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PACIS 2001 Proceedings. 16.

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BUSINESS VALUE OF B2B ELECTRONIC COMMERCE : THE CRITICAL ROLE OF INTER-FIRM COLLABORATION

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ABSTRACT

Many companies are establishing business-to-business (B2B) electronic links with suppliers and customers in an attempt to jointly optimize channel performance across the industry value chain. B2B electronic commerce provides firms with different business value depending on how organizations use the online network. If firms implement the electronic network simply to automate the transmission of commercial documents, they are unlikely to achieve significant benefits. B2B electronic networks offer dramatic performance improvement only when the online network is used to create new collaboration with channel partners. By comparing the effects of B2B electronic commerce with and without collaboration, this research provides empirical evidence that benefits of merging collaboration with online networks are much higher than the payoff from electronic linkage without collaboration. Based on the survey conducted in the grocery industry, this study suggests that the real source of performance improvement in the B2B electronic commerce is not an electronic linkage itself, but the collaboration enabled by the electronic network.

1. INTRODUCTION

As electronic linkages between supplier and customer value-chains become an increasingly important source of competitive advantage, business-to-business (B2B) electronic commerce has been rapidly growing all over the world. The dramatic growth of the B2B electronic commerce results from the rapid adoption of Internet and Web technologies by many organizations. Compared to EDI (Electronic Data Interchange) over VANs (Value-Added Networks), traditionally used for the B2B commerce, Internet and Web provide firms with cheaper and easier-to-maintain network infrastructures for inter-firm online transactions. However, many companies who have adopted the Internet-based B2B exchanges fails to find significant performance improvements (Phillips and Meeker 2000, Edifecs 2000).

Similar arguments had been made when EDI served as a major platform for the B2B commerce. EDI had been widely adopted by many organizations from 1970s through 1990s. While some firms had asserted that the economics of EDI were so compelling that EDI was rapidly becoming one of the “must do” applications, other organizations implementing EDI capabilities had indicated little or no impact of these systems on their organizational performance (Lee et al. 1999).

This research aims to investigate why organizations fails to achieve significant results from the B2B electronic commerce despite of the rapid adoption of electronic links with channel partners. Internet-based inter-firm commerce is early in the game. Thus one possible way to achieve our research goal is to obtain significant lessons from VAN-based EDI practices. EDI has been widely used for decades and have accumulated experiences on critical business factors necessary for successful B2B commerce. If the economic principles governing the B2B commerce remains unchanged regardless of the network infrastructure (whether it is Internet or VAN), experiences in traditional EDI practices can provide organizations with useful insights for Internet-based B2B commerce as well.

When organizations develop electronic networks just to replace traditional communications means (such as postal mail or fax) with trading partners, the impacts of B2B exchanges on organizational performance would be limited. If firms implement the B2B commerce primarily to receive and send orders over electronic networks in an attempt to increase the speed and accuracy of order transfers between firms, they may fail to gain significant benefits from the B2B network. However, if companies establish electronic networks to create “collaborative commerce” with partner firms, the B2B commerce would offer much more significant productivity gains.

In this study we distinguish “collaborative B2B commerce” from “basic B2B commerce” The basic B2B commerce refers to sending or receiving order information without changes in inter-firm operations. In contrast, the collaborative B2B commerce goes beyond online document exchanges, indicating that organizations adopt the B2B network to establish new collaboration mechanisms with channel partners. Our hypothesis is that the collaborative B2B commerce would provide firms with much higher benefits than the basic B2B commerce does.

In order to compare the effects of the “collaborative B2B commerce” with those of the “basic B2B commerce,” we investigate CRP (Continuous Replenishment Process) innovations which can be regarded as new collaborative commerce. In the US grocery industry, many retail firms have established B2B linkages with manufacturers to send and receive weekly orders. The B2B network for sending and receiving orders represents the basic B2B commerce. With new collaborative commerce (CRP), however, retailers no longer place orders with manufacturers. In CRP, retailers transmit information on retail sales and inventory levels at their warehouses through the B2B network. Using these data, manufacturers determine the quantity and timing of the product shipments needed to maintain adequate inventory levels at retail warehouses. CRP thus represents new collaborative B2B commerce between manufacturers and retailers since retailers effectively outsource procurement and inbound logistics decisions to manufacturers who become responsible for minimizing inventories and stockouts at their customer (retailer) warehouse.

Survey data are used to demonstrate that CRP (collaborative B2B commerce) provides firms with much higher productivity gains than the basic B2B commerce. Most survey firms had used EDI and VAN when they introduced the B2B commerce. Many of them are recently switching their B2B network infrastructure to Internet and Web for cost savings. Thus, the survey results are relevant whatever network is used for the B2B commerce. This research demonstrates that the basic B2B commerce by itself does not alter significantly the level of operational interdependence between channel partners, while the collaborative B2B commerce tightly couples business processes and greatly increases inter-firm dependency between firms.

2. THEORETICAL BACKGROUND

Although the potential for the B2B commerce and other forms of EDI to improve firm performance and to change industry structure has been extensively described (Bacos 1991, Clemons and Row 1992), the research on the economic impacts of B2B networks on firm performance demonstrates a mixed result. As illustrated in Table 1, prior empirical studies of B2B network impacts have varied considerably. While some authors asserted that the B2B electronic links play an important role for competitive advantages, other studies of organizations implementing B2B network capabilities report little or no impact of the network on organizational performance.

Conflicting evidence regarding the actual benefits realized from implementing B2B networks raises the following questions:

- *Why do some firms view B2B electronic networks as providing minimal benefits while others view them as a source of critical advantage?*

- Which variables should be taken into account to explain inconsistent claims on the economic effect of B2B electronic networks on firm performance?

Many authors have noted that B2B networks can benefit its initiator but doubted that its followers, who are often coerced to implement the electronic links by the initiator, can gain similar payoffs from their B2B network investments (Iacovou et al. 1995, Riggins and Mukhopadhyay 1994). Some authors even assert that the B2B network initiators realize the benefit at the expense of the followers (Clemons and Row 1993, Hendry 1993). Although we acknowledge the potential difference in benefits between initiators and followers of the B2B networks, we believe there is another essential factor explaining the conflicting results of the B2B network impacts on firm performance: *the level of collaboration with channel partners*. If firms adopt B2B networks just to increase the speed and accuracy of documents exchanged between organizations, they use the network for the “basic B2B commerce.” It is unlikely that such a limited vision of the B2B network will enable companies to enjoy its full potential. Firms need to view the B2B network not just as a new communication means, but also as a vehicle which enables new collaboration with trading partners.

[Table 1] Examples of B2B EC Impacts in Prior EDI Studies

	Source	Findings
Positive/Significant B2B EC Impact	Kekre and Mukhopadhyay (1992)	firms using routine EDI transactions improved performance (higher quality and lower inventory).
	Srinivasan et al. (1994)	timely information with EDI enabled firms to reduce the level of shipment discrepancies.
	Jelassi and Figon (1994)	EDI usage improved quality of customer service, shorten lead time, and reduced management cost.
	Mukhopadhyay et al. (1995)	total benefit of EDI per vehicle in Chrysler amounts to over \$100.
	Reekers and Smithson (1996)	EDI enabled trading partners (both suppliers and customers) to rationalize their operations.
No or Insignificant B2B EC Impact	Wallace (1988)	95% of survey respondents could not identify any advantages from the use of EDI.
	Carter (1990)	most firms implementing EDI did not realize the expected savings.
	Eckerson (1990)	Only a few companies realized significant cost savings from implementing EDI.
	Hollis (1991)	Despite huge investments on EDI systems, they were largely underutilized.
	McCusker (1994)	automation of the purchase cycle using EDI had not measurably affected firms' bottom-line operations.

Industries that were once vertically integrated and manufactured product to stock are evolving into virtual collaborations with legions of specialists producing products and services for current demand. Demand and supply chains are evolving into flexible, technology-enabled partnerships that can produce custom products. Traditional manufacturing should move closer to project, flow-based manufacturing across multiple partners. Likewise, service organizations will be able to coordinate with channel partners more easily to present a unified front to the customer. This trend represents the “collaborative B2B commerce” with trading firms. With “basic B2B commerce” where firms exchanges online documents without changes in inter-firm processes and collaboration, organizations cannot utilize the full potential of the B2B network.

Interorganizational collaboration implies increasing interdependency between firms. Interdependency refers to mutual dependence between organizations, and both firms in a mutually dependent relationship can benefit from increased power over their environment (Galbraith 1977, Thompson 1967). We illustrate that firms can significantly improve

performance when they establish a new collaboration mechanism by increasing their level of dependence on channel partners. This increase in the level of interorganizational interdependency is driven by changes in inter-firm processes and policies, which are enabled by the B2B network technology. B2B networks introduced for new collaboration increases the level of interdependency between firms, while the B2B network alone does not significantly alter the level of inter-firm dependency. By extending cross-functional coupling or interdependence within a single firm (Adler 1995, Ettlie and Stoll 1990) into inter-firm interdependency, this study suggests that the increased level of interdependency is a driving force behind performance improvements in interorganizational relationships. Although several pieces of research have been done to investigate the inter-firm dependence (Kumar and van Dissel 1996, Wallace 1988), the effects of the interdependence on firm performance remain as yet unknown. This research demonstrates that the “collaborative B2B commerce” provide firms with dramatic performance gain by increasing the interdependence between channel partners.

3. CRP : COLLABORATIVE B2B COMMERCE

The US grocery industry in the 1990s went through a period of dramatic change as new store formats entered the market and the traditional approaches to managing the retail supply-chain came under intense pressure. New retail formats were able to offer consumers products at lower prices than grocery retailers had previously charged. These alternative-format stores, including mass merchandisers (e.g., WalMart) and club stores (e.g., Price Club), had greatly increased in popularity during 1990s, and grocery retailer sales were clearly threatened by these rapidly growing chains that offered dramatic price reductions to consumers.

Due to increased competition from the new entrants, many retail chains were pressured to develop some means of strengthening their competitiveness in the market. Some grocery chains have tried to vertically integrate with manufacturers, but industry structure limits vertical integration opportunities in the grocery channel.¹ Product concentration is high for manufacturers of branded products, with three firms generally controlling more than 50% of sales in a single product category. Geographic concentration is high for grocery retailers, with the top three retail chains in a single city or standard metropolitan statistical area controlling 70% of sales in that geographic area. Private label products do represent a form of vertical integration for some retailers, and manufacturer outlets represent vertical integration for some vendors, but vertical integration sales in the grocery channel represent a very small percentage of total channel sales. Therefore, retailer chains’ efforts to increase competitiveness in the grocery industry need to be implemented within an inter-organizational context, rather than through increased vertical integration.

CRP, or vendor-managed inventory program, was introduced by manufacturers and retailers to increase their competitiveness by reducing inventory levels and costs across the entire value chain. B2B online network is a key information technology for the implementation of the CRP innovation. In traditional self-managed inventory management, retailers had provided manufacturers with only the data on quantities of goods required once a week (order information). CRP dramatically increased the total volume of information transmitted between retailers and manufacturers, with daily transmission of information on all products indicating retail warehouse shipments to each store, warehouse inventory levels, orders in transit (shipped but not yet received) and product shortages.

Most of the manufacturers that implemented CRP with retail chains also introduced leveled pricing, known as every-day-low-cost (EDLC). This was in contrast to promotional or high-low pricing that had traditionally been used throughout the grocery industry. Retailers using traditional high-low pricing from vendors used forward-buying of products to reduce

¹ Because vertical integration was difficult, outsourcing and strategic alliances were popular during the early 1990s. Partnering between private-label suppliers and retailers expanded as close cooperation allowed both sides to benefit from a management focus and still achieve most of the benefits of vertical integration (Walsh 1993). Opportunities to establish partnership relationships with private-label manufacturers even encouraged some chains to outsource manufacturing entirely.

procurement costs. Forward-buying involved purchasing products during promotional periods from manufacturers to sell later at standard (high) prices to consumers after the promotion period was over. This resulted in large inventories within the channel, for both retailers (after the promotion) and manufacturers (preparing for the promotional peak). EDLC pricing generally was designed to provide retailers with an average purchase price equal to the average price paid using the traditional pricing structure, including all discounts realized through forward-buying. The objective was to enable retail buyers to achieve a competitive product purchasing cost without forward-buying. This new EDLC pricing not only discouraged the forward-buying of retailers but also facilitated the implementation of CRP innovation. CRP was a new form of the “collaborative B2B commerce” between manufacturers and retailers since it involved with changes in processes, responsibilities and pricing policies.

4. RESEARCH MODEL AND DESIGN

This paper focuses on the impact of the B2B network on firm performance for the supply chain linking large retail chains and large manufacturers within the US grocery industry. A single product-market relationship between a manufacturer and a retailer represents the basic unit of analysis for the research. There has been a growing concern that key performance variables should be chosen with great care when IT impacts are measured (Barua et al. 1995, Mukhopadhyay and Copper 1993). To minimize the risk of compounded effects of non-IT variables on performance measurement, we have chosen inventory turns and stockouts levels as key performance measures in this study. By using operational and intermediate level output variables, instead of final output variables (such as market share or profits), we measure the B2B network impact at the site where the technology is implemented. These lower and operational level impacts, in turn, are expected to affect higher level performance measures such as profits.

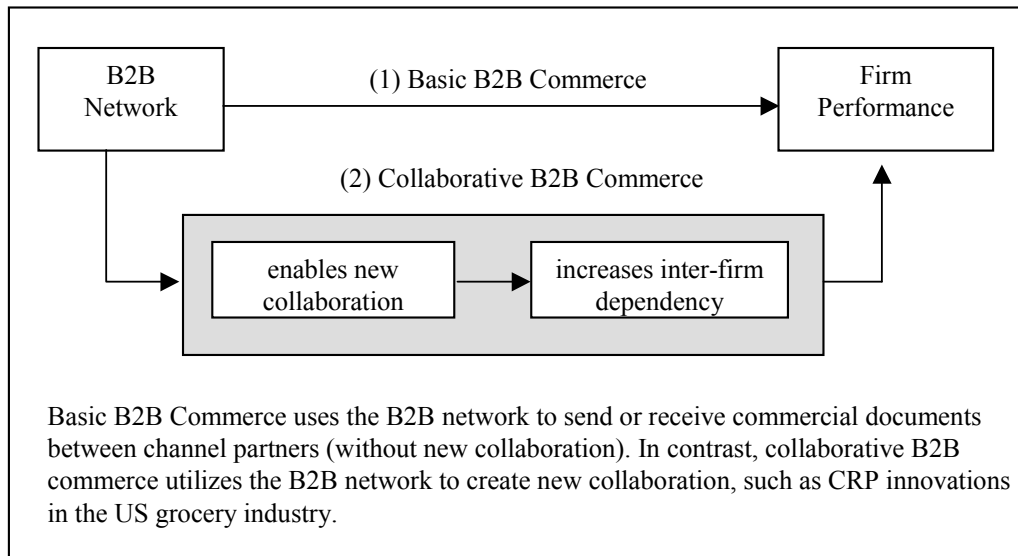
The research is designed to compare the impacts of “basic B2B commerce” on firm performance with those of “collaborative B2B commerce” (see Figure 1). The first hypothesis suggests that the level of performance improvement from the “collaborative B2B commerce” is significantly greater than the improvements in the same key performance variables by simply adopting the “basic B2B commerce.”

H1: The benefits of collaborative B2B commerce are greater than those of basic B2B commerce.

When firms use the B2B network simply to replace traditional manual processes (to send and receive orders), they might obtain marginal benefits such as reduced time and errors. However, the implementation of the B2B network requires investments, and for some firms these direct benefits from substituting online networks for manual paper processes may not be large enough to compensate for their spending on the B2B network implementation. The hypothesis indicates that the basic B2B commerce does not significantly improve channel performance, but enables new processes to be adopted, which can dramatically improve firm performance. By introducing the “collaboration” as a business variable of electronic networks, this hypothesis intends to explain the reason for the conflicting views on the benefits of B2B networks in several studies.

This hypothesis about the relationship between B2B network, process innovation, and channel performance provides a general framework within which an additional hypothesis was constructed and tested.

H2: Collaborative B2B commerce significantly increases interdependency between channel partners, while basic B2B commerce does not substantially alter the level of interdependency.



[Figure 1] Research Model

The second hypothesis posits that the increased level of interdependency or tighter inter-organizational process coupling is more likely to be a source for dramatic performance improvement. B2B network without changes in inter-firm processes and policies is not expected to alter significantly the level of interdependency between channel partners. However, if the B2B network is used to establish collaboration by tightly coupling inter-firm operations (as represented by CRP), it would significantly increase interdependency between firms, which in turn would bring dramatic productivity gains. The second hypothesis thus provides an explanation for the different business value between basic and collaborative B2B commerce in the first hypothesis.

To test these hypotheses, a questionnaire was mailed to all self-distributing grocery chains that were listed in the Progressive Grocer Marketing Guidebook. Some of the firms listed in this source had been acquired by other firms or had terminated operations by the time of the survey (about 8% of the total sample), leaving a total of 109 firms in the sample population of self-distributing grocery chains. Self-distributing chains, for the purposes of this survey, were defined as grocery retailers with more than 10 retail locations that also owned their own warehouses for storing and distributing products to their retail stores. Since the CRP innovation was primarily targeted towards these self-distributing grocery store chains, the selection of sample population was indicative of the potential users of the innovation being examined.

The questionnaire was delivered to 109 firms in the survey sample. Out of the 109 firms, 26 firms returned completed survey forms (a 24% response rate). Of the managers responding to the survey, 76% were general managers, procurement department managers, or category managers for the firm. An additional 24% of survey respondents were MIS managers. Of the 26 respondents to the survey, 14 firms were among the top 50 grocery retail chains in the US by sales and 12 were among the next 100 grocery retail chains by volume. Direct store delivery (DSD) products were excluded from the survey, as CRP innovations had not yet been extended to these products at the time of the survey. Out of the 26 retailers responding to the survey, 19 firms had implemented both collaborative B2B commerce and basic B2B commerce during the five-year period for which data were collected. These 19 firms provided data on the impacts of these two forms of B2B commerce on their organizational performance and inter-firm interdependency.

5. RETAIL SURVEY ANALYSIS AND FINDINGS

5.1 Effects of Basic and Collaborative B2B Commerce

Retailers were asked to estimate the level of improvement in inventory turns and stockouts which they had experienced for products with basic B2B commerce and collaborative B2B commerce. Retailers responding to the survey estimated that the basic B2B commerce improved inventory turns by 0.3 (3% increase) on average, but the collaborative B2B commerce improved inventory turns by 6.1 (50% increase) on average (see (a) in Table 3). These retailers also reported that stockouts had reduced with the adoption of the collaborative B2B commerce by 1.7%, which was significantly lower than the basic B2B commerce.

The second approach used to analyze data over a five-year period for each firm on usage of basic and collaborative B2B commerce together with their impacts on the level of inventory turns and stockouts. The measurement of B2B electronic commerce consists of four facets; volume, diversity, breadth and depth (Masseti and Zmud 1996). We have focused on the volume as a measure of B2B commerce usage in this study: BASIC% (percentage of products purchased by online orders in dollar terms) and COLLAB% (percentage of products replenished by CRP in dollar terms).

Using multivariate regression, the impact of COLLAB% and BASIC% on inventory turns (INV-TURNS) was examined (see Table 2 for the model). We included stockouts (STOCKOUT) as a regressor since retailer inventory levels could be reduced at the expense of increased stockouts. In general, retail managers determine desirable stockouts levels first and then try to maximize inventory turns within the stockouts levels established. Thus, stockouts need to be included as an independent variable to explain variances in inventory turnovers.

The inventory turnovers at retailer warehouses could also be affected by several factors that are independent of B2B electronic commerce implementations. Some retail firms are better than others at forecasting and managing their inventory independent of B2B network implementation decisions. Other factors influencing inventory performance included regional weather conditions (higher inventories in Maine than in California due to snow and hurricanes), total number of stores in the retailer chain, average distance between retailer warehouses and manufacturer locations (New Mexico has longer average lead times for shipments than Pennsylvania), and other company specific factors. Thus, company-specific indicator variables R_i (binary dummy variables) were introduced to isolate the impact of B2B electronic commerce on inventory performance and to exclude the effect of exogenous variables in the research design.

[Table 2] Regression Model Analysis for B2B Commerce Impact

Parameter Estimates			Model Fit
Regressors	Coefficient	estimates	
INTERCEPT	β_0	7.89***	Data point : 130
BASIC%	β_1	0.02*	Prob. > F : 0.0001
COLLAB%	β_2	0.17***	Adjusted R ² : 0.82
Stockout	β_3	0.21	Degree of freedom : 101

* p < 0.1 ** p < 0.05 *** p < 0.01

The results of the multivariate regression analysis are presented in Table 2 (coefficients estimates of control variables are excluded for simplicity). The model fit is statistically significant at the 0.01% level with adjusted R² of 82%. The regression analysis

indicates that for every 1% increase in volume on COLLAB%, inventory turns increases by 0.17 per year, and that for every 1% increase in volume on BASIC%, inventory turns increases only by 0.02 per year. As expected, the effect of STOCKOUT on inventory turns is positive (inventory levels could be reduced or inventory turns could be increased by increasing the level of stockouts), although its parameter estimate is not statistically significant. The results of this analysis support the hypothesis that the impact of the collaborative B2B commerce on performance is much larger than the impact of the basic B2B commerce.

5.2 B2B Electronic Commerce and Interdependence

In addition to inventory performance and B2B EC adoption, data were collected in the survey on multiple measures of perceived interdependence. For 19 retail firms who adopted both basic and collaborative B2B commerce, the interdependence was evaluated separately for basic B2B vendor (a vendor with online orders but without any collaboration) and collaborative B2B vendor relationships (a vendor with CRP collaboration). Interdependence, or mutual dependence, was examined at both a firm level and a functional level through general questions about the level of perceived dependence. Respondents were first asked whether they agreed that B2B commerce increases retailer dependence on manufacturers and manufacturer dependence on retailers (five-point scales were used, from “strongly disagree” to “strongly agree”).

There was a large and highly significant difference in the perceived changes in channel interdependence resulting from basic versus collaborative B2B commerce (see (b) in Table 3). The perceived retailer dependence on manufacturers was significantly higher with collaborative B2B commerce than that with basic B2B commerce at the 0.1% level. The perceived dependence of manufacturers on retailers, however, did not show a statistically significant difference between basic and collaborative B2B commerce. Although retail respondents indicated that CRP’s impact on dependence is bi-directional, they strongly felt that the retailer dependence on manufacturers increased higher than the manufacturer dependence on retailers.

In addition to these general measures of interdependence, data were collected on the extent of perceived channel interdependency between retailers and manufacturers across six inter-firm functional relationships. The questions used and the areas of interdependence were adapted from prior research conducted by Lawrence and Lorsch (Lawrence and Lorsch 1967) on inter-departmental interdependence within individual organizations. The areas of inter-organizational relationships include six cross-functional dependence between two retailer functions and three manufacturer functions (see (c) in Table 3). Interdependence was measured for the six channel relationships using 1-5 ordinal scales (1=not dependent and 5=completely dependent).

The overall mean value across the six inter-organizational functions reveals a large difference in perceived interdependence between basic B2B vendors and collaborative B2B vendors, with a 0.01% statistical significance. A comparison of functional interdependence indicates that the differences in means between the two vendor relationships are statistically significant (at the 5% confidence level or higher) for 5 of the 6 channel relationships. Retailer procurement and marketing/pricing dependence on manufacturer sales and marketing/pricing is not significantly different between two forms of B2B commerce. The lack of change in interdependence for this functional relationship may be due to an interaction between the effects of CRP and EDLC pricing. CRP frequently is associated with EDLC pricing, and EDLC pricing reduces retailers’ dependence on manufacturer sales and pricing in establishing a retailer marketing and pricing strategy. Although CRP adoption might increase the dependence between retailer and manufacturer marketing departments if the same pricing policies were maintained, we suspect that a concurrent adoption of CRP and EDLC complicates this relationship.

The perceived differences in interdependence with and without collaboration provide strong support for the statement that the collaborative B2B commerce increases both retailer dependence on manufacturers and functional interdependence within the channel by tightly coupling inter-firm operations. This increase in channel interdependency is much higher than

the basic B2B commerce, where the B2B network is used only for online document exchange without any collaboration.

6. DISCUSSIONS

6.1 B2B Electronic Commerce and Performance

The survey data analyses support the first hypothesis that the collaborative B2B commerce provides much larger productivity gains than the adoption of the basic B2B commerce. CRP has enabled retail firms to reduce both inventory levels and stockouts simultaneously. Technological innovation alone (represented by basic B2B commerce), however, offers only slight improvements in performance. Investments in the B2B network can be cost justified, but the largest payoffs for the B2B network result from the new collaboration, as represented by CRP in this example.

The effects of this collaborative B2B commerce is not single-sided, and manufacturers also gain significant payoffs from their B2B network investments (Lee et al., 1999). With changes in inter-firm policies and processes, CRP eliminated retailers' forward-buying, which increased channel lead-times and exaggerated demand variations. The new collaboration (CRP) streamlined actual customer demands with retailers' procurements, thereby eliminating artificial fluctuations in demand created by retailers' forward-buying. Thus, the new collaboration has made demand more predictable and enabled manufacturers to manage their production facilities more effectively. Furthermore, the "vertical information integration" between manufacturers and retail firms enabled manufacturers to monitor their inventory performance more effectively through the channel. CRP provides manufacturers with much more timely and detailed information on product movements and stockouts than the basic B2B commerce. Receiving actual sales, inventory, and stockout data not only allowed manufacturers to better manage production facilities, but also enabled them to manage inventory and stockout levels at manufacturers' warehouses. The B2B online network, if used as an enabler of new collaboration, allows both trading partners (manufacturers and retailers) to jointly optimize their channel performance.

The benefits of collaboration under B2B context explain the inconsistent view on the effect of B2B electronic commerce on firm performance. Organizations implementing B2B networks with a limited vision (such as sending and receiving orders) are unlikely to consider B2B commerce as a critical source of competitiveness. However, organizations that implement the B2B network as an enabler of new collaboration view the network as having significant impacts on their performance. Senior managers thus need to go beyond automation (computer-to-computer link) when they consider adopting B2B electronic commerce, and they have to search for potential new collaboration that is enabled by B2B network technology.

[Table 3] Performance and Interdependence Measure in Survey

(a) Reported Impact of B2B EC Adoption	Performance Measure		Basic B2B commerce	Collaborative B2B commerce	mean difference
	increase in inventory turns/year after B2B EC adoption		0.3	6.1	5.8** (n=19)
	percent point reduction of stockouts after B2B EC adoption		0.5%	1.7%	1.2%** (n=19).
(b) Perceived Interdependence with B2B EC	Interdependence Measure ^a		Basic B2B vendor	Collaborative B2B vendor	mean difference
	B2B EC increases retailer dependence on manufacturer		3.5	4.3	0.8** (n=19)
	B2B EC increases manufacturer dependence on retailer		3.1	3.6	0.5 (n=19).
(c) Perceived Inter-firm Functional Relationships	Inter-firm Functional Interdependence Measure ^b		Basic B2B vendor	Collaborative B2B vendor	mean difference
	(retailer function)	(manufacturer function)			
	warehouse operation and transportation	sales, marketing and pricing	3.05	3.74	0.69* (n=19)
		warehouse operation and transportation	3.42	4.37	0.95** (n=19)
		production	2.89	3.68	0.79* (n=19)
	procurement and marketing/pricing	sales, marketing and pricing	3.58	3.84	0.26 (n=19)
		warehouse operation and transportation	3.32	4.16	0.84** (n=19)
		production	3.05	3.79	0.74** (n=19)
	Overall average (six functions combined)		3.22	3.93	0.71** (n=114)

^a five scales were used from 1 (strongly disagree) to 5 (strongly agree)

^b five scales were used from 1 (not dependent) to 5 (completely dependent)

* p < 0.05 ** p < 0.01

6.2 B2B Electronic Commerce and Interdependence

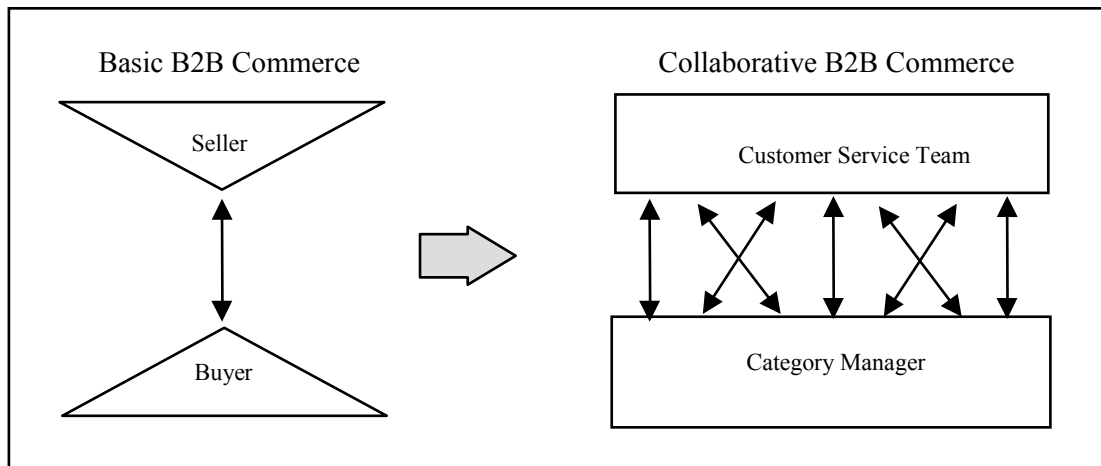
Survey analysis indicated that the collaborative B2B commerce resulted in significantly higher levels of inter-firm dependency between retailers and manufacturers. In contrast, the level of channel interdependence was not significantly increased as a result of the basic B2B commerce. The basic B2B commerce was viewed as an application of technology that simply automated existing data transmission, but the collaborative B2B commerce (CRP) involved changes in business processes that tightly coupled the inter-firm operations. Thus the survey findings strongly support our second hypothesis that the collaborative B2B commerce results in a much higher level of changes in inter-firm dependence than the basic B2B commerce. The high productivity gain in the collaborative B2B commerce is likely to be due to this increased inter-firm dependency, caused by new collaboration. The B2B network, if used only for exchange commercial documents, does not alter the level of inter-organizational interdependence significantly.

The increased interdependence required careful coordination between channel partners. The ownership and management of participating firms are independent, but an increased interdependence requires changes of internal processes within each firm, as well as their commitments to share newly-created risks with channel partners. Managing the increased interdependence is more difficult in an inter-organizational setting where there is no single decision maker who can overcome coordination and communications breakdowns (Lee and Clark 1996). Thus, retail firms that adopted CRP had to introduce new coordination mechanisms to effectively manage the increased interdependence.

Communications between firms involved in inter-firm relationships have significant effects on organizational performance (Lind and Zmud 1995). We have found during the survey that the change of the communication structure with collaborative B2B commerce creates a “coordination surplus” or “inter-organizational slack” that can be invested in other processes and channel relationship building activities. This investment of the coordination surplus provides retailers with benefits beyond the direct improvements realized from B2B electronic commerce adoption. One senior manager of a surveyed firm described this new inter-organizational communication structure by drawing the pictures shown in Figure 2. The basic B2B commerce does not change the communication structure between channel partners. In contrast, the collaborative B2B commerce requires to establish the basis for communications outside the traditional single-point-of-contact and to expand communication channels into multi-level and lower-level managers. As a result of these direct communications linkages, there were many performance improvements realized that were not directly related to the B2B network implementation. The performance benefits of coordination enabled by the collaborative B2B commerce extended beyond warehouse replenishment processes and had the potential to transform the entire channel relationship.

7. CONCLUSION

EDI networks represent the first phase of B2B electronic commerce and still serve as an important B2B commerce technology in many industries. According to the US Commerce Department, EDI supported some \$3 trillion in economic activities across more than 250,000 US companies in 2000. Although we expect EDI transactions to have a long life, many companies recently adopt Internet-based B2B commerce as Internet is widely accepted as a global network infrastructure. Some firms even transfer their B2B platform from VAN-based EDI to Web-based B2B commerce for cost savings.



[Figure 2] Communication Structures in Two Forms of B2B EC

The central assumption for this study is that economic principles for inter-firm online transactions remain unchanged regardless of whatever networks are used for the B2B electronic commerce. Research results driven from EDI practices should be relevant for the Internet-based B2B commerce as well. The CRP innovation, used as an example of collaborative B2B commerce in this study, was originally developed under VAN and EDI environments. However, many retail firms and manufacturers are switching their network infrastructure from VAN to Internet to take advantage of cheap and easy-to-maintain Web technologies. The different effects between basic and collaborative B2B commerce should be valid even after the B2B network platform is switched to Internet.

The contribution of this study lies in its separation of direct impacts of the B2B network from their indirect effects on organizational performance. By comparing the impact of B2B networks with and without collaboration, this research provides clear evidence that B2B networks should be used to establish new collaboration with channel partners.

The relationships between B2B network, inter-firm collaboration, and channel performance examined in this research are limited to a single industry context, so a broad generalization based on this study may be inappropriate. Nevertheless, the result of this study suggests significant business implications to channel partners in other industries. Many suppliers and buyers who implemented B2B networks are still unwilling to cooperate or share data because of the fear that such information sharing could weaken their negotiating position with their channel partners (Clemons and Row 1993). Results of this research show that channel partners can realize maximum payoffs from B2B electronic commerce only when they share information and increase their interdependency with channel partners.

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