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An information systems perspective of supply chain tool compatibility: the roles of technology fit and relationships

Supply chain tools

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Keywords *Electronic data interchange, Electronic commerce, Supply chain management, Trust*

Abstract *Among the primary tools of collaborative commerce are information technologies that are designed to improve flows along the supply chain. However, supply chain management software is not providing organizations with all its potential benefits. This study looks at three information technologies (i.e. group decision support systems, EDI and e-commerce) that can be used to improve information flows and the factors that affect their adoption and use. These factors are divided into those related to the information technology itself and those related to maintaining the relationships that are important in managing supply chain linkages. Factors related to the technology fit such as return on investment, fit with users' needs, affordability of the technology and ability to secure the technology were found to be important in the use of these tools. The ability to secure SCM technologies currently appears to substitute for some level of trust from an information systems perspective. In the case of the most mature technology (i.e. EDI), the results show that trust is related to fit with user needs. The implications of these findings for managers who wish to adopt and implement these SCM tools are discussed. Further study of these factors is suggested, particularly as SCM tools become increasingly more collaborative.*

Introduction

In today's highly competitive environment, companies are searching for ways to improve their competitive position. Recently, a concept known as "collaborative commerce" has altered the traditional relationship between suppliers and manufacturers from one of "haggling and hedging bets on product orders" (Harreld, 2001, p. 22) to a mutually beneficial model that holds promise to improve the competitive position of all parties involved. One of the main concepts underlying collaborative commerce is supply chain management (SCM), which provides a competitive advantage (Hill, 2002). SCM is defined as "the coordinated flow of material and products across the enterprise and with trading partners. But it also includes the management of information flows, cash flow and process/work flow" (Tyndall *et al.*, 1998, p. 8). To facilitate these flows, information technology companies are developing a myriad software tools.

Nearly \$15 billion of supply chain management software has been purchased since 1999 according to a survey by AMR Research Inc. One-third of the companies surveyed spend more than \$10 million annually on supply chain initiatives, with 90 percent planning to make additional purchases by 2004. Supply chain software sales will grow by 15-20 percent in 2002, and should approach the \$7 billion mark (Krizner, 2002). Supply chain management software is one of the few types of start-up that is still able to obtain venture capital funding (Marsan, 2002). However, 86 percent of supply chain professionals believe that current supply chain techniques are not meeting the needs of



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the marketplace, while 53 percent of respondents are not satisfied with the return on investment (ROI) in SCM software (Anon., 1999). This disparity between expected growth and user satisfaction with these SCM tools indicates that competitive advantage is gained by those who not only obtain SCM technologies, but are also able to implement them effectively.

Some of this disparity may be explained by issues beyond merely obtaining these tools, but also by using them effectively to improve ROI and other success measures. AMR Research Inc. found that just 16 percent of implementations took less than six months to be fully implemented while almost 20 percent of these projects took longer than two years to complete, with most taking more than a year (Krizner, 2002). These statistics suggest there are some significant implementation barriers to be overcome, with company culture and trust issues being cited as key obstacles (Harreld, 2001; Sgarioto, 2001). Managing the organizational culture and the relationships involved along the supply chain are as important as the software itself (Stein and Sweat, 1998).

Tompkins (1998) lists among his eight core competencies for SCM the following three:

- (1) Understanding change.
- (2) Understanding supply chain partnerships.
- (3) Understanding supply chain communications.

While these issues, particularly the third, may be facilitated or managed by technology, they are not inherently technology issues. Thus technology, while an important SCM facilitator, is only one of the critical issues involved in SCM. Disappointment with SCM applications has led to supplier relationship management (SRM) applications designed to create near-seamless links for information exchange with suppliers (Hill, 2002; Sawabini, 2001). However, these applications will not be implemented and/or used if there is a lack of trust between an organization and its suppliers.

The goal of most SCM software is to increase flows through collaboration. However, increasing collaboration is not merely a matter of making a tool available. Participants must be encouraged to use the tool share information to make its use effective. Harrington (1998) refers to collaborative relationships as "the most sophisticated form of supply chain partnering" (p. 60). Similarly, Tyndall *et al.* (1998) suggest that supply chain partnerships move from open-market negotiations, to cooperation, to coordination and finally to collaboration. This collaboration leads to a high degree of interdependence along the supply chain. True collaboration leads to maximizing competitive advantage. This research studies three collaborative commerce technologies designed to improve the flows, particularly of information, along the supply chain, either within or among organizations, and examines the factors related to the use of these tools. The tools studied include group decision support systems (GDSS), electronic data interchange (EDI) and e-commerce. These technologies involve the use of communications technologies to manage information flows along the supply chain, both internally and/or externally. However, if an organization has difficulty sharing information internally, it is difficult to then supply the necessary information to external partners. Managing internal supply chain links is as difficult as managing external links (Andel, 1998).

The SCM literature suggests that among the barriers to successful use of these technologies is not merely the technology itself, but also the relationships that are

impacted and fostered through the use of these technologies. The research model shown in Figure 1 examines the impact that both relationship attributes and technology fit attributes have on the matching of these technologies with user needs and the adoption and use of these SCM technologies.

Supply chain management technologies

An SCM tool that can be used for both intra-organizational and inter-organizational decision-making is a group decision support system (GDSS). GDSS is defined as software that enables group collaboration in accomplishing tasks. Examples include Lotus Notes, TeamFocus and VisionQuest. In SCM internal communications are important, since it is difficult to share information with external partners if a lack of internal communication prohibits it from being available in an organized manner. GDSS, which is a tool that facilitates the rapid flow of information necessary to make decisions, allows supply chain links to work effectively as a team or group and make decisions that benefit the team. The ability to function as a team is an important part of the concept of a highly integrated workflow encompassing total operations, known as "supply chain synthesis" (Tompkins, 1998).

EDI and e-commerce are more externally focused SCM tool categories that are receiving attention in the SCM literature. EDI has been in existence in some form for more than 20 years, and has been referred to as the first generation of e-commerce (Sawabini, 2001). A Giga Information Group report found that EDI use is more widespread than was previously believed, and predicts that its use will not slow down soon (Sawabini, 2001). In the present study, EDI is defined as the electronic data communication of invoices, purchase orders, or other standard forms used between customers and suppliers and which follow the standard EDI format for such forms. While EDI has well-established standards and is a relatively mature technology, it only extends to between 15 and 20 percent of a company's trading partners, thus making collaboration difficult (Sawabini, 2001). EDI is also a technology whose implementation has frequently been mandated by supply chain partners (Young *et al.*, 1999).

While EDI has been an important SCM tool, 61 percent of survey respondents expect the Internet to replace traditional EDI networks within the next three years, while 22 percent expect this replacement to occur in the next five years (Anon., 1998). Others suggest that Internet EDI will be just another SCM tool, and that companies will not give up the infrastructure that was built to support EDI, but rather will choose the

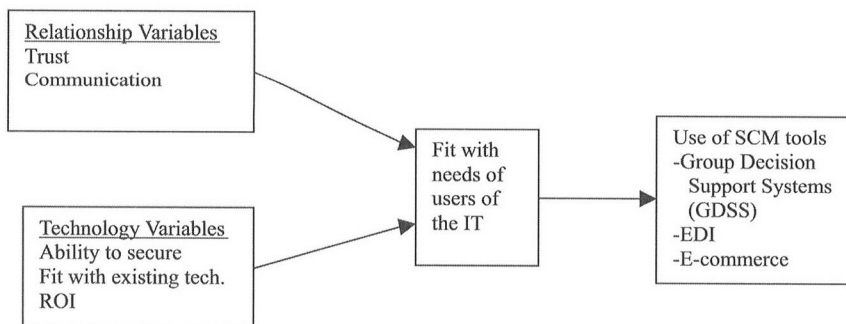


Figure 1.
Research model

most appropriate tool on a case-by-case basis (Sawabini, 2001). The use of the Internet or non-traditional forms of electronic marketing between a company and its customers, suppliers or other business partners is the definition of e-commerce used in this study.

SCM relationships

Communications

Open and frequent communication is necessary to develop and maintain relationships. When considering supply chain software, the key to long-term value is open communication, and this open communication also extends to supply chain relationships (Andel, 1998). Andel (1998) states that "[T]he winning supply chains build their success on people who can communicate". Tyndall *et al.* (1998) report that the top six phrases that describe an organization's supply chain partners are:

- (1) We expect this relationship to last a long time.
- (2) There is continuous contact between our firm and this customer.
- (3) Sustaining this relationship is important.
- (4) Communication between our organization and this customer is frequent.
- (5) There is a high level of contact between our firm and this customer.
- (6) Frequent communication occurs between the firms.

Four of the top six phrases describing the relationship with supply chain partners are related to frequent and open communications. Similarly, among the relationship attributes of strategic supplier alliances studied by Monczka *et al.* (1998) and the partnership attributes studied by Mohr and Spekman (1994) are communication behaviors.

Trust

In any relationship that is highly integrated, and therefore co-dependent, mutual trust is important. Within an organization, and certainly externally, there is a reluctance to share information that often stems from mistrust (Parker, 1997). For company proprietary information to be freely shared with supply chain partners requires trust that this information will not be exploited. First among the top ten reasons for selecting a supply chain partner is that they are trustworthy, followed by them having a high degree of integrity (Tyndall *et al.*, 1998). Monczka *et al.* (1998), who studied trust as an attribute of supplier alliances, found that high levels of trust and coordination were significantly related to the success of these strategic supplier alliances. Specifically, the success measures of price reductions, quality improvements, and product development time reductions were related to trust and coordination. A lack of trust can cost firms and decrease competitive position. One of the main reasons inventories are unnecessarily high is that the low level of trust between companies and suppliers leads the company to carry excess inventory (Whitfield, 2002). Vonderembse and Tracy (1999) suggest that trust is built through establishing supplier selection criteria and developing supplier involvement (collaboration), leading to competitive advantages.

Bruce and Moger (1999) studied two models of supply chain relationships – co-partnerships and *ad hoc* relationships. The co-partnership relationship facilitated an atmosphere of trust and loyalty, while the *ad hoc* relationships were less trustful and more reluctant to share ideas. Organizations that lack trust are not initially willing to be sufficiently open to establish a high level of supplier involvement, since this requires a

sharing of internal information. Supply chains must move from mere cooperation and coordination to true collaboration, and collaboration requires a foundation of trust and commitment (Tyndall *et al.*, 1998). The importance of trust to collaboration in the supply chain is also noted by other practitioner literature (Harreld, 2001; Sgarioto, 2001) as well as academic literature (Sako and Helper, 1998; Welty and Becerra-Fernandez, 2001).

SCM technology fit

Ability to secure

While trust is important from a relationship point of view, from a technological point of view a company can attempt to protect itself from exploitation while maintaining an open collaborative system by its ability to secure SCM systems. A certain level of trust can be replaced by the technological capabilities that secure information. Thus, the ability to secure these tools should impact the decision to adopt and how widely to use SCM tools.

Return on investment (ROI)

A survey by Tompkins Associates found that nearly 53 percent of supply chain professionals are not satisfied with the ROI of their supply chain tools (Anon., 1999). Similarly, others suggest that supply chain ROI is being oversold by vendors (Krizner, 2002). Further, Nickles (1999) suggests that when investing in a technology whose purpose is to facilitate relationships, the ROI of this type of technology is not comparable to technologies that reduce internal costs. The recent slowing of the economy has led to a renewed emphasis on the use of ROI assessment.

Cost/affordability relative to budget

Related to but not the same as ROI, cost/affordability is also an issue. Even if a tool has the potential for a high rate of return, if an organization cannot afford the costs involved in purchasing and implementing the tool they cannot gain the potential benefits, no matter how attractive they are.

Fit with needs of users

It has often been suggested that technology should not be implemented merely for technology's sake, but rather to meet a specific business need. Then, the implementation of the technology can be closely aligned with business needs and the greatest advantages obtained (Hildebrand, 1998). IT systems should be designed to meet the needs of the user, while still being compatible with the existing systems. This is particularly true when considering systems that require a high level of integration, as SCM tools do.

System decisions that are driven by operational needs cause systems to be viewed as tools or enablers of the goals of the business (Tyndall *et al.*, 1998). This matching or aligning of users' business needs with technology tools should be a threshold criterion to ensure appropriate technology choices. Since, as previously discussed, SCM technology tools still have great potential for growth, it is important to consider what factors impact perceived fit with users' business needs.

Methodology

Since information systems (IS) departments, particularly IS management, play a pivotal role in designing, choosing and effectively implementing SCM tools, they were the subjects of this study. The IS department is generally responsible for securing

these systems and integrating them with existing systems: therefore they were in the best position to assess the technological fit of the system. Surveys were sent to over 1,000 IS managers asking for their participation in this study. Of the questionnaires mailed, approximately 900 were believed to have reached the targeted IS manager, based on those returned by companies or the US postal service. A follow-up mailing to non-respondents was sent. One hundred and twenty five (125) usable responses were obtained, giving a response rate of approximately 14 percent. We believe this response rate was due in part to the time pressure on today's IS managers and the sensitive nature of the questions. Follow-up postcards to non-respondents asked them to identify the reason for not participating. The reasons given for not responding were:

- (1) too many surveys (36 percent);
- (2) not enough time (23 percent); and
- (3) length of survey (20 percent).

Industry classifications of the respondents were compared to the industry classifications of the mailing list, and no significant departures existed. Also, the survey asked about technologies other than collaborative tools, so the sample was not biased towards only those organizations that use them. Taken together, these tests suggest that a representative sample was obtained.

The characteristics of those responding are shown in Table I, which indicates that the sample was well represented in the area of manufacturing, where supply chain issues are currently under much discussion, and also contained other types of organizations that would benefit from SCM. The sample contained a large percentage (about 82 percent) of companies who compete nationally or internationally, thus suggesting the need for a relatively complex supply chain. Therefore, the companies represented appear to be a relevant sample to use to study SCM tools. Table I also indicates that the respondents had a high level of responsibility for making IT-related decisions, such as those involved in the decision to implement SCM tools. Therefore, the questionnaire appears to be appropriately targeted.

Measures

The "trust" relationship variable was measured using three Likert-scale questions:

- (1) The atmosphere within this organization can best be described as one of mutual confidence and trust.
- (2) This organization believes that computerized links with other organizations are important to its profitability and efficiency.
- (3) The relationship with our customers and suppliers can best be described as one of cooperation and trust.

Communication was measured using two questions:

- (1) My organization communicates easily and freely with its customers, suppliers, or other business partners.
- (2) What percentage of your subordinates would you rate as having a high level of interpersonal and communication skills?

This second question was recoded into an appropriate seven-point scale so it could be combined with the other communications question. The two communication questions

		Supply chain tools
<i>Level of competition</i>		
Local	18	
National	45	
International	37	
<i>Industry</i>		
Banking, insurance or finance	11	317
Education	9	
Local, state and federal government	12	
Transportation or utilities	5	
Manufacturing	51	
Retail	6	
Health services	6	
<i>Infrastructure</i>		
Mainframe	16	
PC-based	12	
Both	72	
<i>Respondent's gender</i>		
Male	92	
Female	8	
<i>Respondent's level of responsibility for IT decisions</i>		
Mean	81	
Standard deviation	28	
Minimum	5	
Maximum	100	
<i>Respondent's time in position</i>		
Mean	9.2	
Standard deviation	6.7	
Minimum	1	
Maximum	29	
<i>Number of employees at site</i>		
Mean	1,455	
Standard deviation	4,961	
Minimum	20	
Maximum	51,000	

Note: All figures are expressed as percentages, with the exception of respondent's time in position (years) and number of employees at site

Table I.
Sample characteristics

and the three trust questions were factor-analyzed to verify that they were distinct constructs and the factors loaded at greater than 0.60, as expected.

The technology fit variables were measured using a six-point scale. The instructions identified the following categories of fit: 1 = very poor, 2 = poor, 3 = average, 4 = good, 5 = very good or 0 = not familiar enough with the IT to judge. The respondents were asked to use this scale to rate the following fits: estimated return on investment (ROI), overall cost/affordability relative to budget, ability to control or secure, and fit with the needs of the users of the IT. Usage was measured on the following scale:

1 = initial or sporadic use, 2 = a few people use regularly (slightly implemented), 3 = many people use regularly (partially implemented), and 4 = all people use regularly (fully implemented). Adoption/non-adoption was measured by respondents indicating the stage of use for each IT. The choices were: 0 = not familiar with the practice (never considered), 1 = considered and rejected, 2 = currently being considered for use but not in use, 3 = currently being used on a trial basis, and 4 = implemented. Based on the response to this question, respondents were categorized as adopters if they answered 3 or 4 and non-adopters if they indicated 0 or 1. Those responding 2 were eliminated from the analysis since they are currently somewhere in the process and as a result were more difficult to classify. This procedure also serves to maximize any differences between adopters and non-adopters, since only those who have made a clear decision were included. The elimination of these respondents still left sufficient sample sizes ($n > 30$) in the categories to conduct the analysis.

Results of data analysis

Adopter/non-adopter analysis

When analyzing the data regarding GDSS, perception of the organizational atmosphere of trust was perceived to be significantly higher among those adopting GDSS than the non-adopting organizations (see Table II). Also, the overall mean of cost/affordability relative to the budget was "poor" among non-adopting organizations, while it was "average" in adopting organizations. Similarly, the ability to secure a GDSS was perceived to be significantly higher in the adopting organizations.

When comparing adopters of EDI to non-adopters of EDI there were no significant differences between the perceptions of trust level, communication level, ROI, cost/affordability or the ability to secure. This finding may be a result of EDI use often being imposed by supply chain partners (Young *et al.*, 1999). Where use is imposed, factors such as cost and ROI, and even trust and communication, may not be relevant in the decision to use EDI. This finding may be important as supply chain partners attempt to integrate all supply chain links and impose the use of specific SCM tools on partners. In this case the emphasis must be on the factors which are important in successful use rather than adoption. Among adopters and non-adopters of e-commerce, differences can be noted in the perception of ROI, ability to secure and the cost/affordability of e-commerce. While the ROI is perceived as higher among adopters, so is the cost relative to the budget, and the perception among adopters is that they have a greater ability to secure the technology than those not adopting e-commerce. Currently then, e-commerce is perceived as a technology fit rather than a relationship tool, although the literature suggests that this will change.

Correlation analysis

To identify whether the relationships proposed in the research model are present, the data was analyzed using correlation analysis (Table III). Each SCM tool was analyzed individually with respect to each of the variables present in the model. In the case of the GDSS tool, all the technology fit variables (ROI, cost and ability to secure) were significantly correlated to the perceived fit with the user of the GDSS's needs. Similarly, all the technology variables were significantly correlated with the level of use of GDSS. None of the relationship variables were significantly correlated with either fit with the user of the GDSS's needs or the GDSS's level of use.

Variable	Means GDSS		t-test significance	Means EDI		t-test significance	Means e-commerce		t-test significance
	Non-adopter	Adopter		Non-adopter	Adopter		Non-adopter	Adopter	
Trust	4.712	5.074	0.042*	4.638	4.893	0.180	4.672	4.985	0.070**
Communication	3.955	3.944	0.965	3.857	4.027	0.508	3.936	4.058	0.580
ROI	2.517	2.967	0.120	2.500	3.058	0.255	2.000	3.325	0.002*
Cost	2.357	2.933	0.024*	3.000	3.059	0.908	2.000	3.175	0.005*
Security	2.629	3.267	0.049*	2.800	3.329	0.261	1.900	3.025	0.044*

Notes: * $p > 0.05$; ** $p > 0.10$

Table II.
t-test of difference
of means

	Trust	Communication	ROI	Cost	Security	User needs	Usage
<i>GDSS</i>							
Trust	1.000						
<i>p</i> -value							
Communication	0.202	1.000					
<i>p</i> -value	0.024						
ROI	0.024	-0.114	1.000				
<i>p</i> -value	0.858	0.391					
Cost	0.027	0.052	0.848	1.000			
<i>p</i> -value	0.838	0.699	0.000				
Security	0.156	0.034	0.622	0.685	1.000		
<i>p</i> -value	0.246	0.800	0.000	0.000			
User needs	0.095	0.021	0.826	0.770	0.767	1.000	
<i>p</i> -value	0.473	0.875	0.000	0.000	0.000		
GDSS usage	0.122	-0.136	0.374	0.399	0.358	0.430	1.000
<i>p</i> -value	0.317	0.264	0.009	0.005	0.013	0.002	
<i>EDI</i>							
Trust	1.000						
<i>p</i> -value							
Communication	0.202	1.000					
<i>p</i> -value	0.024						
ROI	-0.011	0.092	1.000				
<i>p</i> -value	0.921	0.409					
Cost	-0.103	0.109	0.757	1.000			
<i>p</i> -value	0.364	0.335	0.000				
Security	0.133	0.077	0.477	0.552	1.000		
<i>p</i> -value	0.235	0.492	0.000	0.000			
User needs	0.226	0.076	0.694	0.594	0.670	1.000	
<i>p</i> -value	0.041	0.498	0.000	0.000	0.000		
EDI usage	0.130	0.119	0.318	0.252	0.377	0.480	1.000
<i>p</i> -value	0.215	0.258	0.005	0.030	0.001	0.000	
<i>E-commerce</i>							
Trust	1.000						
<i>p</i> -value							
Communication	0.202	1.000					
<i>p</i> -value	0.024						
ROI	0.014	-0.015	1.000				
<i>p</i> -value	0.918	0.910					
Cost	-0.070	0.006	0.851	1.000			
<i>p</i> -value	0.603	0.965	0.000				
Security	0.110	0.031	0.620	0.600	1.000		
<i>p</i> -value	0.412	0.818	0.000	0.000			
User needs	0.136	0.006	0.863	0.780	0.596	1.000	
<i>p</i> -value	0.304	0.962	0.000	0.000	0.000		
E-commerce usage	0.135	-0.043	0.414	0.239	0.446	0.432	1.000
<i>p</i> -value	0.244	0.711	0.002	0.081	0.001	0.001	

Table III.
Correlation matrix

All the technology fit variables were significantly related to both the fit with user needs ($p < 0.000$) and level of EDI use ($p < 0.03$). The only relationship variable significant with user needs was trust ($p = 0.04$). As in all SCM tool cases, user needs were significantly related to the use of each technology tool. In the case of the SCM tool e-commerce, user needs were significantly ($p < 0.000$) related to each of the technology fit variables. E-commerce usage was significantly ($p < 0.002$) related to both ROI and the ability to secure, but for cost the significance of the relationship is marginal at $p = 0.081$. This suggests that e-commerce cost relative to budget is less important than ROI and the ability to secure the system in the decision to implement e-commerce links. Neither of the relationship variables was related to e-commerce usage or fit with user needs.

Limitations of the study

Data was collected as an exploratory study of new and emerging IT technologies, and was designed to identify factors related to the adoption and use of these technologies. Therefore, the questions used were designed to identify individual factors that may be relevant in the decision to adopt and use a SCM tool, rather than to study any particular factor in depth. The factors identified here show potential for identifying some relevant factors in collaborative commerce tool adoption and use. However, these factors should be explored in great depth through the use of multiple-item measures designed to further examine the complexities involved in these relationships.

The fit measures used in this study are perceptual measures. While these perceptions are those on which adoption and implementation decisions are frequently made, and therefore are appropriate for this study, these perceptions should be verified through the use of more objective measures, particularly for variables such as ROI and cost/affordability.

Discussion: implications for supply chain professionals

In each of the SCM technologies studied there was a very significant relationship between the perceived needs of the users and the implementation of the technology. This suggests that the SCM software market is currently driven by business needs rather than the growing availability of software. SCM software companies should study company/customer needs carefully when designing SCM software. To further understand the motivation behind the use of SCM tools, the statement "This organization believes that computerized links with other organizations are important to its profitability and efficiency" was examined individually. This statement was significantly related to both fit with EDI users' needs and fit with users' e-commerce needs. Similarly, the difference in means for this statement between adopters and non-adopters was significant for both EDI and e-commerce. These findings suggest that managers who wish to promote the use of SCM tools should, when making the case for their fit with user needs, stress the value that these tools have for the organization's profitability and efficiency. This motivation may explain why the use of SCM software is imposed by supply chain partners who are attempting to improve potentially profitable linkages. This finding also suggests there may be a willingness to move forward with greater collaboration if it can be shown that there are financial rewards that outweigh the risks.

With respect to risk, one major concern in the use of all of the SCM tools studied is the ability to secure the technology. Recent world events have also led to a renewed emphasis on the security of computer systems, and this may have a significant impact on the use of these tools. The fact that those adopting these tools feel that they are able to secure them may explain, in part, why the findings for trust were not as strong as expected. Also, the lack of a finding for a relationship of trust, except in the case of EDI and fit with user need, suggests other related explanations. SCM tools are not yet being used in a fully integrated fashion (Harrington, 1998). Therefore, the ability to secure and control information still exists with these less integrated tool segments. However, to obtain the greatest possible competitive advantage, the tools must be highly integrated, suggesting that trust will become increasingly important as the tools become more integrated and more difficult to secure. A similar rationale exists for the lack of a finding for the other relationship variable, communication. Since SCM tools are not yet used in a fully collaborative manner, both the need and the opportunity for communication will increase. One interesting area of future research concerns whether those who use EDI for imposed relationships use it for those where it is not imposed, and further if the level of trust contributes to the decision to use it with non-EDI imposed relationships. Future research studies should continue to explore these relationship variables as SCM tools become more integrated and sophisticated.

These results suggest that in the current environment the technology fit variables of ROI, cost and ability to secure are related to the fit with SCM tool user needs and the implementation of these SCM tools. Those who wish to champion the use of these tools should attempt to increase the perception of the fit of these tools in the organization, particularly with respect to the cost of these tools and the ROI for these tools. This analysis requires significant input from SCM professionals who understand the current processes and the impact the tool will have on these processes. While the literature suggests that measures of technology fit, such as ROI, may not be appropriate in the future, they currently impact both the perception of user need and the use of these SCM tools. Managers wishing to implement these tools might be well advised to justify their use both with the newer concept of stakeholder value and competitive necessity as well as existing measures such as ROI. Also a concern for those wishing to implement SCM technologies is fit with the organization's ability to secure the tool from unwanted access, and the more integrated the tools, the greater the security concern.

Related to security concerns is the level of trust between supply chain links. There is a significant difference between the level of trust between adopters and non-adopters of GDSS ($p < 0.04$) and e-commerce ($p < 0.07$), but not EDI. It is not clear whether these differences in trust level between adopters and non-adopters suggest that when a higher level of trust exists an organization is more likely to adopt these SCM tools, or whether the adoption and use of these tools leads to a greater level of trust. This distinction may prove a fruitful area for future research. The lack of findings for SCM tool use and trust may also be related to the fact that this data was gathered from IS executives. Supply chain management professionals, such as purchasing managers, are frequently the relevant relationship partners with supply chain links. Adopting organizations, however, bring the IS department into the relationship, and this may partially explain the difference in trust levels between adopters and non-adopters as measured among IS professionals. Therefore, SCM professionals should facilitate the development of trust and communication between supply chain partners and IS departments. This interpretation is also supported by the strong finding for security

from an IS perspective. Research that examines ways to facilitate relationship building among SCM professionals, supply chain partners and IS management would aid our understanding of the successful implementation of these tools.

These findings suggest that the factors affecting the adoption and use of SCM technologies vary with the particular tool. For example, in the case of EDI there were no differences noted between adopters and non-adopters. However, in both GDSS and e-commerce, differences existed between adopters and non-adopters as well as between the significance of the factors. Managers cannot therefore expect to be able to successfully implement all SCM tools in the same manner. The findings of this study suggest which factors may be relevant for these three SCM tools. However, further research on these tools and others is recommended to determine how best to facilitate the implementation of each tool to gain maximum competitive advantage.

Conclusion

It should be noted that the factors related to the adoption of the tools, as suggested by adoption/non-adoption differences, are not necessarily the same factors related to the level of implementation or use of each tool in the correlation analysis. This indicates that the decision to adopt one of these technologies does not guarantee its effective use, since the factors facilitating adoption and use vary. Those who wish to champion the use of these tools have a complex task to perform not just to foster adoption, but also to encourage successful implementation. The variables studied here are those most commonly associated with successful collaborative commerce tool use, but they vary both with the specific tool in question and whether the organization is deciding to adopt the technology or whether it is trying to increase the level of use.

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