

PERFORMANCE BENEFITS OF WEB-BASED SUPPLY CHAIN INTEGRATION

Charles E. Downing
Northern Illinois University
cdowning@niu.edu

Abstract

This article examines the performance of three categories of companies: companies which use no electronic supply chain integration at all, companies which use non-Web based electronic supply chain integration, and companies which use Web-based electronic supply chain integration. Performance is examined using the following dimensions: process cost, operational efficiency, customer satisfaction, coordination, cooperation, and commitment between partners, and overall performance. Results show that companies using Web-based electronic supply chain integration experience lower cost, higher operational efficiency, a more cooperative partner relationship, and superior overall performance as compared to companies using no electronic supply chain integration. Companies using non-Web based electronic supply chain integration exhibit higher customer satisfaction, coordination, cooperation, and commitment with partners, and overall performance as compared to companies using no electronic supply chain integration. And finally, companies using non-Web based electronic supply chain integration have a lower volume of complaints and better coordination between partners than companies using Web-based electronic supply chain integration.

Keywords: Supply Chain, process performance, integration

Introduction

The 1980s saw the advent of the personal computer, and the days of “Data Processing” departments solely dictating the timeline of office productivity solutions were gone. The 1990s saw the advent of enterprise resource planning (ERP) software packages, and organizations enthusiastically (even if sometimes slowly and painfully) moved from the silo mentality of departmental and unit-based information systems solutions to enterprise-wide information solutions. Today, companies are increasingly realizing that the progression from departmental to enterprise information systems has a logical next step: supply chain solutions. While many pioneering companies have linked to their customers and suppliers for years (Mukhopadhyay, 1995), the improving reliability and security of the world wide web (“Web”) presents new opportunities for all organizations. Companies are increasingly moving to the Web or considering moving to the Web to conduct business transactions, connecting themselves with suppliers and customers (Goudie et al., 1999; Muller, 1998).

Much of the recent research on electronic data interchange and information technology (IT) in the supply chain has focused on using the Web to conduct business-to-business (B2B) commerce across the supply chain, thus improving the older electronic data interchange (“EDI”) model (Downing, 2002; Simchi-Levi et al., 2000). The B2B market was estimated to be over \$6 trillion by 2005 (Greenemeier, 2000), and this prediction appears to be coming to fruition (Havenstein, 2005). As an increasing portion of companies migrate to the Web it becomes important for both academics and practitioners to understand the benefits and pitfalls of such a migration. Numerous studies enumerate the benefits of electronic supply chain integration and B2B (Downing, 2002; Greenemeier, 2000; Havenstein, 2005; Lee et al., 1999). In particular, Downing (2002) examined three categories of companies with regard to electronic supply chain integration: companies which use no EDI at all, companies which use private or “traditional” EDI, and companies which use Web-based EDI. Performance was examined for these three types of companies using the following dimensions: process cost, operational efficiency, customer satisfaction, coordination, cooperation, and commitment between partners, and overall performance. Companies using Web-based EDI experienced superior performance in commitment between partners as well as overall performance, while companies

using Web-based or traditional EDI experienced superior performance in internal operational efficiency as well as overall performance. While these findings are significant, they were done on a small sample size of companies (18). Also, many current studies claim that companies are misdiagnosing the advantage of B2B over existing ways of doing business (see e.g., Day et al., 2003). Much activity with ambiguous predictions of benefits demonstrates a clear need for further examination.

Hypotheses

Thus, this research will attempt to replicate the findings of the Downing (2002) study with a larger sample size. The goal will be to determine differences in the performance of companies using No Electronic Supply Chain Integration, NON Web-based Supply Chain Integration, and Web-based Supply Chain Integration.

The following is the central research question addressed in this paper:

“How does the supply chain performance of companies using No Electronic Supply Chain Integration or NON Web-based Supply Chain Integration compare to that of companies which have migrated Web-based Supply Chain Integration?”

This central question leads to the following three hypotheses:

H1₀: There is no difference in the mean response to each of the performance categories between companies using No Electronic Supply Chain Integration, and companies using Web-based Supply Chain Integration.

H1_a: The mean response to each of the performance categories will be higher for companies using Web-based Supply Chain Integration than for companies using No Electronic Supply Chain Integration.

H2₀: There is no difference in the mean response to each of the performance categories between companies using NON Web-based Supply Chain Integration, and companies using Web-based Supply Chain Integration.

H2_a: The mean response to each of the performance categories will be higher for companies using Web-based Supply Chain Integration than for companies using NON Web-based Supply Chain Integration.

H3₀: There is no difference in the mean response to each of the performance categories between companies using No Electronic Supply Chain Integration, and companies using NON Web-based Supply Chain Integration.

H3_a: The mean response to each of the performance categories will be higher for companies using NON Web-based Supply Chain Integration than for companies using No Electronic Supply Chain Integration.

Research Methodology, Data Collection and Results

The sample studied consists of business processes at financial services companies, primarily in the Northeastern part of the United States. This sample was chosen because the United States economy is moving more and more toward a services economy, and financial services have long been heavy users of information technology. The geographic region was chosen for convenience. 320 people agreed to receive the survey. If a completed survey was not received within a month of mailing, each potential participant was contacted again and sent out a new survey, if necessary. Completed surveys were received from 129 respondents, for a response rate of 40%. The 129 surveys represent 86 different financial services companies and 79 different business processes. Examples of processes include executing a stock trade, selling an insurance product to an individual or institutional client, managing a portfolio, and technology recruiting and staffing.

To have a meaningful study, the companies needed to vary on what type of electronic partnering they engaged in: No Electronic Supply Chain Integration, NON Web-based Supply Chain Integration, or Web-based Supply Chain Integration. This determination was made by asking each company a series of survey questions regarding the level that Information Technology and the Web play in helping them interact with their business partners. These questions appear in the Appendix. The first two questions, “Information Technology facilitates the sharing of

information between my primary supplier and me” and “Information sharing between my primary supplier and me is primarily through electronic means” were used to determine whether each company was using electronic supply chain integration or not. Respondents needed to answer both questions “5” or higher (toward “strongly agree” which is a “7” on a 7 point scale) to be counted as having electronic supply chain integration. Eighty-three companies were using electronic supply chain integration, while forty-six were not. To further divide the 83 who were using electronic supply chain integration, the third question was used to determine who was using the Web and who was not. Again, respondents needed to answer the question “5” or higher (toward “strongly agree” which is a “7” on a 7 point scale) to be counted as using the Web for electronic supply chain integration. Fifty-one of the companies were using the Web for electronic supply chain integration, and thirty-two were not.

A large survey was completed by all one hundred and twenty-nine companies. Of interest to this study, survey questions were given to all companies regarding their experiences with the major benefits expected from electronic supply chain integration as outlined previously: Reduction of Process Cost, Improved Operational Efficiency, Improved Customer Satisfaction, and Improved Coordination, Cooperation, and Commitment between EDI Partners. And finally, questions were asked about the company’s overall process performance. These survey questions used for this study have been omitted from the Appendix to save space, but are summarized in Table 1. Table 1 also shows the mean responses for each of the three groups, the differences between the means, and the significance level if the difference was found to be significant (shaded).

Table 1. Means for each company type. Differences between Means (with significance level)

Performance Measure	No Electronic Supply Chain Integration Mean	NON Web-based Supply Chain Integration Mean	Web-based Supply Chain Integration Mean	(Web-based SC Integration) minus (No Electronic SC Integration)	(NON Web-based SC Integration) minus (No Electronic SC Integration)	(Web-based SC Integration) minus (NON Web-based SC Integration)
Process Cost:						
Internal Cost (1-7, 1 is high cost, 7 is low cost)	4.71	4.60	4.88	0.17	-0.11	.28
Cost of Doing Business with Partner (1-7, 1 is exceptionally poor, 7 is exceptionally good)	4.12	4.37	4.61	0.49 **	0.24	0.24
Operational Efficiency:						
Internal Efficiency (1-7, 1 is high efficiency, 7 is low efficiency)	4.20	4.50	4.92	0.72 **	0.30	0.42
Partner's Efficiency (1-7, 1 is high efficiency, 7 is low efficiency)	3.96	4.34	4.61	0.65 **	0.39	0.26
Customer Satisfaction:						
Volume of Customer Complaints (1-7, 7 is very good, or few complaints)	5.28	5.97	5.45	0.17	0.68 *	-0.52 *
Overall Customer Satisfaction (1-7, 7 is very good, or high satisfaction)	5.57	5.88	5.75	0.18	0.31	-0.13
Coordination, cooperation, and commitment between EDI partners:						
Degree of coordination with primary supplier (1-7, 7 is very good, or much coordination)	4.57	5.41	4.86	0.30	0.84 **	-0.54 *
Cooperative relationship with supplier (1-7, 7 is very good, or very cooperative)	4.58	5.41	5.04	0.46 *	0.83 **	-0.37
Long term commitment with supplier (1-7, 7 is very good, or highly committed)	4.63	5.22	4.86	0.23	0.59 *	-0.36
Overall Performance:						
Information technology has improved the overall performance of the process (1-7, 7 is Strongly Agree)	5.41	6.13	6.04	0.63 **	0.71 **	-0.09
Overall Performance Based on corporate performance criteria (1-7, 7 is Outstanding)	5.29	5.19	5.45	0.16	-0.10	0.26
Overall Performance Based on similar processes in other companies in the industry (1-7, 7 is Outstanding)	5.17	5.25	5.41	0.24	0.08	0.16

**p<0.01

*p<0.05

Process Cost

In contrast to the 2002 study by Downing, companies using Web-based electronic supply chain integration had lower costs of doing business with their partners than companies with no electronic supply chain integration. This is an important result, as cost has long been an assumed benefit of Web migration with regard to supply chains.

Operational Efficiency

Operational efficiency was again shown to be superior for companies using Web-based electronic supply chain integration.

Customer Satisfaction

Web-based electronic supply chain integration did not do well in the “Customer Satisfaction” category, as shown in Table 1. Non-web-based electronic supply chain integration had a significantly higher mean than Web-based, and the Web-based satisfaction mean for both questions was not shown to be significantly higher than the “no electronic supply chain integration” mean. This contrasts the 2002 study (Downing, 2002), and could possibly be due to the maturity of the processes involved (Web-based being newer and thus less familiar to the customers).

Coordination, Cooperation, and Commitment Between EDI Partners

Companies using non-web-based electronic supply chain integration scored the highest on the coordination and cooperation questions, being significantly higher than the “no electronic supply chain integration” on all three questions and even higher than the Web-based electronic supply chain integration companies on the first question. Traditional EDI, given its relative maturity compared to Web-based electronic supply chain integration, has roots that go back many years. This fact could explain the closeness those companies felt with their suppliers.

Overall Performance

Both Web-based and non-Web-based electronic supply chain integration companies demonstrated superior overall performance as compare to the “no electronic supply chain integration” companies. However, as compared to one another, there was no statistical difference.

Conclusions

The results from this study have important implications for managers:

- As expected but not shown statistically in at least one previous study, moving electronic supply chain integration to the Web can yield decreased costs.
- Operational Efficiency was shown to be best for Web-based electronic supply chain integration.
- Customer Satisfaction may take time to realize. Potential Web-based partners should be cautioned at the outset that extra patience may be required in the early going while waiting for a satisfaction increase.
- Long term coordination, cooperation and commitment with an electronic partner was highest between non-Web-based electronic supply chain integration partners.
- It is safe to expect that overall process performance will increase after implementation of either Web-based or non-Web-based electronic supply chain integration

In conclusion, many of the claims and/or predictions that have been made in practitioner and academic outlets concerning the performance benefits of Web-based electronic supply chain integration seem to be accurate or becoming accurate. In particular, Web-based electronic supply chain integration has lower costs, superior operational efficiency, higher cooperation between partners, and greater overall performance than no electronic supply chain integration. These results suggest that if managers of businesses which could use or need to use electronic linkages have not considered Web-based EDI, now may be the time to do so.

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APPENDIX – Survey Questions

Survey Questions Used to Determine Type of Electronic Partnering

	Strongly disagree			Indifferent			Strongly agree
	1	2	3	4	5	6	7
Information Technology facilitates the sharing of information between my primary supplier and me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Information sharing between my primary supplier and me is primarily through electronic means.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The WWW facilitates the sharing of information between my primary supplier and me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
