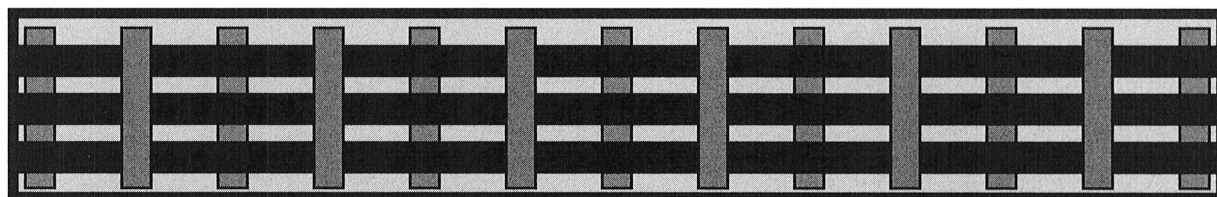


The Internet: Motivations, Deterrents, and Impact on Supply Chain Relationships

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The Internet's Effect on the Supply Chain

In the emerging economy there is a new Internet-based infrastructure that is challenging most assumptions about the firm and competition. Quinn (1999) discusses how the Internet is changing the business world, and companies need to determine how it can be integrated into existing channels.

"E-commerce" and "e-business" describe new business models and strategies, made possible by rapidly developing technologies. Many firms are now buying or selling products on the Internet. So successful has Internet commerce become that Forrester Research estimates that by 2003 U.S. business-to-business (B2B) trade will total \$1.3 trillion, 30 times the \$43 billion transacted in 1998. AMR Research projects that the U.S. B2B e-commerce market could easily reach \$2.7 trillion by the end of 2004. Forrester Research also predicts that e-marketplaces may account for as much as 53% of all on-line business trade by the end of 2005 (Fitzgerald 2000). Many believe that B2B e-commerce could lead to reduced processing costs and productivity improvements (Cohn, Brady, and Welch 2000).

To take advantage of the perceived benefits of e-commerce and improve their competitiveness, companies are working feverishly to implement business-to-business systems. In a survey assessing Internet usage, Lancioni, Smith, and Oliva (2000) found that over 90% of the respondents used the Internet in some part of their supply chain management program. Kennedy and Deeter-Schmelz (2001) investigated Internet usage as a tool for industrial purchasing, finding that most buyers were using the Internet for gathering information and placing routine orders. The Internet seemed to be more useful as

an information-gathering tool than as an on-line transactional tool. Interestingly, Deeter-Schmelz, Bizzari, Graham, and Howdyshell (2001) found that suppliers played a critical role in the adoption of Internet by buyers.

Carter, Carter, Monczka, Slight, and Swan (2000) forecast that the Internet would have a tremendous impact on the supply chain. Although some research has examined supply partners and Internet use, more is needed to further understand how supply chain partners utilize the Internet and what they hope to gain. Barua, Konana, Whinston, and Yin (2001) suggested that the Internet provides opportunities for companies to develop relationships with suppliers as well as customers. Domke-Damonte and Levsen (2002) found the number of competitive moves increased as Internet usage increased for small hotel owners. It becomes more important to manage relationships as competition increases through the use of e-commerce. Basch (2000) stated that the most effective Internet strategy for manufacturers is a collaborative one with their channel partners. Christopher and Juttner (2000) reinforced the importance of monitoring supply chain relationships.

Dresner, Yao, and Palmer (2001) examined Internet usage across the food industry supply chain to determine whether distributors were using Internet technology at the same rate as retailers and manufacturers. They found no significant differences. They also found relatively little use of Web-based technology in the food industry supply chain. This paper pursues the supply chain angle, addressing some important questions in terms of strategy, motivations, and deterrents to e-business.

Objective

Specific research objectives include understanding the following:

- the impact of e-commerce on the relationships among supply chain members, specifically manufacturers, distributors, and industrial customers,
- the importance of e-commerce ability in selecting distributor partners,
- the perceived benefits of e-business,
- the perceived barriers to e-business, and
- the primary role of e-business in a company's overall business strategy.

It is commonly accepted that e-commerce will make the supply chain more efficient. Our research will investigate whether supply chain partners have the same expectation and whether e-commerce helps or harms relationships.

Methodology

A survey using a structured approach was developed to gain the perspectives of manufacturers, distributors, and industrial customers regarding the research objectives. With the input of industry participants, a basic survey was designed and then customized for each sample group (manufacturers, distributors, and industrial customers). Next, the surveys were pre-tested with industry and academic members, finalized, and administered by mail. The distributor and manufacturer surveys were mailed to a random sample of distributor and manufacturer members of IAPD (International Association of Plastics Distributors) and PTDA (Power Transmission Distributors Association). The industrial customer survey was mailed to a random sample of industrial purchasers from a mailing list bought from *Purchasing* magazine. The customer respondents, who were likely purchasers of plastics or power transmission equipment or supplies, represented a variety of industries, including automotive, food processing, aerospace, lumber, and packaging. Four weeks after the surveys were mailed, a follow-up mailing included the same survey with a cover letter thanking those that already filled it out and encouraging others to please do so. Both mailings offered respondents a copy of a summary report of the findings. Finally, in-depth interviews were conducted with a limited number of manufacturers, distributors, and industrial customers to gain additional insight.

Surveys were mailed to 250 manufacturers, 300 distributors, and 1,200 industrial customers.

The surveys sent to the industrial customers were mailed to purchasing professionals in those organizations. There were 23 manufacturer respondents, 24 distributor respondents, and 50 customer respondents. A total of 93 usable responses resulted in a 5.54% response rate. Response rates for the manufacturer, distributor, and customer respondents were 9.2%, 8.0%, and 4.2%, respectively. Titles of respondents included president, vice president, branch manager, sales manager, director of purchasing, and materials manager. The average amount of experience in the industry for respondents was 21.2 years. Respondents were geographically dispersed companies and included small, medium, and large companies ranging from less than 100 employees to over 1,000 employees. Annual company sales ranged from less than \$1,500,000 to over \$500,000,000. See Table 1 for a summary of demographic information.

Results

Five-point Likert scales were used to determine the impact of e-commerce on the relationships among supply chain members, the importance of e-commerce ability in selecting distributor partners, the perceived benefits of e-business, and the perceived barriers to e-business. Statistical analysis was conducted using SPSS version 10.0, starting with ANOVA to determine if there were significant differences between responses of the different sample groups (manufacturers, distributors, and customers). Where significant differences were identified, a t-test of independent samples was performed. The significant results regarding these topics are discussed in the following sections.

- *Impact of E-Commerce on Relationships*
The three sample groups (manufacturers, distributors, and industrial customers) were asked to assess the impact of e-commerce on their relationships with other supply chain partners. Specifically, manufacturers assessed the impact of e-commerce on their relationships with distributors and customers, distributors assessed the impact of e-commerce on their relationships with customers and manufacturers, and customers assessed the impact of e-commerce on their relationships with manufacturers and distributors. A five-point Likert scale was used with one being very

negative and five very positive. The results are shown in Table 2.

Overall, most channel participants believed that the impact of e-commerce on their relationships was minimal or slightly positive. An exception was the manufacturer respondents' belief that e-commerce had a moderately positive impact on their customer relationships, due perhaps to direct selling by some manufacturers using the Internet. This strategy has increased direct contacts between manufacturers and customers, possibly leading manufacturers to believe that relationships have improved. It has been suggested that e-commerce would lead to

the disintermediation of distributors. Channel partners, however, do not believe that e-commerce has hurt their relationships, suggesting that this is not the case.

T-tests of independent samples were conducted to determine if there were differences among groups in their assessment of e-commerce effects on their relationships with a particular group. For example, did manufacturers differ from distributors in their assessments of the impact of e-commerce on their relationships with customers? Data was also analyzed to determine if there was a significant difference in how manufacturers and customers assessed the

Table 1
Respondent Demographics
Percent of Respondents

Demographics	Manufacturers (%)	Distributors (%)	Customers (%)	Overall (%)
Number of Employees				
1 – 99	30.4	70.8	24.0	37.1
100 – 249	13.1	12.5	18.0	15.5
250 – 499	21.7	8.3	18.0	16.5
500 - 1000	17.4	4.2	14.0	12.4
Over 1000	17.4	4.2	22.0	16.5
Missing Values	0.0	0.0	2.0	2.0
Annual Sales Revenue (MM\$)				
Under \$1.5	4.3	4.2	2.0	3.2
\$1.5 – \$4.9	8.7	20.8	4.0	9.3
\$5 – \$19.9	17.4	41.7	24.0	26.8
\$20 - \$49.9	13.0	12.5	16.0	14.4
\$50 - \$99.9	17.4	8.3	20.0	16.5
\$100 – \$500	17.4	4.2	16.0	13.4
Over \$500	13.0	0.0	10.0	8.2
Missing Values	8.7	8.3	8.0	8.2

Table 2
Impact of e-Commerce on Relationships

	Overall Mean	Distributor	Manufacturer	Customer
Impact of e-commerce on relationships with distributors	3.41	----	3.39	3.43
Impact of e-commerce on relationships with manufacturers	3.33	3.15	----	3.43
Impact of e-commerce on relationships with end-users	3.54	3.33	3.78^a	----

^aSignificant difference at the .10 level between manufacturer assessment of the impact on relationships with customers (3.78) and customer assessment of impact on relationships with manufacturers (3.43)

Table 3
Importance of e-Commerce Ability When Selecting Distributors

	Overall Mean	Distributor	Manufacturer	Customer
Importance of e-commerce ability when selecting distributors	2.95	----	2.72	3.05

impact of e-commerce on their relationships with distributors. Finally, differences between customer and distributor responses assessing the impact of e-commerce on relationships with manufacturers were examined. No significant differences were found in any of the above cases.

In addition, a t-test of independent samples was conducted to determine if there were significant differences between two group's perceptions of the impact of e-commerce on their relationships with each other. For example, did manufacturer and distributor respondents assess the impact of e-commerce on their mutual relationships in the same way? Data was also analyzed to see if there was a significant difference in how manufacturers and customers assessed the impact of e-commerce on their mutual relationships. Finally, differences between customer and distributor responses were examined. As shown in Table 2, there was a significant difference at the .10 level between manufacturer respondents' assessment of the impact of e-commerce on their relationships with customers and customer respondents' assessment of the reciprocal relationship. Manufacturers believed that e-commerce had improved their relationships with customers to a greater extent than customers believed that it had improved their's with manufacturers. This may be because manufacturers now have a more direct relationship with some of their customers. And since e-business makes it easier to share information, information-sharing may help manufacturers to serve customers. As for customers, their needs may be unchanged and if these needs are being met at the same level, they wouldn't view the relationship as improving.

• *Importance of E-Commerce Ability When Selecting Distributors*

A five-point Likert scale, with one being unimportant and five being very important, was also used to assess the importance of e-commerce ability when choosing a distributor partner.

Manufacturer respondents were asked to assess this factor when selecting a distributor, whereas customer respondents were asked to assess it when selecting a distributor to buy from. It appears at this time that e-commerce ability is not important for either the manufacturer or customer, based on reported means of 2.72 and 3.05, respectively, as shown in Table3. It is possible that e-commerce does not rate higher because other variables are more important when choosing a partner. In addition, respondents may assume that a potential trading partner that scores high on other important dimensions may also have e-commerce ability.

• *Expected Benefits From E-Business*

In many industries the supply chain, is inefficient, from planning the development of a new product to making product available to the end-user (Cullen 2002). E-business provides an opportunity to remove some of these inefficiencies. Suppliers and buyers can both benefit from on-line purchasing through enhanced information availability as well as savings from productivity improvements and lower processing costs (Cohn, Brady, and Welch 2000; Croom 2000).

In this study, a five-point Likert scale, with one being unimportant and five being very important, was utilized to assess the importance of possible benefits from e-business. These benefits included increased sales volume, better customer retention, reduced cost, reduced inventory, reduced accounts receivable, streamlined processes, and reduced cycle time. As shown in Table 4, distributors rated all benefits as important with only reduced inventory viewed as minimally important. This might be because distributors view holding inventory as one of their major functions. Manufacturers also rated all of the functions as important except reduced inventory. It could be that manufacturers have already minimized inventories and don't see how e-business can effect further reductions. Both manufacturers and distributors rated customer-focused benefits, including

increased customer base and increased sales volume, higher in terms of importance, but customers rated it as less important. That is not a surprise since customer respondents had a purchasing focus. Customer respondents rated issues tied to reducing costs as relatively more important. There was a significant difference at the .01 level between manufacturer and customer respondents in terms of how they rated the importance of reduced inventory. This benefit was much more important for customer respondents. There was also a significant difference at the .10 level between distributor and customer respondents in terms of how they rated this same benefit. Clearly, reduced inventory was a more important benefit for customers, probably because they see it as a means to lower costs. Overall, all groups perceived many of the benefits surveyed to be important.

● *Barriers to E-Business*

Although respondents perceived many benefits from e-commerce, there were still apparent reservations. Weber (1999) found that some buying firms failed to see the benefit of logging on to the Internet for tasks that can be easily accomplished by the phone. Others were concerned about security and costs (Carter et al. 2000, Wenninger 1999). A challenge in implementing e-business systems is creating functionality for processes that have always occurred more informally. This requires standards not

only around the data but also around the definition, timing, and ownership of data (Cullen 2002).

Respondents assessed barriers to e-business for their firms using a Likert scale, with one being unimportant and five being very important. The barriers that respondents evaluated included no business need, benefits not demonstrated, financial costs, resistance from IT, resistance from manufacturers, resistance from customers, resistance from distributors, unprepared trading partners, technical immaturity, and lack of standards. Financial costs, lack of standards, technical immaturity, and unprepared trading partners were identified as the most likely barriers. As shown in Table 5, there was a significant difference at the .05 level between distributor and customer respondents in terms of how they assessed the barrier of financial costs. Although both groups rated it as a barrier, it was considered a significantly higher barrier by distributors. In general, distributors tend to be smaller in terms of size and sales revenue than manufacturers, so they may not have the resources to commit to e-commerce development, but manufacturers may be able to work with their distributor partners to overcome these financial barriers. Although resistance from IT was not rated as an important barrier, there was a significant difference at the .05 level between manufacturer and customer respondents, with customers rating it as more of a barrier.

Table 4
Expected Benefits from e-Business

Importance of following benefits expected to be gained from e-business:				
	Overall Mean	Distributor	Manufacturer	Customer
Increased sales volume	4.03	4.05	4.33	3.86
Increased customer base	3.83	3.95	3.83	3.76
Increased customer retention	3.97	4.15	4.06	3.83
Reduced cost	4.07	4.10	3.89	4.14
Reduced inventory	3.59^{a,b}	3.45	3.00	3.97
Reduced accounts receivable	3.70	3.75	3.72	3.67
Streamlined processes	4.16	4.20	3.94	4.25
Reduced cycle time	3.99	4.00	3.72	4.11

^aSignificant difference at the .01 level between manufacturer and industrial customer respondents

^bSignificant difference at the .10 level between distributor and industrial customer respondents

Purchasing professionals may have had a more direct relationship with IT, leading them to be more wary of IT involvement. Finally, there was a significant difference at the .10 level between manufacturer and distributor respondents in terms of how they perceived resistance from end-users. Distributors saw resistance by end-users as a slight barrier, whereas manufacturers did not. Distributors may have put significant resources into e-business systems only to find them not used by customers. In some cases, distributors have shut down Web sites because the demand for the service fell far short of expected use. Most of the barriers seem tied to costs and a lack of standards. As standards are developed, companies will probably feel more comfortable making the commitment necessary for a successful e-business system.

• *Role of E-business in Overall Strategy*

Companies implementing an e-business initiative should be sure it supports a strategic manufacturing or supply chain management requirement. It should not be implemented for its own sake (Small 2001). The results of e-business initiatives will vary from company to company, and to capitalize on the benefits, a

viable plan must address the firm's specific requirements (Cullen 2002).

Respondents were allowed to choose one response from several to answer the question, "What is the primary role of e-business in your overall business strategy?" The possible responses included the following: a major strategy to surpass competition, a necessary response to competition, a response to requests from trading partners, a peripheral element, mostly experimental, and other. There was no clear agreement between or among group members, as shown in Table 6.

Distributor (25%) and manufacturer (32%) respondents were more likely than customer (18%) respondents to believe that e-business was a major strategy to surpass competition, suggesting a more proactive stance. This would be consistent with the identified benefits to be gained from e-business by each respondent group. The manufacturer and distributor respondents rated increasing sales volume and customer retention higher than did customer respondents. E-business can provide a major strategy to surpass competition from a sales perspective. On the other side, customers (purchasers) were more focused on saving

Table 5
Barriers to e-Business

Importance of the following barriers to e-business:				
	Overall Mean	Distributor	Manufacturer	Customer
No business need	2.78	3.05	2.5	2.76
Benefits not demonstrated	3.14	3.17	2.81	3.26
Financial costs	3.60^a	3.95	3.81	3.34
Resistance from IT	2.63^b	2.63	2.13	2.82
Resistance from manufacturers	2.64	2.33	----	2.79
Resistance from end-users	3.12^c	3.44	2.75	----
Resistance from distributors	2.87	----	3.12	2.76
Trading partners unprepared	3.42	3.56	3.47	3.34
Technical immaturity	3.45	3.42	3.47	3.45
Lack of standards	3.56	3.58	3.67	3.50

^aSignificant difference at the .05 level between distributor and industrial customer respondents

^bSignificant difference at the .05 level between manufacturer and industrial customer respondents

^cSignificant difference at the .10 level between manufacturer and distributor respondents

Table 6
Role of e-Business in Overall Strategy

Primary Role	Overall (%)	Distributor (%)	Manufacturer (%)	Customer (%)
Major strategy to surpass competition	23.4%	25.0%	31.8%	17.9%
A response to requests from trading partners	4.9%	5.0%	9.2%	2.6%
Mostly experimental	23.5%	20.0%	22.7%	25.6%
Necessary response to competition	27.2%	50.0%	13.6%	23.2%
Peripheral element	18.5%	0%	22.7%	25.6%
Other	2.5%	0%	0%	5.1%

money. Few respondents in any of the groups believed that e-business was a response to requests from trading partners. Interestingly, almost one-fourth of all respondents believed that the role of e-business was mostly experimental, suggesting that the role of e-business is still unclear. This might provide opportunities for channel members to help their customer partners better delineate their e-commerce strategies. Distributors (50%) were much more likely than either manufacturers (14%) or customers (23%) to believe that the role of e-business in overall strategy was a necessary response to competition. It seems that e-business strategy is primarily a reactive approach for distributors, but they need to assess if this stance is consistent with their firm's overall business strategy. Suggesting that e-business may still not play a key role in company strategy for manufacturers and customers, about 25% of each group indicated that it was a peripheral element in overall strategy. This may also suggest that these companies are going to let the overall strategy of the firm drive the e-business strategy of the firm.

Limitations of Research

The low response rate was a limitation of the research, causing the statistical analysis to be based on small samples. Attempts were made to increase the response rate, including follow-up requests and an offer of summary findings. The length of the questionnaire may have been a deterrent, as respondents needed about 15 to 25 minutes to complete it. In addition, several individuals returned the survey unanswered,

indicating that they receive too many survey requests.

Another limitation may be generalizing the results. Only two industrial product supply chains were included, which may limit the validity of extrapolating the results to other industrial distribution products.

Conclusions, Managerial Implications, and Future Research

Overall, members of the supply chain believed that e-commerce had a slightly positive impact on their relationships with other supply chain partners, but, e-commerce ability was not a very important criterion when selecting distributor partners. Distributors, manufacturers, and customers all perceive benefits from e-business. As might be expected, the customer respondents, which included respondents from the purchasing area, rated issues tied to reducing costs as relatively more important. Although these issues were important for distributor respondents, these respondents were more concerned about customer issues. Manufacturer respondents showed greatest concern for customer-related issues, including increased sales volume and customer retention. With respect to barriers to e-business, financial costs were of greater concern for manufacturer and distributor respondents than for customer respondents. A lack of standards and technical immaturity was a major concern for all groups. Regarding the role of e-business in overall strategy, there is no universal agreement.

Managers need to continue to be concerned about the impact of e-commerce on relationships

with supply chain partners and cannot assume it is positive. They need to examine how e-commerce can foster and improve relationships, and monitor the impact of e-commerce to ensure the relationships are not impaired.

Although neither manufacturers nor customers indicated that e-commerce was important in selecting distributor partners, managers need to understand the current and potential needs of their supply chain partners. Implementing an e-commerce system is costly, and should not be undertaken without evidence of a definite need by supply chain partners and the expectation of clear benefits.

There are many barriers to e-business. Supply chain members may need to work together to overcome some of these barriers. For instance, manufacturers could provide distributors with financial incentives or Web site assistance to encourage them to become involved with e-business.

Research regarding the Internet and e-commerce remains important. It is clear that e-commerce will continue to grow, but more research is needed to better understand this area and help quantify the costs and benefits. Respondents noted the many important benefits of e-business, but quantifying these benefits and allocating them directly to e-business versus other business tools needs further research. In addition, research should investigate the role of e-business from a strategic perspective.

Dr. Zank's research interests include e-commerce, supply chain management, and green purchasing and marketing. Dr. Vokurka focuses his research on supply chain management, manufacturing strategy, and performance improvement.

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