as the activities of its suppliers, customers and other supply chain members, are linked and assimilated (Narasimhan and Jayaram, 1998). The chapter goes on to explore the role of e-procurement as an example of how e-business concepts have been applied to one key SCM activity, namely purchasing and procurement. B2B e-marketplaces represent a recent innovative development, which has been hypothesised to optimise procurement processes and to add significant value in organisations' supply chains. In this context, the chapter examines the nature and evolution of e-marketplaces and goes on to identify key adoption drivers and benefits based on recent research. Based on the foregoing some future research directions are proposed and a number of key conclusions drawn.

BACKGROUND

This section sets out the background to this chapter by introducing the supply chain concept as it has evolved in recent years. It highlights the importance of the concept of integration in this context and explains how the effective management of supply chain information flows is critical in this regard. The

role of e-business (as defined earlier) is then introduced as a possible means of enhancing the management of information throughout the supply chain.

The Supply Chain Management Concept

A supply chain is a bidirectional flow of information, products and money between the initial suppliers and final customers through different organisations (Nurmilaakso, 2008). It can be both internal and external in its nature. In an internal context, the elements of a SC are represented by various intra-organisational functions (such as for example sales and marketing, procurement, production planning, warehouse and transport management), whereas the external supply chain further encompasses movements of material, information and funds between companies and their suppliers, customers and various business partners.

Simchi-Levi et Al. (2000, p.1) define supply chain management (SCM) as “a set of approaches utilised to effectively integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time in order to minimise system-wide costs while satisfying service level requirements”. Lambert et al. (1998, p.1) expand the SCM definition to include the concept of value creation by depicting SCM as “the integration of business processes from end user through original suppliers that provides products, services, and information and hence add value for customers and other stakeholders”. In brief, SCM is about breaking down the barriers both within and between organisations and to ultimately link them in an integrated way to allow value-add to customers starting from product design to delivery through the planning, implementation and monitoring of the various flows. Supply chains are increasingly competing with other supply chains and as such the ultimate goal of effective SCM is superior business performance. The constituent parts of a supply chain are linked together via the flow of information and therefore the proper implementation and integration of various functions via information and communication technology (ICT) is vital for a successful SCM strategy. Supply chain integration (SCI) is an important part of SCM. It aims to facilitate the flow between all organisations in a supply chain and thus positively affects operational performance (Naylor et al., 1999; Bagchi et al. 2005). In short, a key tenet of SCM relates to the need to move from fragmented supply chain architectures to configurations that are characterised by integration.

Information Flows and Supply Chain Integration

The sharing of information is a critical success factor if seamless product and money flows between initial suppliers and end-consumers in the ‘macro’ (or external) supply chain, as well as in the ‘micro’ (or internal) supply chain between different intra-organisational functions, is to be achieved. An inefficiency anywhere in the chain, be it internal or external in nature, will result in the chain as a whole failing to maximise its true competitive potential. The whole chain is only as strong as its weakest link.

Figure 1 exhibits a simplistic representation of a macro and micro supply chain. In the macro or external supply chain materials flow from the raw material source (n-tier supplier) through the various stages in the chain to the final consumer (n-tier customer). Money (i.e. funds) then flows back down the chain. Ideally, at every link in the supply chain value is added and profits generated. Houlihan (1988) noted in the late 1980s that the supply chain is viewed as a single process, meaning that the various links in the chain need to function in as seamless a manner as possible. Akkermans et al. (2003, p.286) defines a supply chain as a “network consisting of suppliers, manufacturers, distributors, retailers and customers”. This network is supported by three pillars:

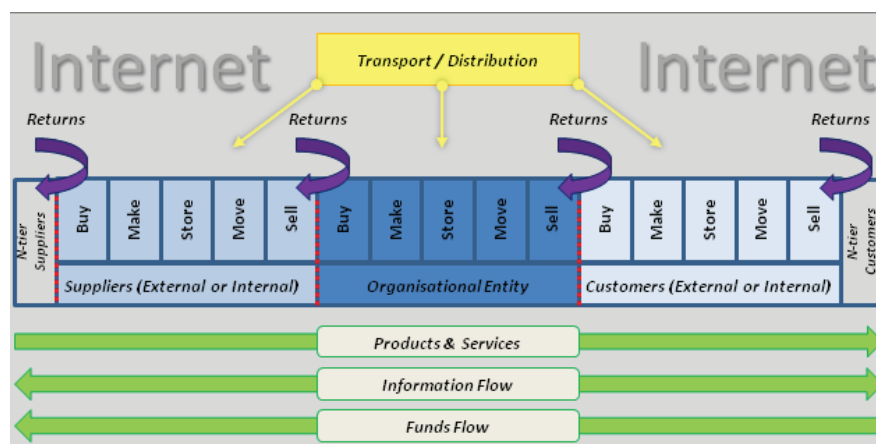
e-Business in Supply Chain Management

- (a) processes, which embed a firm's capabilities in logistics, new product development, and knowledge management;
- (b) organisational structures, which encompass a range of relationships from total vertical integration to networked companies, performance measurement and management approaches; and,
- (c) enabling technologies, which include process and information technologies.

In a similar manner, Monczka et al. (1998, p. 78) emphasises the network paradigm by referring to the use of “a total systems perspective across multiple functions and multiple tiers of suppliers”. The reference to “multiple functions” emphasizes the internal (or micro) integration aspects of an effective supply chain. Most (manufacturing) businesses can be described in terms of five functions: buy, make, store, move and sell. Traditionally, these functions have been managed in isolation, often working at cross-purposes. SCM, and in particular SCI, means thinking beyond the established boundaries, strengthening the linkages between the functions, and finding ways for them to work together in a systematic and seamless way. A recognition that the “whole is greater than the sum of the parts” calls for more effective integration between purchasing and procurement (buy), production planning and control (make), warehouse management (store), transport management (move) and customer relationship management (sell) (see Figure 1). Optimisation of subsystems (i.e. functional departments, production sites, individual processes in a manufacturing cycle) can result in a sub-optimised total system. Lack of efficiency and/or effectiveness is often a result of the poorly designed interfaces between subsystems rather than any inherent subsystem weaknesses.

The most important problem encountered in both micro and macro supply chains occurs when information about consumer demands becomes distorted on its way from the end-consumer to the initial supplier. A negative result of this information distortion is inaccurate demand forecasts and inefficient resource allocations, resulting in long lead times and high costs. Fast and accurate information sharing along all internal and external elements within a supply chain is a prerequisite for reducing this distortion (Nurmilaasko, 2008). Trent and Monczka (1998) describe two types of integration: the first one involves the forward coordination of the physical product flow from the suppliers to the customers; the

Figure 1. Micro and macro supply chain framework



second one entails the backward coordination of the information flow from the customers to the suppliers. Nurmilaasko (2008) identifies three levels of SCI:

- (a) manual SCI meaning human-to-human information sharing (e.g. telephone, fax, e-mails, etc.);
- (b) semi-automated SCI meaning human-to-system information sharing (e.g. web portals); and,
- (c) fully automated SCI meaning system-to-system information sharing (e.g. middleware systems).

The Role of e-Business

Network technologies enabled by e-business standards have the potential to transform and integrate the functional elements of many industries. The Internet facilitates the abolition of the trade-off between richness and reach of information, which means that communication can occur at almost zero cost, without constraints on the richness of information. (see, for example: Graham et al., 2004; Evans and Wurster, 1997). Richness of information includes characteristics such as bandwidth, customisation, and interactivity. Reach is defined as the connectivity, and is the number of agents involved in exchanging information. Before the development of the Internet, to reach large numbers of people with rich information was a costly and time-consuming process and prone to errors due to manual information replication. Sweeney (2007) depicts that managing information flows in the supply chain is one of the most crucial activities in SCM as the flow of materials and money is usually initiated by information movements. Hardaker and Graham (2001) reinforce this by outlining that coordination in a supply chain occurs through the communication of orders, stock levels and demand feedback. Poor management of information flows essentially leads to the so-called bullwhip-effect that requires the holding of excessive levels of inventory. High demand visibility plays a strategic role in reducing inventory levels (Sweeney, 2007). Efficient and effective network-based communication structures in a supply chain have the potential to offset these effects. SCI and e-business are interrelated insofar as integrated e-business functions facilitate undistorted and accurate information sharing. In this way, optimal alignment of business functions represents the means to an effective overall SCI strategy. The next section describes the impact of e-business on the integration of supply chain configurations in more detail.

E-BUSINESS EVOLUTION AND CONCEPTS

Integrated SCM has generated much interest dating back to the 1960s (e.g. Forrester 1961) because actions taken by one member in the supply chain can influence the profitability of all other members. However, the lack of ICT hindered the implementation of a more “systems-oriented” approach. Inter-organisational systems (IOS) such as electronic data interchange (EDI) have been used since the 1970s to link one or more organisations to their suppliers or customers through private value-added networks. Computer reservation systems in the airline industry were one of the pioneering applications within the domain of IOS (Monteiro and Macdonald, 1996; Pemberton et al., 2001) as with growing traffic airlines realised the need for efficient, quick, inexpensive, and accurate handling of their inventory information to communicate with travel agencies and other customers. IOS are automated information systems shared by two or more companies and differ from internal information systems by allowing information to be sent across organisational boundaries. However, entities within a supply chain often have different and conflicting objectives and interests and, therefore, complex interactions take place (Gregor and

Johnston 2000). Riggins and Mukhopadhyay (1999) note some limitation of IOS. IOS implementation projects are intrinsically more risky than traditional internal IT projects. Companies have less control over processes due to the uncertainty of external trading partner actions. Inter organisational systems often have interdependent benefits and therefore the way in which a trading partner implements a system may affect the benefits realised by the other party.

EDI, in its traditional form, is partially ineffective for allowing multiple enterprises to make use of common data and process models of the whole supply chain. It offers limited functionality and is problematic because it has not been standardised worldwide. EDI data is usually exchanged in batch fashion, which makes it complicated to handle exceptions. Process-level integration between multiple enterprises is, therefore, complex to implement because the data produced by one organisation's EDI applications is frequently processed by dissimilar application sets in the receiving organisation. Although EDI can help to decrease transaction costs, it is rather inflexible and limited to the establishment of bilateral relationships typically for manufacturers that could afford its implementation at a relatively high cost per contact (Huber and Wagner, 2007).

Companies in the supply chain are striving to increase control over their suppliers as well as to obtain up-to-date and accurate information about their business partners to enhance their supply chain competencies and agility. Traditional EDI provided only limited success in the context of SCI. The advent of more advanced ICT, most notably the Internet, offers the potential to move beyond the limited EDI transaction sets to automate the data flows across the supply chain, thus making a contribution to a more multilateral information exchange and the fostering of market-based exchanges in all transaction phases. Recent developments in XML programming are enabling the transformation of the supply chain into a network facilitated by Internet technologies (Richmond et al., 1998).

Overall, e-business solutions in general are seeking to enhance supply chain effectiveness and efficiency through the automation of business processes. The adoption of e-business can result in benefits such as higher transparency, reduced transaction, manufacturing and other costs, reduced unmonitored corporate spending (also known as maverick or rogue purchasing) and more centralised purchasing spend and more coordinated and efficient collaborations for such projects as joint product design. E-business may also:

- Facilitate collaboration and supply chain information sharing, such as order forecasts and inventory planning;
- Automate requisition and purchase order creation and integrate payment processes; and,
- Help organisations develop plans for the more effective management of sourcing and logistics.

Electronic linkages in the supply chain can change the nature of inter-organisational relationships. However, they should ideally enable the sharing of resources and core competencies and the synchronisation of working processes between external partners in virtual network organisations. There is a wide diversity of e-business tools and services. The following sections highlight some of the aspects and tools of e-business as they impact SCM.

THE IMPACT OF ERP SYSTEMS ON SCM

With the change of the ICT landscape, supply chain design as opposed to supply chain coordination is becoming a core competency (Fine, 1998). At the same time, many firms have implemented company-

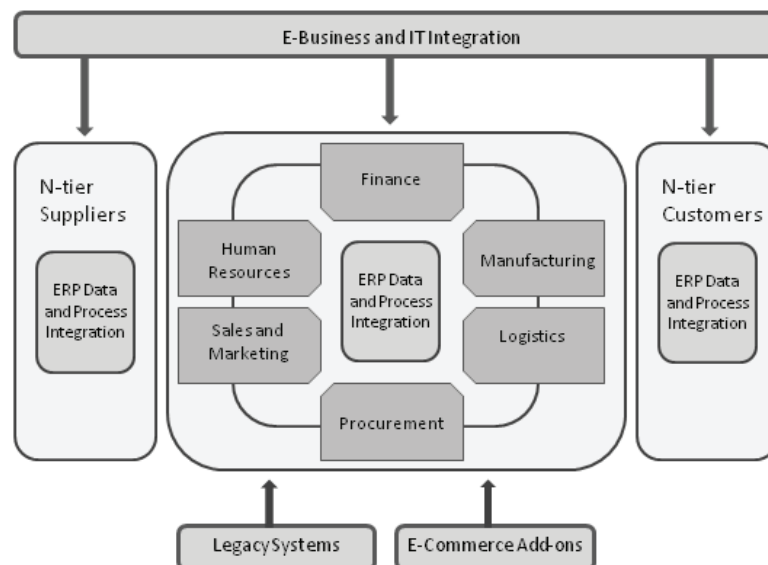
wide systems, called enterprise resource planning (ERP) systems, which represent the logical extension of the material requirements planning (MRP) systems of the 1970s and of the manufacturing resource planning (MRP II) systems of the 1980s. Interestingly, Akkermans et al. (2003) note that the two trends seem to be evolving independently in industry, although from a managerial decision making perspective they are quite closely linked.

ERP are systems that connect different functions within an organisation, as well as an organisation's supply chain partners (i.e. suppliers, distributors, third party logistics providers), enabling the various business partners and organisational entities to share information, such as order status, product schedules, sales records, as well as to plan production, logistics and marketing promotions. (Gunasekaran and Ngai, 2004, p.280)

Akkermans et al. (2003, p.285) describe ERP as a “comprehensive transaction management system that integrates many kinds of information processing abilities and places data into a single database”. Prior to ERP, data were distributed across several separate databases and information processed through multiple disconnected information systems. Organisations typically maintained separate systems for purchasing, order management, human resources, and accounting. As illustrated in Figure 2, ERP amalgamates these intra-organisational sub-systems into a single seamless overarching system. Information system fragmentation has been identified as one of the primary causes of information delays and distortions along the supply chain (McAfee, 2002). ERP systems enhance transparency across the supply chain by increasing information velocity and thus reducing bullwhip effects. Akkermans et al. (2003) argue that ERP adoption could be associated with significant gains in supply chain effectiveness.

With the rapid growth of the Internet, the business environment has changed dramatically and enterprises have become more extended in their scope. E-business has changed the definition of enterprise systems. Beyond the core intra-organisational business functions that ERP has traditionally interlinked,

Figure 2. e-business enabled ERP system



e-business drives and facilitates ERP systems to incorporate extra-organisational networks (Wang and Nah, 2001). The new generation of ERP fully integrates and optimises business processes in a transparent virtual internal and external network. Such systems allow real-time collaboration between supply chain partners and forward visibility by sharing large amounts of information along the supply chain. Internet technology provides the bridge between companies and their business partners to make e-business possible, while e-business makes the ERP system more transparent and outward. ERP is not limited to a single company, but may be viewed as an integrated system along the value chain of companies in the same industry, or across industries (Wang and Nah, 2001). Thus, ERP systems can be extended to incorporate additional e-Commerce and e-business operations and thereby increasing supply chain functionality (Olhanger and Selldin, 2003). ERP, by facilitating synchronous decision making, can be viewed as a key enabler of SCI (Su and Yang, 2010).

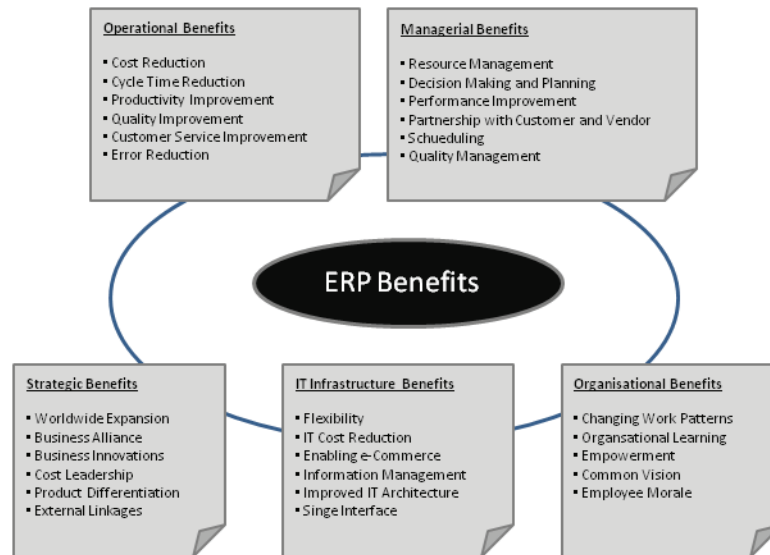
Ackerman et al. (2003) identified a number of key SCM trends for which ERP provides support. These are:

- (1) mass customisation for products that can be configured as a combination of a number of predefined options;
- (2) standardisation of processes and data; and,
- (3) integration of globalised businesses.

By assessing the impact of ERP on SCM, Su and Yang (2010) found mainly positive relationships between ERP benefits and SCM competencies. The authors demonstrated that SCM competencies in a firm's operational and planning and control process are positively impacted by the operational, managerial and strategic benefits of ERP (see Figure 3). A firm's operational process is hereby referring to a firm's competencies to facilitate order fulfillment across the supply chain by linking internal and external supply chain components. The term 'planning and control process' refers to the design, application, and coordination of information to enhance purchasing, manufacturing, customer order fulfillment, and resource planning. Operational benefits are defined as the benefits of ERP systems that result from automating cross-functional processes - i.e. the use of data to better plan and manage production, manpower, inventory and physical resources, and from the monitoring and control of the financial performance of products, customers, business lines and geographic areas. Managerial benefits of ERP are expected to improve the day-to-day business process, resulting in long-term benefits such as improved customer responsiveness, improved customer satisfaction, on-time delivery, and improved decision making. Strategic benefits arise from the system's ability to support business growth, reduce the cost of maintaining legacy IT systems, and to capture the benefits derived from facilitating business learning, empowerment of staff and higher employee morale and satisfaction. IT infrastructure benefits involve business flexibility, IT cost reduction, and increased IT infrastructure capability. Organisational benefits include the support of organisational change, the facilitation of business learning, employee empowerment and the building of a common vision.

The managerial and strategic benefits of ERP show the greatest impact on SCM competencies in the behavioural process. The term 'behavioural process' refers to the behaviour that fosters supply chain coordination and includes relationship integration. Stock et al. (2000) assert that high levels of external integration are characterized by collaborative activities with suppliers and customers, i.e. by a blurring of organisational distinctions between the logistics activities of a firm and its suppliers and customers. In the study conducted by Su and Yang (2010), IT infrastructure and organisational benefits do not di-

Figure 3. ERP benefits



rectly impact SCM competencies. The authors explain this finding by noting that the integrative design of ERP systems increases the complexity involved in source code modifications. Many companies significantly underestimate the effort for modification.

However, Akkermans et al. (2003) identify four shortcomings in ERP:

- (1) lack of extended enterprise functionality;
- (2) limited flexibility in adapting to changes in the environment;
- (3) limited advanced decision support functionality; and,
- (4) lack of (web-enabled) modularity.

The authors note that these shortcomings can be overcome by implementing and using various add-ons, such as connectivity software, processware, data warehousing tools, or supply chain execution systems. According to Akkermans et al. (2003) traditional ERP systems were never designed just to support SCM, particularly across multiple enterprises. Their architectural advantage of being fully integrated for one firm may become a strategic disadvantage in a dynamic business environment, where modular, open and flexible IT solutions are required.

E-PROCUREMENT AS AN E-ENABLED SUPPLY CHAIN FUNCTION

One of the key links in the supply chain is supply management as it sets the foundation for other links in the chain. It is at the supply end where most of the expenditure on supply chain activities exist (Pretutti, 2003). Reducing procurement costs can have a powerful effect on a firm's finances – a 5% cut can translate into a 30% jump in profits (Kothari et al., 2005). E-procurement represents an implicit part of supply management, whereby Internet technology is applied to facilitate corporate buying. It pervades

each major component in the purchasing process. Within the realm of e-procurement, the concept of e-design has emerged to facilitate supplier involvement in the specification development process of a product. It facilitates reduced time-to-market cycles by overcoming the silo-effect of the traditionally sequential design activities (Presutti, 2003).

The use of the Internet also facilitates e-sourcing, which is the process of finding new potential suppliers using ICT with the aim of decreasing search costs. Identifying new sources of supply increases competition during the tendering process. E-tendering is the process of sending RFx to suppliers and receiving responses electronically. The three types of RFx commonly used for sourcing are: RFI (request for information), RFP (request for proposal), and RFQ (request for quotation). RFIs typically involve a potential buyer asking a seller to provide additional information on a product or process. RFQs involve a potential buyer requesting a specific price for given items, while RFPs tend to include both a quote and a qualitative description of the work to be done (Huber and Wagner, 2007).

Presutti (2003) notes that some of the earliest e-procurement solutions focused on establishing ordering routines and reducing transaction costs associated with operating resource purchasing for typically maintenance, repair and operating (MRO) supplies by automating the requisitioning to payment cycle. E-business in procurement can enable organisations to order products in online catalogues or desktop purchasing systems whereby the requisitioner's authorisation is electronically checked. The order information can electronically pass through various checking procedures, e.g. authorisation by relevant managers or directors. Once cleared, the order can be aggregated with others to the same destination and issued electronically to the supplier. This process flow reduces operational costs, improves process efficiency, delivers greater centralised control over purchasing and may increase negotiating power with suppliers through order consolidation (Huber and Wagner, 2007). Supplier evaluation and rating is a final step in the purchasing process, which requires extensive and accurate performance data. In comparison to the traditional paper-based system, e-procurement solutions provide data warehousing capabilities that capture and retrieve data to conduct effective and efficient supplier performance assessments.

Organisations can also take advantage of virtual electronic purchasing consortia (EPC) to electronically conduct tasks that are necessary for the management of demand aggregation between two or more legal entities. EPC can exploit the potential of economies of scale and scope without the diseconomies of increased transaction and communication costs (Corsten and Zagler, 1999) and result in average net reductions in purchasing costs of over five per cent and a return on investment of over 70 per cent (Huber et al. 2004). EPC can deliver the required volume (especially for smaller firms) to carry out reverse auctions. An electronic reverse auction is a buyer-initiated quotation process, where purchasers post an RFQ for a product, while suppliers electronically bid against each other in a progressive way and compete in an online bidding event to achieve a sale for the requested product. Reverse auctions are based on game theory, with dynamic price applications used to streamline the RFx process. Only pre-qualified suppliers might be allowed to bid electronically for a specific demand. Reverse auctions may make a contribution to the EPC sourcing process when:

- The addressed markets are fragmented;
- A critical mass and global sourcing expertise is needed;
- Standardisation of products is desired; and,
- Transactions costs are high.

However, implementation of reverse auctions has not been without controversy, because they can be contradictory to the long-term benefits associated with collaborative buyer–supplier alliances. This perceived conflict is primarily caused by the emphasis of reverse auctions on awarding business based on aggressive price competition and increased supplier transparency instead of long-term total cost of ownership (TCO) considerations (Huber and Wagner, 2007). New technology providers such as e-marketplaces can facilitate electronic procurement processes.

E-MARKETPLACES IN SUPPLY CHAIN MANAGEMENT

B2B e-marketplaces represent a recent innovative development, which has been hypothesised to optimise procurement processes and to add significant value in organisations' supply chains. This section examines the nature and evolution of e-marketplaces and goes on to identify key adoption drivers and benefits based on recent research.

e-Marketplace Definition and Evolution

Laseter et al. (2001, p.1) define an e-Marketplace as a “forum that leverages the Internet to facilitate commerce among businesses including a wide range of entities — from independent or pure-play dot-coms financed by venture capital, to industry consortia backed by pooled funds, to private networks created by individual companies.”

A B2B e-Marketplace is facilitated by IT, where numerous buyers and suppliers in special markets get together to seek information and to buy and sell goods and services (Bakos, 1998; Koch, 2002) at a fixed or dynamic price which is determined in accordance with the rules of the exchange (Sculley et al., 1999), with the e-Marketplace charging commissions for the products they help to move. B2B e-Marketplace functionalities are based on the Internet and thus have an advantage over traditional ERP systems in terms of the ease of communication links across geographical boundaries and with external enterprises. EDI and ERP systems typically run proprietary software and therefore many firms are not totally committed to these systems because of high operating costs. An e-Marketplace by contrast is usually sponsored by a third party with non proprietary software enabling every business to use and share data at lower costs. This creates a more level playing field as small and large firms are able to participate in electronic markets (Eng, 2004).

According to IBM et al. (2000), e-marketplaces built upon a shared Internet-based infrastructure can provide firms with a platform for (see Figure 4):

- Core business transactions that have the potential to automate and simplify the requisition-to-payment process online, together with procurement, customer (relationship) management, and marketing/selling;
- A collaboration network for product design, supply chain planning and optimisation, as well as fulfilment processes;
- Transparent product information that is amassed into a universal classification and catalogue structure;

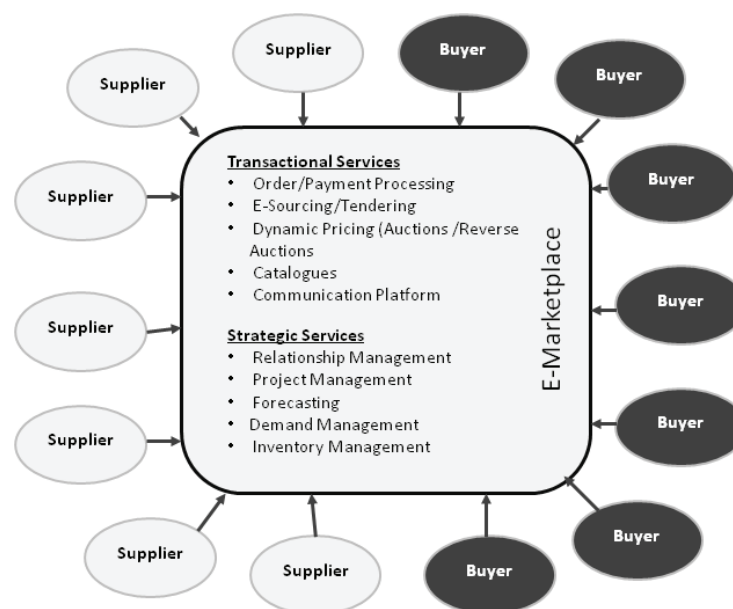
e-Business in Supply Chain Management

- A setting where sourcing, negotiations, and other trading processes such as auctions can take place online and in real time; and,
- An online community for publishing and exchanging industry news, information, and events.

B2B e-Marketplace capabilities can change traditional SCM processes by lowering costs and increasing speed of response to supply and demand needs. A distinct benefit is the facilitation of EPC and the associated reduction of purchasing costs through higher volume contract terms by aggregating purchasing across divisions and companies. Suppliers can increase sales channels to geographically remote locations at lower selling costs through lower inventory requirements, improved order accuracy, and streamlined electronic processes (IBM et al., 2000).

E-marketplaces can focus vertically (operating in only one specific industry), but also focus horizontally (across various industries). Horizontal e-marketplaces are often well suited to buying indirect inputs such as MRO, which tend not to be industry specific. Vertical e-marketplaces, by contrast, are well suited to buying direct or strategic goods that are incorporated into the final product. Another classification of e-marketplaces is into open, buy-side and sell-side systems. Open e-marketplaces can be distinguished from a buy-side system insofar as it must be a neutral community not only to buyers, but also to sellers, thereby considering the interests of both purchasers and sellers. Buy-side solutions are governed by one organisation (private e-business solution) or several firms (consortia-led solution) and are set up to support the purchasing processes. A sell-side solution typically comprises a supplier and multiple buyers and is initiated by suppliers and distributors to support their sales processes. Sell-side solutions can be direct ordering on supplier websites or seller-led e-marketplaces (Huber and Wagner, 2007). Baldi and Borgman (2001) also identify 'meta' e-marketplaces that are formed by a group of independent market providers who collaborate and exchange requests and offers by interconnecting their e-marketplaces to increase liquidity.

Figure 4. Networked e-marketplace model



e-Marketplace Adoption Drivers and Benefits

Recent research, undertaken in the airline industry, has examined the impact of B2B e-marketplaces on organisations' supply chains by investigating adoption drivers and performance indicators (Wagner and Smyth, 2006). The authors developed industry-specific constructs by viewing e-marketplaces as a technological innovation and examining the contexts in which e-marketplaces are adopted. The airline industry lends itself as a case in point for investigation as airlines have been using ICT and EDI standards to support the procurement of goods and services for more than 40 years (Neil and Purchase, 2004). Within the realm of their study, Wagner and Smyth (2006) note that firm size has a significant effect on e-Marketplace adoption, whereby smaller organisations often adhere to more traditional forms of purchasing. Larger firms seem to be less subjected to knowledge and technology barriers. Other drivers or strategic stimuli for e-Marketplace adoption include the extent of strategic partnerships, the level of overall ICT sophistication and the level of Internet services used. In contrast to theoretically derived expectations, factors such as pressures from the business context, the level of resource/information sharing, the extent of outsourcing and joint procurement integration, and the purchasing organisation centralisation / decentralisation could not be confirmed as adoption drivers. The findings further suggest that e-Marketplace use is positively related to overall satisfaction with and performance of an organisation's procurement practices. E-marketplaces do reduce procurement related search costs. Other benefits typically occur in the facilitation of order processes, higher transparency of suppliers, reduced inventories, product price reductions and reductions in purchase order costs. In a similar manner Eng (2004) found that the most notable transactional benefit from e-Marketplace participation is lower unit costs of procurement, followed by dynamic and global sourcing by being able to unload excess inventories and to source more competitively. E-marketplaces contribute to higher SCM efficiency due to reduced time between billing and payment and efficient exchange of information. The latter is also seen as the key strategic benefit of e-marketplaces, along with streamlined SCM processes resulting in increased customer satisfaction. Wagner and Smyth (2006) further note that commodities where markets are fragmented to a higher extent are traded on e-marketplaces to a higher extent than commodities with a rather concentrated supply base. Savings from e-Marketplace adoption, which occur more in process costs rather than product costs, tend to exceed the investment costs. However, e-Marketplace adoption does not have a direct impact on overall financial performance, but on operational effectiveness and efficiency. The findings also suggest that the adoption of e-marketplaces is highly relevant to e-procurement implementation among airlines. The results also suggest that many companies in the industry still make only rudimentary use of all offered services although the overall e-Marketplace diffusion level is relatively high.

Eng (2004) researched which SCM e-Marketplace functions companies use. The most popular use of the e-Marketplace is in auctions and reverse auctions (52%), followed next by processing as regards online ordering, payment, non-technical negotiations, and customer or supplier information management (47%). E-marketplaces are further used for listing products or making purchases from catalogues (35%), searching for buyers or sellers (33%), and for improved online communications and exchanges of information (25%). However, technical exchange and development (11%) is the least subscribed function. Inter-firm relationship management (14%) and collaborative project management (14%) reported a low percentage of usage. Eng's (2004) research thus proposes that e-marketplaces are more popular for transaction-based exchange than the strategic type of exchange. In particular, the auctions facility of an e-Marketplace exhibits the most significant contribution to unit cost reduction. By comparison, the most significant contribution of e-marketplaces to streamlined supply chain operations is improved

communication and information exchange. To summarise, an e-Marketplace facilitates the procurement process by using the Internet as a platform for communications. An e-Marketplace provides the basis for one-off transactions without requiring long-term commitment, or negatively affecting supply chain processes in a significant manner (Eng, 2004).

Wagner and Smyth (2006) note, however, that there are still a number of challenges ahead for e-Marketplace implementation. These include further supplier integration, training and education of staff and the development of further e-Marketplace services, as the technology is often not yet ready to support the range of airline requirements. Overall, research indicates that industries that are information intensive derive more advantages from e-Marketplace implementation and are more likely to advance with the technology.

FUTURE RESEARCH DIRECTIONS

E-business has not only to deal with technology, but also a range of important human and organisational issues. Studies of ICT-based systems in organisations consistently demonstrate that insufficient consideration of a system's social environment and the relationships between people and technology has been a major reason why investments have often been assessed as being a failure, or only a partial success (e.g. Nathan et al. 2003). The technical and social aspects (i.e. "hard" and "soft" wiring) of e-business need to be designed and optimised concurrently. Without top management support, e-business is difficult to implement successfully. For smaller firms in particular, where resources and ICT/IOS sophistication are limited, the lack of financial resources, managerial and technological skills and system integration can inhibit e-business adoption. More adequate training and education in e-business and change management is a critical factor for the future, as companies tend to express hesitation about the use of emerging e-business technologies. Further research needs to focus on these issues.

Some of the barriers to e-business adoption are related to human factors (e.g. insufficient leadership, unwillingness to cooperate, resistance to change, inertia, lack of trust, personal insecurity, fear of losing jobs, threat of being by-passed by technology, communication problems and difficulties in aligning the processes and cultures of partner companies). Other barriers relate to structures, processes and systems (e.g. lack of resources, the plethora of different standards, lack of services provided by e-marketplaces). Many organisations have focused on a few key e-business services to date, but are not considering potential benefits across the range of services available and across the supply chain (Huber et al. 2004). Currently available e-business solutions are still some way from covering the entire spectrum of business requirements and relatively few options are readily available to support or automate complex activities. They have the potential to evolve from matchmaking or transaction support focus to knowledge and trust networks, where common workflows can enable SCM on a more widespread basis in future. However, more research is required to better understand these issues across a variety of business contexts and sectors.

CONCLUSION

So far, however, we are still in the first stages of increasing the recognition of the potential of e-business. Many organisations still lack an effective ICT infrastructure, which may organise, support and facilitate

the highly complex and often rapidly changing interfaces among the organisational entities and disciplines involved in business processes. It is important to note, however, that organisation embarking on an e-business processes. It is important to note, however, that organisation embarking on an e-business initiative have to consider a sensible alignment of technology (as an enabler) with their business strategy in order to be successful. The introduction of e-business might serve as a ‘Trojan Horse’ to enforce necessary changes in organisational structures and processes (e.g. part standardisation or use of a single coding system). E-business can drive new organisational forms (such as a virtual organisations), fulfill certain tasks in the inter-firm context and allow firms to improve supply chain processes. Therefore, e-business has a vital role to play in integrated SCM.

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