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ELECTRONIC COMMERCE EXCHANGES: A REVIEW AND CONCEPTUAL MODEL

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Abstract

The paper reviews 19 articles on business-to-business (B2B) electronic commerce (EC) exchanges and develops a table categorizing research in this area including: author, focus, theoretical approach, and method. Our review indicated that this research coincides with stages in the system development life cycle. Research in this area is primarily based in economic theory.

Keywords: Electronic commerce, exchange, literature review

Research Question

An EC exchange is a central marketplace facilitated by information technology, in which multiple buyers and suppliers come together to gather information and buy and sell goods and services (Bakos, 1991; Bakos, 1997; Bakos, 1998; Choudhury, 1998; Graham, et al., 1996; Malone, et al., 1987; Senn, 1996). Exchange participants can include: buyers, sellers, technology providers, and investors. Exchanges have been in the limelight since 1999 with the commercialization of business-to-business (B2B) electronic commerce (EC). However, this concept was discussed in the literature as electronic markets years before (Malone, et al., 1987). The purpose of this paper is to review nineteen articles, on B2B EC exchanges, including work on electronic markets provided this works meets our definition of an exchange. In our literature review, we use the terms the authors used in their studies, so some of the review will use the term electronic market while other parts of the review will use the term B2B EC exchange.

This paper contributes to theory by providing an overview of work in the B2B EC exchange field including the development of a conceptual model, Figure 1, mapping the research streams to stages in the system development life cycle.

Research Method

We used insights from Cooper's (1998) book to guide our literature review. Our review includes mostly academic articles. We conducted our search for existing research on B2B EC exchanges by searching conference proceedings, on-line databases, and the Internet. We used the keywords EC exchange or EC market. We also followed bibliographic citations. The conference proceedings searched include: Americas Conference on Information Systems (AMCIS), Decision Sciences Institute (DSI), Hawaii International Conference on System Sciences (HICSS), International Conference on Information Systems (ICIS), and Production Operation Management Society (POMS). Electronic databases searched include ABI/Inform and IEEE.

Focus of Existing Work

Table 1 at the end of this paper, provides an overview of B2B EC exchange literature including: author, life cycle stage, focus, theoretical approach, and method. The work on B2B EC exchanges fits into life cycle stages, commonly discussed in systems development (Flaatten, et al., 1991). As such, we organize our literature review by stages in the system life cycle: idea, implementation, use, and evaluation. The first work on B2B EC exchanges was fueled by the recognition that advances in

technology would soon allow multiple buyers and sellers to link together via electronic communication networks. Work in the idea stage included describing: how B2B EC exchanges would function, their impacts, and their anticipated benefits. The implementation stage began when organizations recognized the benefits of B2B EC exchanges and decided to implement them. Work in this area includes decisions to implement and implementation challenges. Once the systems were implemented, organization began using them. Work in this area includes a description of the different categories of B2B EC exchanges. The use stage is followed by an evaluation stage, where organizations measure the impact of their electronic market. We posit Figure 1 as a conceptual model of the B2B EC exchange literature. The paragraphs below discuss work in each phase.

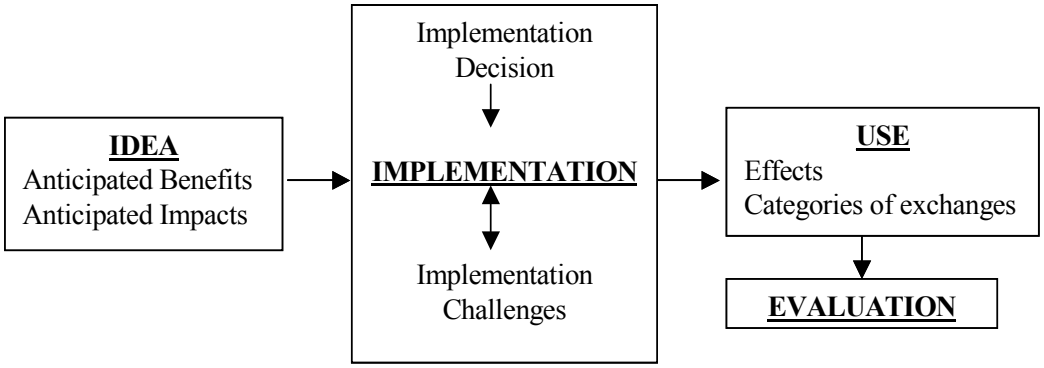

Figure 1. Conceptual Model of B2B EC Exchange Research

Idea

Work in the area of electronic markets began when Malone (1987) predicted that with the presence of electronic communication technologies, electronic markets would become the favored mechanism for coordinating material and information flows among organization. This phenomenon is known as the electronic markets hypothesis. Later, Bakos (1998) explained the functions of electronic markets as matching buyers and sellers, facilitating transactions, providing institutional infrastructure, aggregating product information, price discovery, and providing procurement and industry specific expertise.

Two streams of research make up the idea stage: anticipated benefits and anticipated impacts.

Bakos (1998) explained the benefits of electronic markets with regard to products, price, and transaction cost.

Electronic markets have three advantages for products. First, electronic markets allow increased personalization and customization of product offerings. Second, electronic markets allow aggregation and disaggregation of information based product components. And third, electronic markets lower the search cost for buyers trying to shop for products and the communication cost for sellers trying to communicate information about their products.

Electronic markets have advantages with regard to price. First, since they allow buyers to make offers and electronically negotiate prices, electronic markets are changing the microstructure of markets. Second, since they have the ability to track information on customers via data warehousing and data mining, electronic markets facilitate customized pricing. And third, since electronic markets facilitate increased information sharing and communication between buyers and sellers, they enable price discrimination. Price discrimination includes charging different prices to different consumers in different situations.

Since electronic markets allow better information sharing between buyers and sellers, they reduce the cost of executing orders. Decreased costs can occur in: logistics, transportation, distribution, inventory and payment systems.

A Boston Consulting Group report (2001) outlined nine sources of value creation for electronic markets: aggregation, process automation, transparency/auctions, lower marketing and sales costs, lower transaction costs, lower inventory costs, lower cycle time, and improved asset utilization. The report divided the sources of value creation into value shift activities and value creation activities.

Malone et al.'s (1987) electronic market hypothesis posited that electronic markets would impact communication, brokerage, and integration. In the paragraphs below we discuss each of these impacts along with work in the area.

The *electronic communication effect* posits that electronic markets will lower communication costs, enable electronic aggregation of demand and supply, and enhance a firm's ability to more closely coordinate their economic activity. Bakos' (1991) opinions support the existence of an electronic communication effect. Bakos' article considered the implication of electronic markets. He was particularly interested in how improved price dissemination would affect buyers and sellers. Bakos points out that increased communication is likely to reduce seller profits and increase buyer welfare. Bakos posits this effect in commodity markets and explains that to protect profits, sellers must work to control how markets evolve. The best case for seller's involve markets providing product information.

The *electronic brokerage effect* predicts that electronic communication technologies will make it possible for technologically capable intermediaries to replace traditional middlemen and reduce transaction costs. Within this stream, Choudhury's (1998) research proposes that electronic markets will reduce the extent of usage of brokers by buyers. However, Lee and Clark (1996) posit that the introduction of electronic brokerage systems may transform direct search markets into brokered markets. They also posit that electronic auction systems implemented in intermediary markets can create a new auction form.

The *electronic integration effect* predicts that electronic communication technology will enable suppliers and buyers to use information technology to create joint, interpenetrating processes. In support of this effect, Malone et al. (1987) posit that electronic markets may become more like electronic hierarchies. The authors explain that since electronic communication technology enables sharing databases and integrating physical and electronic processes, their implementation will be customized to the buyer supplier relationship (physical, human, and time). This increased integration will lead to hierarchical rather than market relationships. Bakos and Brynjolfsson (1993) work also supports this idea. They found that electronic markets may decrease the number of suppliers. Bakos and Brynjolfsson found that information technology increases the importance of noncontractible investments by suppliers (e.g. quality, responsiveness, and innovation). And, when these investments are important firms will employ fewer suppliers.

A few researchers posited effects of electronic markets that did not fall in the above categories. Bakos (1997) used mathematical modeling to show that reduced search costs in a differentiated market with heterogeneous buyer tastes and seller product offerings, impact market equilibrium, resulting in increased efficiency, possibly lower prices, and increased seller competition. Choudhury (1998) proposes that electronic markets will lower prices (1) in commodity markets and (2) in markets with differentiated products if the system supports selection with price information. Electronic markets will not lower prices if the market is differentiated and the system supports only identification with product information. Choudhury also proposes that electronic markets will lower the inventory levels maintained by buyers.

Tumolo (2001) posited that buyers changing suppliers in order to buy through the exchange may get poor product performance, especially when buying critical parts or components. In the case of suppliers, exchanges may dominate over other selling channels and cause suppliers that do not join the right exchange to miss sales.

Implementation

Our model posits that the anticipated benefits of B2B EC exchanges lead organization to implement them. Research streams in the implementation stage include: decision to implement and implementation challenges.

Several authors have investigated why organizations decide to use electronic markets.

Malone et al. (1987) investigated the motives of buyers and suppliers for getting involved in electronic markets. Malone et al. found that buyers and suppliers have different motives for getting involved in electronic market. Suppliers join electronic markets because they want buyers to purchase their product rather than competitors. Buyers join electronic markets to increase their number of alternative suppliers and improve their ability to compare alternatives.

Choudhury (1998) investigated when buyers use electronic markets and found buyers will use electronic markets for the purchase of products that are low in asset specificity and complexity of description. Dai and Kauffman (2000) investigated the motivators for buyers to move from an extranet to an electronic market. Dai and Kauffman found the buyer's decision regarding whether to use an extranet or an electronic marketplace for the procurement of goods is a function of: desired gains from lower search

costs and operation costs enabled by an electronic market; importance of information sharing between suppliers; level of competition in the supplier market; and desired levels of desired supplier relationship specific investments. Senn (1996) posited that organizations will participate in electronic markets because of opportunities to create a product, deliver a service, or get in touch with potential customers.

The Boston Consulting Group (2001) report provided organizations advice on types of marketplaces to participate in as well as strategies for participation. Klueber et al. (2000) used action research to propose some motivations, a concept, and a procedure for analyzing the potential for partnering with an electronic market. Analysis criteria include: state of control, value chain coverage, market form, strategic fit, revenue generation, and customer incentives.

Several authors have discussed electronic market implementation challenges. These include revenue schemes, attaining critical mass, guaranteeing promises, and integration with existing company systems.

A Boston Consulting Group report (2001) explained that public marketplaces depend on three major sources of revenue. The report explained that marketplaces depending on transaction fees or commerce services for revenue will not survive. Most of the revenue will come from services that support collaboration activities. The report went on to offer advice for creating viable e-marketplaces.

Critical mass involves getting enough buyers and sellers to use the exchange. Lee and Clark (1996) explain that firms adversely affected by electronic markets are expected to resists implementing the system and thus prevent achievement of critical mass. Tumolo (2001) cited critical mass as a hurdle for organizations trying to implement B2B EC exchanges.

The need to guarantee that products purchased over the exchange will be the right product delivered at the right time is also an implementation challenge for B2B EC exchanges. Several authors have discussed this issue. Lee and Clark (1996) posited the need for product rating standards and a trusted third party for product evaluation. In a description of problems with exchanges, Memishi (2001) cited a lack of uniform data description standards explaining that most organization will want to participate in multiple exchanges and the different ways of describing products must be standardized.

B2B EC exchanges also need to determine how to seamlessly integrate transactions made over the exchange with the organization's existing information systems (Tumolo, 2001).

Use

Once an organization overcomes the implementation challenges and gets their system implemented they can begin using the system. Currently, research in the use stage includes a case study on the effects of electronic markets on intermediaries and several categorizations of the different types of B2B EC exchanges. The lack of other research streams falling in the use stage may be because many organizations are still trying to implement their exchanges. Memishi (2001) supports this thought. Memishi reported that the general consensus is that it is going to take several years to resolve implementation issues associated with exchanges with AMR predicting ten years.

Bailey and Bakos (1997) used thirteen case studies to investigate how intermediaries benefit participants in electronic markets. They found that markets do not become disintermediated when information technology is used as a transaction facilitator. The authors identified four new roles for electronic intermediaries: aggregating, matching suppliers and customers, providing trust, and providing interorganizational market information.

Chircu and Kauffman (2000) developed an intermediation, disintermediation, and reintermediation framework explaining the long-term effects of electronic markets. They use this framework in a field study of the travel industry and show that traditional travel agents will avoid disintermediation and remain profitable in the long run.

Authors have categorized B2B EC exchanges along several dimensions.

Tumolo (2001) categorized marketplaces based on whether they focus on multiple industries or a single industry. Tumolo explains that horizontal and vertical exchanges exist. Horizontal exchanges provide many commodity products that can be used across most industries. For example, the purchase and sale of things like office supplies. Vertical exchanges focuses on a specific industry and provide participants with specialized products, in-depth industry knowledge, and opportunities to collaborate.

Memishi (2001) posits that exchanges focusing on vertical industries are likely to be more successful than those serving a variety of industries, as their expertise will allow them to be in tune with what the market needs.

The Boston Consulting Group (2001) report found two types of e-marketplaces, private electronic marketplaces and public e-marketplaces. A single buyer or seller drives a private electronic marketplace with participation open primarily to the company's suppliers or customers. Public e-marketplaces are founded by an industry consortium and are open to any industry participant.

Kaplan and Sawhney (2000) identified four business models for electronic marketplaces. These models are classified by: type of product and characteristics of transactions they support. First, MRO (maintenance, repair, and operation) hubs are horizontal markets that enable systematic purchasing for operating supplies. Second, yield managers are horizontal markets supporting spot purchasing of operating supplies. Third, electronic catalog hubs operate in vertical markets and provide integrated product information used for repetitive purchasing of manufacturing inputs. And fourth, exchange hubs are vertical markets for spot purchasing of manufacturing inputs.

Dai and Kauffman (2001) used pricing practices and supplier identification practices to categorize electronic marketplaces. Dai and Kauffman posit four types of electronic markets: private aggregation, public aggregation, private negotiation, and public bidding. In price aggregation, buyers purchase large quantities and frequently ordered items from preselected suppliers at fixed prices. In public aggregation, buyers purchase from all possible suppliers at fixed prices. Public aggregation is usually used in fragmented markets and for time critical or small quantity purchases. Private negotiation is used to procure production inputs and involves dynamic pricing from pre-screened suppliers. Public bidding is used for asset/capacity exchanges and involves buyers identifying eligible suppliers from member firms.

Dai and Kauffman's investigation of motivators for their four types of electronic marketplaces resulted in three findings. First, the price aggregation and matching networks that have arisen on the Internet are not predicted by the theory of electronic markets. Second, online B2B markets not only enable electronic transactions, but also promote expertise sharing and collaboration among multiple partners involved in highly complex business processes. This was not entirely foreseen by the theory or electronic markets. And third, current B2B electronic markets and e-procurement solutions fail to deliver sufficient value in the settlement and logistics step of the electronic markets hypothesis.

Exchanges can also be categorized by ownership structure. Two ownership structures are independently owned (neutral) or participant-owned (biased) marketplaces. Memishi (2001) posited that for an exchange to succeed the founding companies have to distance themselves from the exchange and set up an independent ownership structure. Otherwise, other companies in the industry will not want to join an exchange that is owned by a company that they compete with. The current state of exchanges supports this since Tumolo (2001) explained that independent third parties intermediaries rather than individual buyers typically run exchanges.

However, a truly neutral marketplace may not yield as many benefits as one owned by organizations in the industry. Bannan (2001) reported that successful EC marketplace get most of their funding from the companies that use them. Yoo et al. (2001) empirically analyzed neutral and biased (buyer-owned, and supplier-owned) electronic marketplaces. They use price, market-share, surplus, social welfare, and competitiveness to see which structure is the best. They found that biased marketplaces are better then neutral marketplaces with regard to total surplus. And buyer-owned marketplaces generate larger surplus than supplier-owned.

Evaluation

Organizations must evaluate their B2B EC exchange endeavor. While the model shows evaluation as a later stage of the life cycle, the research focuses on evaluation at both the beginning and end of the life cycle. As Table 1 indicates very little work has been done in this area. This may be because most exchanges are still struggling in the implementation stage.

Senn (1996) has done work in the evaluation area. Senn posited an electronic market's potential be evaluated based on the following benefits: extending the firms reach, bypassing traditional channels, augmenting traditional markets, boosting service, and advertising. Senn also posited evaluating electronic market projects by setting and measuring benchmarks with a timetable.

Table 1. B2B EC Exchange Literature

Author	Life Cycle Stage	Focus	Theoretical Approach	Method
(Bailey and Bakos, 1997)	Use	Investigates how intermediaries benefit participants in electronic markets by reducing transaction and coordination costs.	Electronic markets	Case study
(Bakos and Brynjolfsson, 1993)	Idea	Explains why the number of suppliers used by a buyer have declined when theory predicts the opposite when information technology is used	Incomplete contracts	Mathematical Modeling
(Bakos, 1991)	Idea	Examines how prices, seller profits, and buyer welfare are affected by reducing search costs in commodity and differentiated markets	Economic	Author's opinion and literature review
(Bakos, 1997)	Idea	Analyzes the impact of electronic markets by focusing on the reduction in buyer search costs	None	Mathematical modeling
(Bakos, 1998)	Idea	Explains how the internet has affected markets	None	Author's opinion and literature review
(Bannan, 2001)	Use	Describes the current status of electronic marketplace including listing successful and unsuccessful marketplaces	None	Author's opinion and literature review
(Group, 2001)	Idea, Implementation, Use	Provides advice on realizing the benefits of, creating value with, and choosing marketplaces. Discusses types of marketplaces.	None	Survey, interviews, analysis of public data
(Chircu and Kauffman, 2000)	Use	Develops an intermediation, disintermediation, and reintermediation framework explaining the long-term effects of electronic markets. Uses this framework to show that traditional travel agents will avoid disintermediation and remain profitable in the long run.	Electronic markets, resource dependency theory, appropriability of innovation value	Literature review and case study
(Choudhury, 1998)	Idea, Implementation	Explains when buyers use electronic markets and how electronic markets affect: prices, inventory levels, and the role of brokers	Electronic markets	Case study and survey
(Dai and Kauffman, 2000)	Implementation	Motivators for buyers to move from extranets to electronic markets	Electronic markets	Mathematical modeling
(Dai and Kauffman, 2001)	Use	Motivators for various on-line business models and adoption requirements of purchasing firms	Electronic markets	Set of mini cases from a review of websites
(Kaplan and Sawhney, 2000)	Use	Identifies 4 business models for electronic marketplaces	None	Authors' opinion and literature review

Author	Life Cycle Stage	Focus	Theoretical Approach	Method
(Klueber, et al., 2001)	Implementation	Proposes a procedure to analyze the potential for partnering with an electronic marketplace	None	Action Research
(Lee and Clark, 1996)	Idea, Implementation	Analyzes the impact of electronic market implementation on search, price discovery, and trade settlement to understand the impact on electronic firms and markets	Economics	Authors' opinion and literature review
(Malone, et al., 1987)	Idea, Implementation	Explains how advances in information technology affect firms and market structures and options these changes present for corporate strategies	Transaction cost economics	Author's opinion and literature review
(Memishi, 2001)	Implementation, Use	Describes the current status of B2B EC exchanges include problems and success factors	None	Author's opinion and literature review
(Senn, 1996)	Implementation, Evaluation	Helps managers evaluate the business potential of electronic markets and the Internet characteristics enabling electronic markets	None	Author's opinion and literature review
(Tumolo, 2001)	Idea, Implementation, Use	Various issues related to B2B EC exchanges including: status, types of, success factors, and failure factors	None	Author's opinion and literature review
(Yoo, et al., 2001)	Use	Compares electronic B2B marketplaces with different ownership structures	None	Empirical

Conclusion

This paper reviewed 19 articles on B2B EC exchanges. Our review developed a conceptual model, Figure 1, of B2B EC research showing that this research follows some stages of the system development life cycle. The early work was fueled by the recognition that information technology could link multiple buyers and sellers. The more recent work reflects the current business environment and reports on the implementation and use of B2B EC exchanges. As Table 1 shows, work on facilitators of implementation and use and ways to evaluate B2B EC exchanges would strengthen this research stream.

As Table 1 indicates much of the work on B2B EC exchanges is based on the electronic markets hypothesis (Bakos, 1991; Bakos, 1997; Malone, et al., 1987). This hypothesis is based on transaction cost economics (Williamson, 1979). Transaction cost economics deals with the question of when to use markets or hierarchies to coordinate the flow of materials and services through an organization's value chain. The rest of the work in the table does not cite a theoretical base. More theoretical work would improve research in this area. Theories suitable for the study of B2B EC exchanges include: institutional theory (DiMaggio and Powell, 1983; Meyer, 1977), organizational embeddedness (Granovetter, 1985) interorganizational relations (Oliver, 1990), and network theory (Gulati and Garguilo, 1999).

In addition, only ten articles listed in Table 1 list a research method. Work on B2B EC exchanges would be improved with more empirical research especially ethnography, case studies, and surveys.

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