BUSINESS MODELS FOR INTERNET-BASED E-PROCUREMENT SYSTEMS AND B2B ELECTRONIC MARKETS: AN EXPLORATORY ASSESSMENT

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ABSTRACT

Information technology (**IT**) has long been applied to support the exchange of goods, services and information between organizations. Early on, when *interorganizational information systems* (**IOIS**) like EDI systems were introduced, electronic markets emerged for business purchasing. However, it is only with the advent of *Internet-based e-procurement systems* and *business-to-business* (**B2B**) *electronic markets* that the real opportunities for *any-to-any* (**A2A**) online transactions have opened up across space and over time. The extensive connectivity offered by online trading networks creates value by lowering communication and search costs. But this benefit is just one aspect of what is desired by adopting firms. The other aspect is that purchasing firms expect to maintain established long-term relationships with preferred suppliers. As a result, *private aggregating and negotiating mechanisms* are being adopted for large quantity business supply purchases, while *public market mechanisms* are more often adopted when firms face uncertain and high variance demand. This paper draws on IS and economics theory to investigate the motivation for the various online business models, and the adoption requirements of purchasing firms, through the examination of a set of mini-cases.

Keywords: Business-to-business e-commerce, buyer-supplier relationships, e-business, electronic markets, e-procurement, interorganizational information systems.

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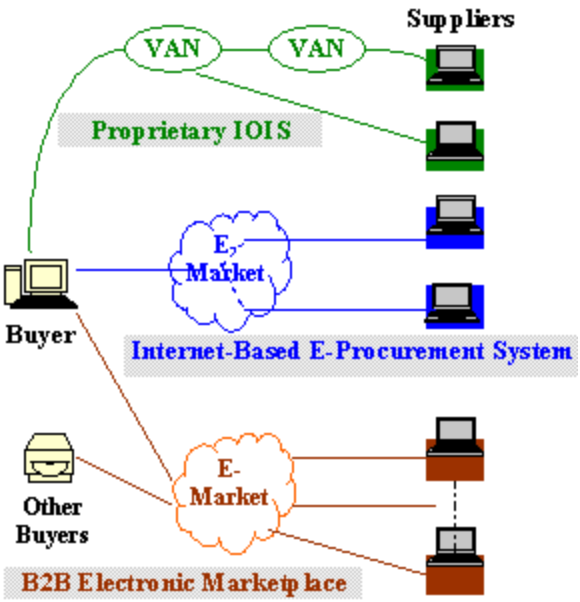
1. INTRODUCTION

Information technology (**IT**) has been applied to support information sharing between organizations and to streamline corporate purchasing. Such *interorganizational information systems* (**IOISs**), as they are often referred to, can form electronic marketplaces where buyers and sellers in a vertical market can exchange information and make transactions (Bakos, 1991). Before the commercial application of the Internet and the World Wide Web, proprietary information systems such as electronic data interchange (**EDI**) systems were the major means by which firms exchanged business documents electronically in a standard machine-processable format. Although the EDI systems continue to enable firms to achieve more efficient data and information management and to improve supply chain management, there are still a lot of companies that do not yet use EDI due to the relatively high costs of implementing and running such systems (Waltner, 1997). These costs include the investments in installing the systems and the expenses involved in leasing communications networks, or value added networks (**VAN**s), among other cost drivers.

Internet-based e-procurement systems and *business-to-business* (**B2B**) *electronic marketplaces* are different from *proprietary IOISs* that involve EDI. They are open systems that enable firms to reach and transact with suppliers and customers in virtual markets without investments in dedicated systems. Figure 1 displays the above three IT-enabled procurement mechanisms.

Figure 1. IT-Enabled Procurement Mechanisms



According to a recent report, the value of goods and services sold via B2B electronic markets will reach $2.7 trillion by year 2004, representing some 27% of the overall B2B market and almost 3% of global sales transactions (Gartner Group, 2000). This growth is slated to occur in the context of a global market for B2B transactions worth $953 billion, growing to about $7.29 trillion by 2004 (Gartner Group, 2000). With more corporate procurement completed online every month, the number of virtual marketplaces in the United States has soared from 300 in June 1999 to more than 1000 in 2000 (Girishankar, 2000). It is clear that by offering lower prices and a wider range of suppliers, electronic markets are changing the way firms procure their materials, equipments and supplies.

By connecting in the new electronic marketplaces of the World Wide Web, a buyer firm is able to streamline its purchasing activities electronically, even when not all of its suppliers can automatically process electronic orders. For example, H-E-B Food Stores, a $7-billion supermarket chain, purchases its wholesale supplies via Inc2Inc.com (www.Inc2Inc.com), a new electronic marketplace, instead of using proprietary extranets. H-E-B Food Stores does this because it has suppliers who do not have automated computerized systems, but still they can be integrated for purchasing via the Internet and a Web system (Girishankar, 2000). In this way, H-E-B Food Stores is still able to transact with those suppliers, even when the company is in the midst of automating its purchasing processes. Recognizing the benefits from its initial testing, the firm plans to move 80% of its procurement online.

B2B electronic markets function as *digital intermediaries* that focus on *industry verticals* or *specific business functions*. They set up virtual marketplaces where firms participate in buying and selling activities after they obtain membership. For example, CheMatch.com (www.chematch.com) is a B2B exchange for buying and selling bulk commodity chemicals, polymers and fuel products. Firms subscribing to CheMatch.com can log onto its virtual exchange floor, and then post requests to buy and offers to sell, and respond to offers. When two firms agree to transact, the transacting terms are faxed to both parties and the deal is settled. The marketplace creates value by bringing buyers and sellers together to create *transactional immediacy* and *supply liquidity*, and by supporting the exchange of demand and supply information.

E-procurement systems are usually integrated with corporate enterprise systems and organizational intranets. They typically consist of two parts. One part resides on the top of the company's intranet behind its firewall, where employees can search and place order for desired supplies. The purchase orders, after they have been approved and consolidated, are sent out to a third party, usually a neutral electronic marketplace. This is where the second part of the e-procurement system resides. At the electronic marketplace, these orders are transformed into various formats according to different protocols so that they can be received and processed by different suppliers. The major benefits of adopting e-

procurement systems are reduced operating costs and searching costs, which lead to high returns on investments.

With electronic catalogs, electronic auctions and other capabilities supported by the new electronic markets, buyers can do one-stop, comparison shopping for thousands of suppliers and select the best source in real time. At the same time, they do not need to make a commitment to a dedicated procurement IS infrastructure. This, obviously, is very attractive to many firms, since it is likely to be cost-minimizing for many, and it makes clear the rationale for why new electronic markets are being started every month. Indeed, electronic markets are now operating in a variety of industries, including industrial metals, chemicals, energy supplies, food and grain, construction, automotive and so on. Moreover, both industrial materials (e.g., see www.freemarkets.com) and maintenance, repair and operating supplies (**MRO**) (e.g., see www.mro.com) can be transacted online. Today, not only goods, but also services are being procured via the electronic markets of the Internet. (See Table 1 for other examples in the various industries.)

Table 1. Industries with B2B Electronic Markets

INDUSTRY	B2B E-MARKETS	COMMENTS
Metals	e-STEEL.com MetalSite.com	E-markets for steel and metal products
Autos	AutoXchange.com GMTradeXchange.com	Buyer driven e-markets in a concentrated industry
Energy	Altra.com YOUtilities.com	Trading portals for electrical power and natural gas
Life Science	SciQuest.com Chemdex.com	E-markets for chemical reagents and lab instruments
Petroleum	Petrocosm.com WorldOil.com	E-markets of equipment and services for oil and gas companies
Construction	Bidcom.com Buzzsaw.com	E-markets integrating business models of building industry
Foods	Inc2Inc.com Instill.com	E-markets for food wholesale
Chemicals	ChemConnect.com CheMatch.com	E-markets for bulk chemicals

The boom of e-procurement systems and B2B electronic markets brings firms to vast virtual markets. For example, according to FindMRO.com's website (www.findmro.com), this DotCom player can provide access to more than 5 million items from some 12,000 suppliers. Buyers will be able to purchase in a much larger supplier base with lower search and communication costs via the electronic markets than ever before, and thus will benefit from better deals with respect to prices and product features.

However, previous research reports that buyers possibly do not necessarily like to take full advantage of the opportunities of enlarging their supplier base. Instead, they may prefer to transact with just a handful suppliers so that the suppliers have incentives to make specific investments in systems that enable and support buyer-supplier coordination (Bakos and Brynjolfsson, 1993). In addition, reducing the coordination costs will lead to more interfirm coordination and information exchange, resulting in closer interorganizational relationships (Clemons, Reddi and Row, 1991). Since there are set-up costs for establishing integrated buyer-supplier relationships, to safeguard these relationship-specific investments and to achieve economies of scale in transacting, buyers will prefer to develop partnerships with a small supplier group (Dyer, 1997).

With the advent of Internet-based electronic markets, will the concern about buyer-supplier relationships affect the buyer's adoption of e-procurement systems and electronic markets? Will electronic markets change buyer-supplier relationships, or accommodate the requirements of relationship management? What will buyers do in adopting e-procurement systems and electronic markets?

In our view, the answers to these questions form the underlying motivation for the business models of current e-procurement systems and B2B electronic markets. In this paper, we will start by analyzing these business models in greater depth to identify the value created by electronic markets and the potential effects of these virtual markets on buyer-supplier relationships. This will enable us to develop a clearer understanding of why, when and how buyers adopt e-procurement systems and electronic markets. We will argue that it is the purchasing firms' adoption requirements that shape these business models to a greater extent than anything else.

2. THEORETICAL BACKGROUND

IS and economic research on IT and its impacts provides a rich resource for studying the various business models of B2B electronic markets and the dynamics of adoption of e-procurement systems and electronic markets. In this paper, we consider three specific literatures: research on the electronic markets hypothesis, buyer-supplier relationships, and technology adoption in the presence of network externalities.

The Electronic Markets Hypothesis (EMH)

More than a decade ago, Malone, Yates and Benjamin (1987) formulated the *Electronic Markets Hypothesis* (**EMH**), and presented a prediction about how network technologies would change markets that has been the subject of great debate ever since. According to the EMH, electronic markets were predicted to be the favored mechanisms for coordinating material and information flows among organizations in the presence of electronic communication technologies. Such technologies would create

an *electronic communication effect*, according to the authors, which, in turn, would lower communication costs, enable the electronic aggregation of demand and supply information, and, as a result, enhance the ability of firms to more closely coordinate their economic activities. They would also create an *electronic brokerage effect*, making it increasingly possible for technologically-capable intermediaries to replace traditional middlemen and reducing *transaction costs*.

Since the time that Malone, Yates and Benjamin made their initial predictions, it has become much quicker and more convenient for buyers to screen suppliers and product offers using the electronic communication and information sharing capabilities of the World Wide Web. As a result – and as the theorists predicted – less time and effort are required now than ever before to search for prices and product information when buyers shopping in electronic markets.[1] In the presence of lower search costs, buyers tend to search for more information, and thus seller prices become lower and more dispersed (Bakos, 1997). The results are that the buyer can consider more alternatives. In addition, the quality of the alternative that buyer selects will improve, and the costs of the entire product selection process will decrease. Lower price and product information search costs are among the major benefits that buyers expect from adopting electronic markets.

In addition to discovering price and product information, electronic markets are also playing the role of *digital intermediaries* (Bailey and Bakos, 1997). Demand and supply information can be aggregated and disseminated, and buyers and sellers can be matched in electronic markets, just as an expert non-technological intermediary would be able to do. Facilitating mechanisms for transaction settlement also can be provided so that logistics and payment can be arranged. Moreover, industry-specific expertise is an important asset that electronic market intermediaries are able to leverage. This is an important factor that has enabled traditional intermediaries to *reintermediate* or recapture market share in electronic commerce (Chircu and Kauffman, 2000). When the business process or the product selection procedure is complex, expert advice can save buyer time and effort spent on purchasing. Thus, one would expect that both market facilitation and expert services will become integral parts of the offerings associated with the new electronic market business models of the World Wide Web.

Traditional B2B electronic markets are IOISs through which buyers and sellers in a vertical market can exchange information and make transactions (Bakos, 1991). Researchers have found that IOISs can enable firms to make significant improvements in the efficiency of their supply procurement processes. For example, Mukhopadhyay, Kekre and Kalathur (1995) report on the effects of Chrysler Corporation's

[1] Whether they save money in the process, especially in the case of such popular retail market applications as airline ticket, rental car and hotel room reservation-making, where price and flexibility comparisons are paramount, is another question. Intermediated solutions may still be more efficient. See Berghel (2000) for an interesting viewpoint on the inefficiencies of transacting on the World Wide Web.

adoption of EDI systems. Their results show that the firm obtains approximately $100 in savings per vehicle, attributable solely to electronic document preparation and better information exchange. Similarly, Choudhury, Hartzel and Konsynski (1998) show that electronic markets can also improve purchasing efficiency in the aircraft parts industry.

Buyer-Supplier Relationships

In spite of the benefits of electronic markets, IOISs have not been as widely adopted as one might expect, especially among smaller firms, which have failed to find the robust technical standards that are needed to make IOIS adoption economical.[2] In addition, an IOIS network usually has a small number of suppliers and does not function like a pure market. This is because an individual supplier's benefit decreases when there are more suppliers participating in the IOIS network (Riggins, Kriebel and Mukhopadhyay, 1994). Furthermore, as the network size increases, the bargaining power of each individual firm in the network decreases and in turn, individual incentives to make non-contractible investments decrease (Bakos and Brynjolfsson, 1993).

However, for buyer-supplier transactions, it typically is difficult and, quite realistically, even impossible, to contract for all of the efforts that a supplier must make in such a relationship. For example, efforts expended in the areas of technological innovation and quality improvement may be *non-contractible*. In order to encourage the supplier to maintain the appropriate incentives to make these *relationship-specific investments*, the buyer will tend to keep its supplier network smaller than what might otherwise be predicted, in a marketplace with greatly reduced search costs.

Clemons, Reddi and Row (1993) proposed, at the same time, the *move to the middle hypothesis* for the impact of IT on interfirm relationships. On the one hand, as IT increases the information availability and processing capacity, coordination costs, operations risk and opportunism risk are all reduced. The results are reduced need for ownership and more outsourcing due to lower transaction costs. On the other hand, reducing the transaction costs will lead to more *explicit coordination* which generates highly integrated interorganizational relationships involving significant investment in human relationships and organizational processes. In order to recoup these specific investments, firms will choose to allocate businesses among fewer suppliers over a long period of time. In addition, increasing the level of explicit coordination will increase product differentiation, which in turn will increase search costs and thus decrease the benefits of search among a large number of suppliers. Combining these factors with the need to give suppliers incentives for making *non-contractible* investments, Clemons, Reddi and Row

[2] Personal communication with Andrew Marchesi, National Account Representative, SPS Commerce (www.spscommerce. com), October 18, 1999. Marchesi argues that the new WWW-based capabilities are creating a renaissance in opportunity for consulting firms that previously specialized in proprietary EDI-based solutions, and are now moving to embrace the new technical solutions associated with the Internet.

(1993) concluded that firms will favor developing long-term value-adding partnerships with a small group of suppliers.

Adoption of Network Technologies

With the development and popularity of the Internet and the World Wide Web, e-procurement systems and electronic markets have evolved as new channels for corporate purchasing. Internet-based electronic markets provide open transaction networks where a large number of potential buyers and sellers are able to participate without the restrictions of time and space. For a buyer, the more suppliers in an electronic market, the more purchase alternatives it can consider, and the more benefits it can extract from the low search costs provided by Internet technologies. For a supplier, the more buyers in an e-market, the more reach its products achieve, and thus the better are the firm's chance of increasing sales. On this basis, we argue that the organizational adoption of electronic markets must take into account the extent of the *network externalities* that a particular solution offers. In this instance, network externalities refer to the installed base effect of buyer and supplier participants, which together enable the market to achieve its presence and size. Clearly, the larger the installed base of participants (buyers from the point of view of a seller, and sellers from the point of view of a buyer), the greater will be the business value of an electronic market solution.

To increase the size of its market, an *electronic market maker* typically aims to connect many players that employ different technologies in their procurement activities. When firms consider adopting *any* new technology in the presence of network effects, the compatibility of the new technology with older technologies that form the current core of the industry's solutions typically will determine the success of the new technology. Only with such considerations made will the new technology generate the *demand-side economies of scale* that will permit it to succeed in the marketplace (Farrell and Saloner, 1992; Katz and Shapiro, 1994).

When there is little compatibility, users of the new technology will have to incur the costs of *transient disconnectivity*: they may not be able to link with the established pool of users of the old technology, and lose part of their revenue stream in the process. Anticipating the incompatibility, potential adopters may not choose the new technology, even if the total benefits of the new technology are greater than those of old (Farrell and Saloner, 1986). By the same token, compatibility between "the networks" will serve to boost adoption. Illustrating the demand-side economies of scale that lead us to this conclusion, Kauffman and Wang (1999), in their study on the adoption of national level electronic banking networks, showed that both CIRRUS and PLUS enjoyed significant growth. This occurred even after they became compatible with each other, and when the individual networks had long been viable on their own.

Two mechanisms can be used to achieve compatibility: *standardization* and *adaptation* (Katz and Shapiro, 1994; Farrell and Saloner, 1992). *Standardization* requires that all technologies follow the same specification so that components of various implementations of the adopted solutions are interchangeable. When standards for electronic procurement are adopted, the users of one system can communicate directly with the users of other systems, saving the ongoing costs of keeping two systems up to date, while enjoying the benefits of network effects. The primary drawback of standardization in this context is the reduction of variety that might be desirable in the presence of *heterogeneous preferences* for e-procurement. *Adaptation* occurs when "adapters" or "converters" are attached to the components of a system. They enable it to interface with systems employing other technologies, resulting in at least *partial compatibility*.

Since they are widely perceived by senior managers in IS as new ITs that support corporate purchasing, Internet-based e-procurement systems and B2B electronic market solutions need to be compatible to the greatest possible extent with the existing technologies, to have a reasonable chance to be widely adopted in the marketplace. They must be especially compatible with traditional IOISs like EDI systems. This is particularly important for those firms who have already had and would like to keep electronic linkages with their suppliers. Therefore, one would expect that e-procurement systems and electronic markets will provide functions that ensure that they will be compatible with traditional IOISs, and even other electronic market-based networks.

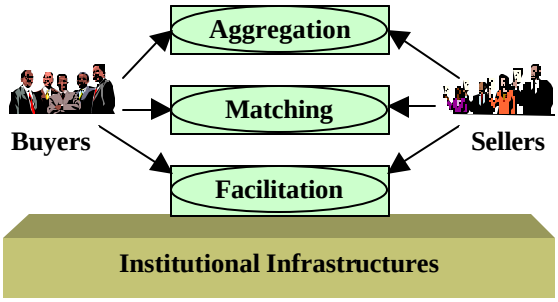
3. ANALYSIS OF E-PROCUREMENT SYSTEMS AND B2B ELECTRONIC MARKETS

Markets are developed to support exchanges of information, goods and services between buyers and sellers. Let's take a closer look at their capabilities and how they are supported with the new technologies of the Internet.

Capabilities of Electronic Markets

There are three major *market functions: matching demand and supply, facilitating transactions* and *providing institutional infrastructures* (Bakos, 1998). As *digital intermediaries*, B2B e-markets also fulfill the tasks of aggregating product information and discovering price (Bailey and Bakos, 1993), and providing procurement and industry-specific expertise. These functions are exhibited in Figure 2.

Figure 2. Market Functions



To aggregate buyers and sellers, electronic markets collect and compile supplier catalogs so that buyers can browse and search for products. To match buyers and sellers, electronic markets provide dynamic pricing and negotiating mechanisms such as exchanges and auctions. With the development of electronic markets, facilitating functions are gradually attracting more and more attention. Support for logistics and financial payment are either incorporated to the e-market services or are provided by dedicated electronic markets. Since online markets operate under the same institutional infrastructures as the traditional markets, we will not discuss any of the institutional aspects in this paper.

Aggregation

We next turn to a consideration of electronic catalogs and the manner in which they provide the necessary capabilities for *aggregation*. We will also discuss the rationale for using them in electronic markets, and the forms in which we observe them being implemented.

Electronic Catalogs. *Electronic catalogs* are the major means for searching out product information in e-procurement systems. A user firm of an e-procurement system needs to request its suppliers to distribute their catalog content to the particular electronic market to which their e-procurement system is connected. The market maker categorizes and normalizes the catalogs according to the buyer's requirements, eliminating the headache of adapting data formats and sorting out the specifics of presentation to the electronic market maker. A copy of this aggregated catalog is also hosted on the buyer's intranet. Employees in the buyer company can browse the catalog and place orders for the product, and the orders will be transmitted to the electronic market, through which they will be sent to the appropriate suppliers in specified individual formats. To start this process, the buyer and the suppliers usually have to establish contracts for the products in the catalogs. As a result, the buyer is able to pre-select business partners and to retain pre-qualified supplier relationships. At the same time, these electronic markets also publish the product catalogs from other suppliers and thus make it convenient for buyers to recruit new suppliers.

We next discuss two examples involving typical forms of B2B electronic markets that aggregate product information. The first one features a *private, buyer-specific cataloging*, while the second one provides *public, buyer-neutral cataloging*.

Private, Buyer-Specific E-Cataloging. Consider the following example involving Schlumberger, Inc., a Texas-based oil exploration and technology services company. The firm uses Commerce One's (www.commerceone.com) e-procurement solution system for purchasing supplies via the Internet (Oven, 2000). The Commerce One's *BuySite* procurement system sits on Schlumberger's intranet and is used by the employees to shop for office supplies, technical equipment, furniture and so on. Schlumberger's suppliers post their product catalogs on Commerce One's *MarketSite* (www.marketsite.net). (See Figure 3.) But the catalogs that Schlumberger's employees actually browse are customized with pre-negotiated prices and terms. Purchase orders are sent to Commerce One's *MarketSite* via the Internet and then are transmitted to different suppliers. *MarketSite* not only customizes and aggregates supplier catalogs for buyers, but it also recruits suppliers whose product information is posted.

Figure 3. Commerce One's *MarketSite* E-Market

Public, Buyer-Neutral E-Cataloging. Another ap-plication of e-catalogs is found in the contexts where search costs are high, price volatility is low and purchases are time critical. This is the case of chemical reagent industry and biotechnology industry. Research chemists and life scientists face a myriad of choices when they seek particular reagents or lab equipment. It is difficult for a supplier to have a complete inventory of all possible products. Hence, buyers' search costs are high, and suppliers struggle to target appropriate buyers. Electronic markets emerge here to provide online catalogs.

For example, SciQuest.com's (www.sciquest.com) marketplace provides online aggregated catalogs for products used by pharmaceutical, chemical and biotechnology industry, including nearly 600 suppliers with more than a million products. (See Figure 4.) The data in the online catalogs include detailed chemical structures for chemical and biological reagents, and specifications for lab instruments. The site

makes the search and order processes simple for researchers and scientists. The small quantities of reagents that are used in research usually do not satisfy the requirements of transactional purchasing (where bulk orders are made), but researchers typically cannot wait for an auction to obtain a reagent to proceed with an experiment. So online catalogs are suitable for such circumstances.

Figure 4. SciQuest.com's Scientific Products Market

Buyer-specific catalogs are favored in transactional purchasing, where the purpose of adopting e-procurement systems is to reduce operating costs. This will occur when the purchases occur frequently and with large quantities. Price discovery and search for product information will not be the focus in such situations. For the same reason, supplier selection mostly occurs offline, and buyers often have established long-term relationships with their suppliers. However, system integration and connectivity with suppliers are necessary, since operating costs can only be minimized by the firm by streamlining the whole purchasing processes.

In contrast, in the second example, the public catalog approach greatly lowers search costs when the demand exhibits a high variety and may occur for small lots quantities. And, because the purchases that are made are not done on a frequent basis, the buyer may be unable to identify the relevant suppliers beforehand. In this case, the more product information that an electronic market can provide, the more benefits the buyer will expect to obtain. Hence, public catalogs listing all potential suppliers are highly desirable.

Matching

In electronic marketplaces, firms are able to satisfy their procurement requirements through *dynamic pricing* – where buyers and sellers both actively engage in a process of *price discovery* -- and *negotiation*.

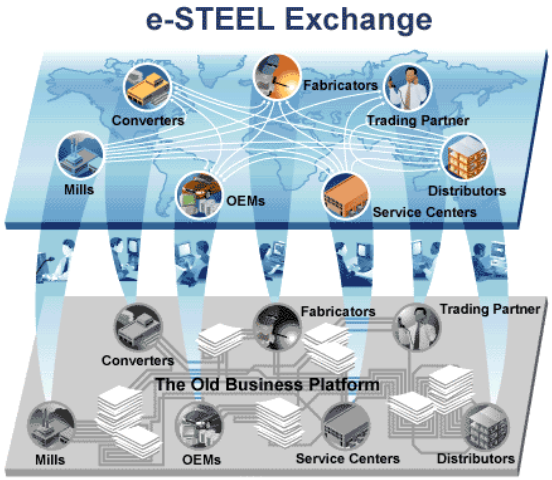
Dynamic Trading Processes. These often take the form of electronic auctions, but are basically *dynamic trading processes*. We identify a number of aspects that define such processes.

- *First*, the criteria for bidding include quality, delivery, warranty and other dimensions, as well as price. All these requirements are specified in requests to buy and offers to sell. Business is awarded not on a *best-price basis*, but on how the offers satisfy the various conditions.
- *Second*, the bidding processes typically will allow for counter-offers to be made. Participants can withdraw, reject, counter or accept offers. They are not required to accept the highest bid.
- *Finally*, both public and private negotiation mechanisms can be found in B2B markets.

Like online consumer markets (e.g., eBay and Priceline), some B2B electronic markets have created open exchange floors where member firms can post offers and submit *requests for quotes* (**RFQs**) to all participants. Some B2B electronic markets even allow member firms to pre-select participants for their bids. Auctions are used as market mechanisms for awarding business within a group of pre-qualified suppliers.

Private Negotiation Mechanisms. Some firms benefit by being able to negotiate deals electronically with various partners, while maintaining privacy. One example of a *private negotiation mechanism* is e-STEEL.com (www.e-steel.com), a portal for firms in the steel industry to exchange prime and non-prime steel products that include hot-rolled, cold-rolled, coated, plate, tin mill and rebar steel. e-STEEL has a interesting business model that reflects some of the capabilities that we have already discussed. (See Figure 5.)

Figure 5. The Private Negotiation e-STEEL Exchange Business Model



Note: The value proposition behind this business model is that it transforms the marketplace by increasing connectivity for participants and reducing reliance on paper documents. See the e-STEEL website at http://www.esteel.com/theexchange.shtml for other relevant details.

For example, steel mills, converters, fabricators and trading companies can apply to participate in the *e-STEEL Exchange*, which operates as a fully electronic market. Member firms can create inquiries to buy and offers to sell, as well as browse existing offers that are posted on this virtual market. In these inquiries and offers, terms about product specifications, shipping and payment are included, in addition to prices. When creating product inquiries, buyers are allowed to choose to whom the inquiries will be sent. For example, inquiries can be sent to an individual e-STEEL member, a group of e-STEEL members, or all members, depending on the perceived interests of the buyer. Similarly, sellers can determine to whom their offers will be sent. After the inquiries and offers are submitted, buyers and sellers then can track the responses to their inquiries and offers, make counter-offers, and carry out effective electronic negotiations. Once an agreement is reached, an electronic advice is sent automatically to the buy-side and sell-side parties in the deal. This model gives member firms a great amount of flexibility in choosing business partners, along with the transaction efficiency.

Such private negotiation mechanisms typically are adopted for purchasing manufacturing materials in large quantity, such as steel products and bulk chemicals. These products are usually of high strategic significance to the buyers, and hence, supplier reliability and qualification are of great concern, possibly even of greater concern than achieving the lowest price. Buyers usually identify qualified suppliers based on their previous purchasing experiences, and they attempt to maintain these established buyer-supplier relationships. Private negotiation helps them to achieve this by rewarding a few pre-selected suppliers with their business, while also enabling them to be able to benefit from low search costs that the electronic market affords.

Public Bidding Mechanisms. It may be beneficial for buyers to adopt a *public bidding mechanism* for their online corporate purchasing when they seek to procure products in small batches. For instance, buyers are sometimes able to find products that cannot be obtained via traditional mechanisms when suppliers wish to dispose of excess inventories. Public bidding mechanisms create great reach for a seller. As a result, they can maximize the likelihood of selling excess inventory, for example. FastParts.com (www.fastparts. com) is a good example of this. Founded in 1991 as an electronic bulletin board for procurement, the company grew into an Internet-based online procurement exchange. Today, it features auctions of used and surplus electronic parts and components. FastParts.com serves the needs of procurement professionals who have to deal with two related challenges:

- carrying excess inventories related to cancelled jobs; and,
- facing inventory shortages for orders that were incorrectly forecast.

On the FastParts.com market, the auctions are open to all member firms, and a firm can be both a buyer

and a seller.

Comparing Market Mechanisms. The above market mechanisms are the major means for fulfilling the aggregation and matching functions in present online B2B markets. Their features are compared in Table 2 regarding the pricing, participating suppliers and purchasing characteristics.

Table 2. Comparing Aggregating and Matching Mechanisms

MARKET MECHANISMS	FEATURES
Private Aggregation	Buyers purchase from preselected suppliers at fixed prices; applicable to frequent and quantity purchases; examples: Ariba Commerce Platform; Commerce One MarketSite
Public Aggregation	Buyers purchase from all possible suppliers at fixed prices; applicable for fragmented markets and for time-critical or small quantity purchases; examples: SciQuest.com; PlasticsNet.com
Private Negotiation	Dynamic pricing with pre-screened suppliers; applicable for procuring production inputs; examples: e-STEEL.com; Chematch.com
Public Bidding	Buyers identify eligible suppliers from member firms via dynamic pricing means; applicable for asset / capacity exchange, surplus assets; examples: FastParts.com; USBid.com

Facilitation

After buyers and sellers agree to transact via the Internet, they still need to arrange for payment and delivery. So other considerations impact the form that markets will take relative to the firms that seek to adopt workable solutions.

Internet-Based Financial Services. Although the present generation of B2B electronic markets primarily focuses on identifying products and suppliers for buyers, online financial settlement is rapidly catching up. What is required is for financial institutions to become more active in providing Internet-based real-time credit and business payment services. American Express, an issuer of corporate credit cards, is partnering with B2B electronic market platform provider, Ariba Inc. (www.ariba.com), to fill the void in Internet-based payment processing systems (Junnarkar, 2000). Ariba also is working with the Bank of America to develop a line of B2B online financial services that will expand to include electronic invoicing, electronic payment capabilities, an automated clearinghouse, wire transfer and foreign

exchange services (Nelson, 2000). Ariba is already well known for its *Ariba Marketplace* and *Ariba Dynamic Trade* capabilities, and the proprietary *Ariba Commerce Services Network*. (See Figure 6.)

Figure 6. Ariba's B2B E-Commerce Platform

Note: Within this buyer-supplier exchange platform, Ariba also provides software modules that permit the specification of different market microstructures, reverse auction capabilities (like Priceline.com), and other NASDAQ-like capabilities. Adding Internet-based financial services will round out an already strong set of capabilities. See Ariba's website at www.ariba.com.

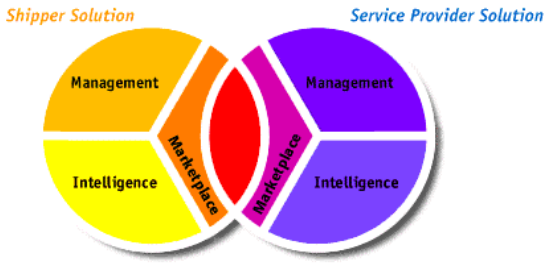
Delivery and Logistics. Due to the complexity of *logistics* for corporate procurement, the *delivery* process for goods to their buyers also creates business opportunities for Internet-based market-makers. In electronic markets that are dedicated to logistics, the focus is to ensure the smooth flow of information among multiple players involved in the delivery process. Optimum Logistics (www.optimumlogistics.com) offers an Internet-based open logistics system for bulk commodities, including chemicals, vegetable oils, petroleum products and other bulk liquids, as well as steel, gas and agricultural products. Shipment of bulk commodities involves multiple players from various transportation and storage providers, to freighter forwarders and surveyors, to customs agents and banks. Producers and receivers have to coordinate all the players during the shipping process so that the right information is delivered to the right person at the right time. Optimum Logistics aggregates information from the different participants along logistics value chain and delivers it to the appropriate parties. As a result, bulk shipping is streamlined and it becomes possible for receivers to take actions when a shipment is delayed.

Procurement Expertise. Besides the mechanisms for facilitating corporate procurement, *procurement expertise* also can be built into the business models that Internet-based market-makers deploy. eBreviate.com (www.ebreviate.com) incorporates strategic sourcing expertise into its *downward auction* approach. A *downward auction* involves a single buyer, with multiple bidders interacting in a bidding process that yields the buyer a progressively lower price. eBreviate.com helps buyers to calculate the total costs of each bid that is made, taking into account price, warrantees, maintenance costs and other

priorities. The foundation of this firm's business model's success lies in the procurement expertise it provides for buyers to make the best choices.

A similar business model has been adopted by Celarix.com (www.celarix.com), whose CEO, Evan Schumaker, argues that the Internet has "revolutionized the way global organizations communicate with their customers and trading partners." The firm delivers an Internet-based market for acquiring and delivering shipping services, as well as information-intensive capabilities to manage logistics and analyze performance. (See Figure 7.)

Figure 7. Celarix.com's Business Model for Delivering Procurement Expertise



Note: Celarix.com distinguishes two primary parties for its procurement expertise and B2B market services: *shippers* and *transportation-related service providers*. The latter provides additional expertise in logistics, but requires automation for Internet-based business that is uneconomical to build from scratch. Additional details are available at www.celarix.com/provider.asp.

Finally, although procurement expertise is applicable to various categories of products, industry-specific expertise has proven to be especially valuable with respect to a particular set of products or services. And so we see a number of players in the industry with business models focused around this approach. They include Bidcom.com, Instill.com and YOUtilities.com.

Effects of Technology Adapters

As a new channel for corporate procurement, the compatibility of Internet-based e-procurement systems and electronic markets with existing solutions is important, if they are to accrue value for the organizations that adopt them. The major e-procurement system providers, such as Ariba and Commerce One, transform purchase order messages from buyers into formats that are supported by different technologies (e.g., EDI systems or TCP/IP-based systems), and then send these transformed messages to suppliers. Based on our prior discussion of the theoretical background of technology adoption, we identify these firms as fulfilling the role of *technology adapters*. They interface Internet-based e-procurement systems with other electronic communication systems.

As a result, buying companies who adopt these B2B electronic markets and market connectivity software solutions will be able to continue communicating and transacting with their established business partners even after they switch to the new technologies. This is very desirable for firms that want to streamline procurement processes by implementing direct information and data exchange with different suppliers. The attractiveness of this approach to buyers causes them to become more willing to adopt (and, hence, exhibit a greater *willingness-to-pay* for) the electronic market solutions. The growth of participation by buyers, in turn, will bring in more suppliers. This will give rise to the rapid growth of electronic markets that are able to function as technology adapters.

4. DISCUSSION

We next present our general findings in this exploratory research.

- **Finding #1: The private aggregating and matching networks that we observe on the Internet are not predicted by the theory of electronic markets.**

In Internet-based electronic markets, the buyers' job of identifying product and price information becomes much easier and more efficient due to the *electronic communication effect* and the *electronic brokerage effect* (Malone, Yates and Benjamin, 1987). The benefits of lower *search costs* and *coordination costs* will be amplified, reducing *transaction costs* overall, when there are more players in the markets and when buyers can transact with an extensive pool of suppliers. However, in some cases, buyers would rather forgo some of the benefits engendered by extensive searches to engage in closer relationships with a handful suppliers. That is why private aggregating and matching mechanisms will also play a significant role in the mix.

In our prior analysis, we noted that a *private aggregation approach* is likely to be adopted for transactional purchases for which prices are negotiated offline with selected suppliers and thus will be fixed in online purchasing. Even though operational efficiency is the major benefit accruing to firms that adopt such e-procurement systems, buyers still will expect much flexibility in choosing suppliers online, given the *reach and range* of connectivity of electronic markets. A *private matching approach* will be adopted for purchasing production inputs that are of significance to buyers. Buyers will reward a few preferred suppliers with their business by using reversed auctions and online negotiation mechanisms. As such, buyer-supplier relationships will be taken into account, while the benefits of dynamic pricing on electronic markets are exploited.

Overall, the adoption of private transacting mechanisms tells us that interorganizational coordination mechanisms are not moving directly towards the pure market that the EMH predicts in the presence of IT. Nor is the current outcome exactly what the positive externalities associated with open transacting networks

should lead to, despite the impact of Internet-based systems in lowering coordination and search costs. Instead, in adopting e-procurement systems and electronic markets, firms are retaining their linkage with preferred suppliers while they are enhancing their flexibility in developing new suppliers.

- **Finding #2 – Online B2B markets not only enable electronic transactions, but they also promote expertise sharing and collaboration among multiple players involved in highly complex business processes, which were not entirely foreseen by the theory of electronic markets.**

We have already made a case that B2B electronic market providers can deliver procurement expertise, increasing the effectiveness of the new technological solutions and the willingness-to-pay for them on the part of buyers and suppliers. In addition, Internet-based electronic markets can create value by providing platforms on which project activities are organized according to *optimized workflow models* that are suiting to various industries. For example, Bidcom.com (www.bidcom.com) focuses on supporting the whole lifecycle of a building construction project, and thus it encapsulates a business process model that is commonly used in the building industry. Realizing that collaboration and information exchange among participants are essential for successfully accomplishing the projects within schedules, Bidcom.com integrates collaboration services, project management services, and marketplace services into its business model. Presently, collaboration processes are just supported by a few electronic markets, but buying firms have expressed the desire for additional such support. One expects that more and more B2B electronic markets will make collaboration processes an integral part of their business models in the future.

- **Finding #3 – Current B2B electronic markets and e-procurement solutions fail to deliver sufficient value in the final step of the electronic markets value cycle: settlement and logistics.**

Corporate purchasing consists of three major steps in the value cycle for electronic markets that create value for an organization: *information search*, *negotiation*, and *settlement and logistics* (Gebauer and Segev, 1998). Today's e-procurement systems and electronic markets have developed a variety of models for searching and negotiation. But, the last step -- settlement and logistics -- is just starting to gain the attention of Internet-based market-makers. We briefly discussed and illustrated how logistics and financial services providers are beginning to respond. However, with the rapid growth of online purchasing, adopting firms will demand highly levels of support for transaction settlement. Since the payment and delivery processes involved in corporate purchasing are so complex, specialized expertise is often required. The future holds promise that these market service providers (e.g., banks, telecommunications security specialists, and other networking-focused firms) will become indispensable to, or even act as alliance partners with the Internet-based market-makers.

- **Finding #4 – The network externalities associated with open B2B electronic markets will make it increasingly attractive to bring together the purchase of production inputs and operating inputs.**

Overall, Baily (1987) identifies five types of business purchasing requirements: merchandise for resale; parts and material for production; maintenance, repair and operating supplies; plant and equipment; services such as maintenance of equipment, and cleaning. Two more general types can be identified, based on the purpose of the purchases: *production inputs* and *operating inputs*. Equipment, parts and material for manufacturing, for example, are production inputs; maintenance, repair and operating supplies and services, on the other hand, are operating inputs. Present B2B electronic markets are focused either on production inputs for a particular industry or on operating inputs across industries (Kaplan and Sawhney, 2000). However, the latest trend is to enable purchasing companies to procure both production and operating supplies from the same e-market. This strategy not only brings more resources to the e-market, but also makes better use of the positive network externalities associated with open trading networks. Indeed, positive network externalities create a basis for it.

For example, Ariba Commerce Platform, the online MRO marketplace operated by e-procurement system provider Ariba Inc., has included *vertical Internet markets*, such as SciQuest.com, into its suppliers list. Buyers on the *Ariba Commerce Platform* are able to purchase life science reagents and instruments from SciQuest.com when they procure other operating supplies. In this way, both Ariba and SciQuest.com are able to expand the scope of their respective trading networks. Simultaneously, each can take advantage of what the other can offer: Ariba has more suppliers and SciQuest.com has more customers. As a result, Ariba and SciQuest.com both become more valuable to potential adopters due to the network externality effects. In the midst of competition among such networks, adopting companies will choose markets that provide both operating and production supplies, and such electronic markets are destined to become larger and more important players on the Internet of the future.

5. CONCLUSION

E-procurement systems and B2B electronic markets are changing the way that companies procure their supplies and exchange information with suppliers. The impact of this change will definitely influence firms' adoption decisions for their procurement solutions. To buyers in supply chain management, e-procurement systems and B2B electronic markets are perceived as a new procurement channel enabled by the Internet and new technologies of the World Wide Web. Adoption of these technologies and the corresponding business models associated with them, are of great significance to the success of many businesses in a spectrum of industries.

On the one hand, firms can expect to benefit from reduced coordination and search costs that have become available by joining trading networks with extensive organizational connections. On the other hand, buyers still will need to maintain established long-term relationships with preferred suppliers. Therefore, a variety of business models are likely to continue to be viable in the marketplace, and will be adopted by firms with heterogeneous requirements. By drawing on theory from the IS and economics literature, our aim in this paper has been to understand these business models and the related adoption behaviors that we observe. In addition, by investigating current practices observed in B2B electronic markets for procurement, we have built a foundation upon which an understanding of future developments in this arena can be obtained.

Our analysis is based on a systematic study and classification of representative cases of e-procurement systems and electronic markets. This led us to an extensive investigation of current e-procurement channel adoption behaviors. In the future, it would be appropriate to carry out research that combines theoretical and empirical analysis to shed light on the issues we have discussed and to provide guidance for business decision-making relative to the adoption of the new e-procurement channels.

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