Information System Innovations and Supply Chain Management: Channel Relationships and Firm Performance

Daekwan Kim
Florida State University

S. Tamer Cavusgil
Roger J. Calantone
Michigan State University

This study explores how innovations surrounding supply chain communication systems (SCCS) affect channel relationships and market performance. Drawing on the resource-based view of the firm, the study hypothesizes that certain SCCS innovations can be viewed as firm resources that enhance channel capabilities, which in turn affect a firm's market performance. The empirical research is based on 184 responses from a survey with U.S. supply chain and logistics managers using structural equation modeling as the analytic method. The results suggest that the effect of applied technological SCCS innovations on channel capabilities is mediated by interfirm systems integration. In contrast, administrative SCCS innovations enhance information exchange and coordination activities directly. Furthermore, the influence of applied technological innovations for SCCS is not strong enough to affect either responsiveness of the partnership or firm performance, whereas administrative innovations for SCCS affect both.

Keywords: *supply chain communication system; technological innovation; administrative innovation; channel capability; interfirm system integration*

Journal of the Academy of Marketing Science.
Volume 34, No. 1, pages 40-54.
DOI: 10.1177/0092070305281619

Since the 1970s, information technology (IT) productivity has been debated from the economy level to the industry, firm, and activity levels (Brynjolfsson 1993). Some researchers find a positive relationship between IT investment and firm productivity (Brynjolfsson and Hitt 1996). In a narrower scope, IT also enhances efficiency in various firm activities (Stank, Crum, and Arango 1999) and processes (Mukhopadhyay, Rajiv, and Srinivasan 1997).

Nevertheless, a few scholars report either no effect or even a negative influence of IT on productivity (Kettinger, Grover, Guha, and Segars 1994). In a study by Kettinger et al. (1994), for instance, 24 firms out of 30 experienced negative consequences for market share or profits within 5 years of IT deployment, and only 3 of those 24 firms gained both market share and profits after 5 years. Powell and Dent-Micallef (1997) also found no relationship between IT deployed and overall store performance in their survey of retailers. Disappointing outcomes of IT investment raise questions about its vital role in the contemporary organization (Taylor 2003).

Despite the contradictions in the literature, scholars and consultants still tout the importance of IT in enabling companies to achieve more efficient and effective communication with their channel partners (Bowersox, Closs, and Stank 1999). Manufacturers need to work closely with suppliers and distributors to reduce unnecessary inventory, which usually cuts costs and helps make product

pricing more competitive (Porter and Millar 1985). In addition, active information exchange among partners speeds up reaction to market and/or environmental changes, as well as competitive development of new products (Clemons and Row 1992). Likewise, distributors must work closely with inbound suppliers and outbound retailers to postpone the point of sale to consumers as much as possible to reduce inventory cost. Retailers need to share information about customer preferences so that these can be incorporated into products.

The present study explores the roles of IT and, thus, information systems (ISs) in channel relationships and firm market performance (e.g., sales growth, market development, product development) in the context of supply chain communication systems (SCCS), a key element of supply chain management systems (SCMS). We define an SCCS as an IS shared by channel partners in order to carry out electronic transactions, quality and cost calibration, and collaborative forecasting and planning (Bowersox et al. 1999). An SCMS is defined as an internally and externally integrated corporate system that enables channel members to carry out supply chain activities, including strategic management functions (Bowersox, Closs, and Cooper 2002; Bowersox et al. 1999).

A typical SCCS incorporates elements of, and interfaces with, various corporate IS within SCMS, such as enterprise resource planning, customer relationship management, advanced planning, transportation management, and warehouse management systems. One element of a typical SCCS is electronic data interchange (EDI), which has played a key role in SCMS (Rogers, Daugherty, and Stank 1993), although future success will depend on such emerging elements of SCCS as radio frequency exchange and satellite technology, meeting the information needs within the supply chain. It is worth noting that an IS (e.g., SCCS) is distinct from IT. An IS is a bundle of IT software and hardware with context incorporated to achieve organizational goals, whereas IT is a combination of computer hardware and software that is used for communication.

We pursue three objectives in this research. First, we explore whether and in what way a firm's internal channel capabilities are enhanced by SCCS innovations. We assess the empirical relationship between those innovations (as a resource) and channel capability (as a mediator). Second, we examine how SCCS innovations influence the firm's market performance (e.g., sales growth, market development, product development) through enhanced channel relationships. Both the literature (e.g., Kettinger et al. 1994) and the recent convoluted experience with IT by *Fortune* 500 firms (e.g., Taylor 2003) suggest little or no link between IT investment and firm performance. We attempt to refute that view by identifying the conditions that lead to the failure of IT investment for IS innovations. Third, we investigate the extent to which SCCS innovation is a source of competitive advantage for firms. Through SCCS innovations, firms are likely to gain a sustainable competitive advantage resulting from improved channel functions (e.g., information exchange, coordination, responsiveness of the partnership).

The focal firm's market performance is adopted as the ultimate outcome variable in this study since it is likely to reflect the benefits from improved channel functions adequately. That is, as channel functions include not only transactions but also quality and cost calibration, and sharing plans for new products and market development, market performance is expected to reflect outcomes of enhancements in channel functions well. Subsequently, it will be measured by sales growth rate and effective development of new markets and products (Sarkar, Echambadi, and Harrison 2001).

MODEL AND HYPOTHESES

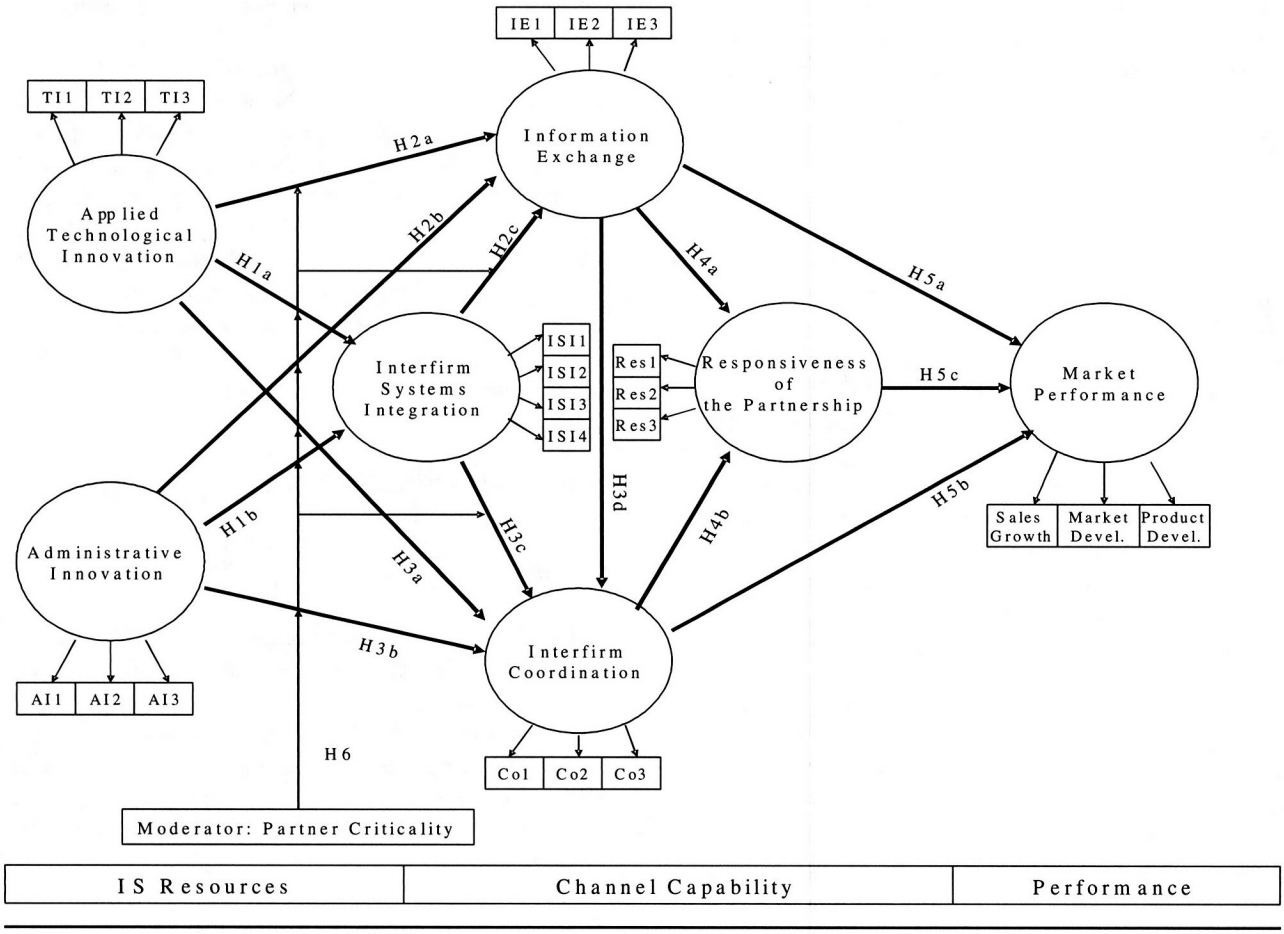
Conceptual Framework

Drawing on the resource-based view (RBV) of firms, we propose the model that consists of IS resources, channel capabilities, and firm performance, as depicted in Figure 1. We postulate that IS resources, such as applied technological innovations and administrative innovations, enhance internal channel capabilities, which in turn influence firm market performance (Barney 1991; Collis 1994).

IS Innovations as Resources of the Firm

According to the RBV, firm resources include "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness" (Barney 1991: 101). Resources can be classified into three types of capital: physical, human, and organizational (Barney 1991). The RBV assumes that resources are distributed heterogeneously and are not perfectly mobile across firms (Barney 1991), which can be a source of sustainable competitive advantage (Collis 1994). Nonetheless, not all physical, human, and organizational capital contributes to competitive advantage (Barney 1991). Therefore, it is critical to understand the conditions under which firm resources can serve as such a source in order to receive their full benefits. This study examines three types of IS resources cited in the literature as potential sources of competitive advantage: applied technological innovation and administrative innovation for SCCS (Swanson 1994), and interfirm systems integration (Bowersox et al. 1999).

FIGURE 1
Operational Model and Hypotheses



Applied Technological Innovation for SCCS

Applied technological innovation for SCCS is the extent to which a firm adopts or uses the most advanced information technology to improve its SCCS (Swanson 1994). The literature discusses technological process innovations that focus on technical IS improvements in general (Swanson 1994), but we are concerned primarily with deployment of IT, particularly the degree of proactive adoption or use of the most advanced IT for SCCS.

Applied technological innovations for SCCS are likely to be an important firm resource because firms with advanced technology outperform their competitors (Closs and Savitskie 2003). From the RBV perspective, one way to make SCCS unique and imperfectly mobile across firms is to adopt new technology proactively and receive its benefits before it is fully diffused across the industry (DiMaggio and Powell 1983). That is, proactive adoption of new SCCS technologies through applied technological innovations, especially before they are fully adopted by competitors in the industry, can be a source of competitive advantage enhancing efficiency in channel activities both within the firm and with its partners. Therefore, applied technological innovations are expected to affect a firm's channel capabilities (e.g., information exchange, interfirm coordination) positively to the extent it makes the activities of a firm more efficient (Barney 1991) than those of its competitors.

Administrative Innovation for SCCS

Another way to gain benefit from SCCS is to increase a firm's ability to appropriate SCCS through administrative innovations (Swanson 1994). Firms vary in the degree of SCCS use. Some receive the full benefits, while others materialize limited gains. Grant (1996) argued that firms have different levels of ability to derive benefits from their resources. Incorporating this notion, administrative innovation for SCCS in this study refers to the extent to which the firm possesses the necessary knowledge and skills to exploit or use its SCCS in a way that competitors cannot imitate easily.

Firms can seek administrative innovations for SCCS in various ways. For example, SCCS deployment can be tailored to the firm's core competencies or capabilities. Because IT alone cannot be a source of competitive advantage, due to its wide availability in the market (Powell and Dent-Micallef 1997), the RBV stresses that these technologies must be embedded in a firm's managerial process. Such SCCS customization through administrative innovations improves its heterogeneity (Barney 1991), making the systems a source of competitive advantage. Therefore, only when a firm integrates the advanced technology with its core strengths, assets, or capabilities, such as strong channel and customer relationships through administrative innovations, will it gain an enduring competitive advantage (Barney 1991).

Effective administrative innovations also require the accumulation of internal SCCS skills and knowledge rather than outsourcing of them (Powell and Dent-Micallef 1997) because a source of advantage residing outside the organization means low heterogeneity and high mobility of the source. Reflecting this, more firms are investing in IT for their SCCS than ever before, building IS departments in an effort to develop the internal skills necessary to make full use of advanced technology. In sum, when SCCS technology is embedded into a firm's core competencies through internally accumulated skills and knowledge, the system is more likely to be deployed in a unique way within the organization, enhancing its immobility and heterogeneity. Such enhancements in immobility and heterogeneity of SCCS should improve a firm's channel capabilities (Barney 1991).

Interfirm Systems Integration

Firms are integrating their activities both internally and across channel partners. We focus on the integration with channel partners and view it as a two-dimensional process: interfirm systems integration and interfirm activity integration. The literature does not explicitly consider these as separate dimensions. We believe the distinction is important because the effect of SCCS innovations on both supply chain activities and market performance can be explored more effectively through interfirm systems integration than activity integration. Furthermore, we consider systems integration as another type of IS resource that indirectly reflects the technological connectivity between channel partners (Bowersox et al. 1999). A high degree of systems integration allows two proprietary systems to reduce technical barriers and incompatibility so as to communicate more effectively during collaborative activities (Bowersox et al. 1999).

Interfirm systems integration could cover a wide spectrum of interfirm channel activities, including but not limited to order placement and tracking; exchange of data on performance, point-of-sale information, and inventory data; and planning and forecasting (Bowersox et al. 1999). In this study, we confine the scope of interfirm systems integration to important collaborative channel activities, such as planning and forecasting with other channel members, essential parts of collaborative planning, forecasting, and replenishment (CPFR) activities that the supply chain literature discusses recently (Bowersox et al. 1999; Esper and Williams 2003).

Although the literature does not address interfirm systems integration explicitly, it discusses how IS in general has driven channel partners toward closer (activity) integration (Clemons and Row 1992). As a channel member undergoes technological and administrative innovations, there can be more active sharing of planning, strategies, resources, and competencies among partners. As a result, SCCS innovations, whether technological or administrative, facilitate the development of stable, close relationships among channel partners (Clemons and Row 1992). That is, IS innovations facilitate supply chain integration and eventually enhance firm performance through improved channel capabilities by "cementing relationships with customers, enabling integration forwards or backwards in the industry value chain or in establishing a technical lead" (Roberts and Mackay 1998: 176). And, such interfirm integration for collaborative channel activities should reflect interfirm systems integration (Bowersox et al. 1999). Therefore, we propose the following:

Hypothesis 1a: Applied technological innovations for SCCS facilitate interfirm systems integration.

Hypothesis 1b: Administrative innovations for SCCS facilitate interfirm systems integration.

Channel Capabilities of Firms

Organizational capability is an outcome of knowledge and resource integration within and across firms (Collis 1994). In this study, channel capability refers to the exploitation of resources and other capabilities to derive efficiency in channel activities and, ultimately, sustainable competitive advantage (Collis 1994). We investigate interfirm information exchange and transaction-related coordination activities with the partner for whom SCCS is deployed for, and responsiveness of the partnership as channel capabilities.

Information Exchange

Information exchange is the sharing of knowledge with channel partners to serve downstream customers effectively and efficiently. Such knowledge would include any changes in the business environment, such as market and customer preferences. Among the multiple dimensions of information exchange are timeliness, accuracy, adequacy, completeness, and credibility of information (Mohr and Sohi 1995). In order for channel partners to use the

information effectively and efficiently, it should be exchanged when it is needed, in an adequate format, without any missing elements (completeness) (Mohr and Sohi 1995), and it should come from a credible partner or source.

Information exchange is the most obvious and immediate outcome of SCCS innovations (Clemons and Row 1993). Both applied technological innovation and administrative innovation help partners share more information, as SCCS improves their efficiency in gathering accurate, necessary, and timely data (Rogers, Daugherty, and Stank 1993). In addition, the information domain expands beyond channel members to partners of partners (Clemons and Row 1993), allowing them to share timely and accurate information via SCCS (Bowersox et al. 1999). Therefore, the more innovations for SCCS, the better should be the quality of information exchange with the channel partner SCCS is deployed for.

Hypothesis 2a: Applied technological innovations for SCCS facilitate information exchange with the focal firm's channel partner.

Hypothesis 2b: Administrative innovations for SCCS facilitate information exchange with the focal firm's channel partner.

Interfirm Coordination

Interfirm coordination refers here to transaction-related activities between channel partners (Clemons and Row 1993). These range from the collection of product-related information to order follow-up. Thus, the identification and articulation of customer needs as well as the pursuit of new customers or buyers also can be coordinated across partners (Clemons and Row 1992). SCCS innovations help channel partners coordinate transaction-related activities more efficiently at less cost or can achieve better coordination for the same cost (Roberts and Mackay 1998).

The literature offers several possible effects of SCCS innovations as firm resources on interfirm coordination activities. Both applied technological innovation and administrative innovation help channel members reduce communication errors and delays under the electronic hierarchy (Malone, Yates, and Benjamin 1987), facilitating effective electronic coordination. Furthermore, SCCS innovations reduce transaction costs in logistics because of enhanced communications between channel partners and ultimately coordination costs (Lewis 2001). According to Clemons and Row (1993: 76, 88), "A proposition that underlies much of the work in the area of strategic information systems is that IT reduces the cost of coordination, leading firms to coordinate more," and "for some segments of the retail market this increased coordination [because of IS innovations] was observed." Therefore, a better SCCS from applied technological and administrative innovations can improve interfirm coordination with the partner that SCCS is deployed for (Clemons and Row 1992).

Hypothesis 3a: Applied technological innovations for SCCS enhance interfirm coordination with the focal firm's channel partner.

Hypothesis 3b: Administrative innovations for SCCS enhance interfirm coordination with the focal firm's channel partner.

Information exchange by itself does not offer much benefit. Instead, it contributes to such channel capabilities as coordination and responsiveness of the partnership (Bowersox et al. 1999). Truman (2000) argues that channel partners exchange more information in an effort to enhance coordination. The purpose of an SCCS is to collect, interpret, filter, store, and share data through effective information exchange within and across partners to improve efficiency in coordination activities (Truman 2000). Thus, it is plausible to argue that information exchange enhances coordination (Lewis 2001).

Hypothesis 3d: Information exchange facilitates interfirm coordination.

Interfirm Systems Integration as a Partial Mediator

We maintain that interfirm systems integration partially mediates the influence of SCCS innovations on a firm's channel capabilities, including interfirm information exchange and coordination. Using the term *connectivity*, Bowersox et al. (1999) discusses how a firm's efforts to maintain a good interfirm channel system affect channel activities through interfirm systems integration. Moreover, Clemons and Row (1992) contend that

> often environmental and technological factors will make it possible to increase the overall efficiency of production or exchange through closer integration of decisions and operations. However, the supplier must invest in information systems to accumulate the information and in decision processes to utilize that information for production scheduling and delivery. (P. 14)

The literature further claims that supply chain partners are integrating systems to obtain better information (Lewis and Talalayevsky 1997). Therefore, SCCS innovations are likely to improve interfirm coordination and information exchange activities through closer systems integration (Stank et al. 1999). Thus,

Hypothesis 2c: Interfirm systems integration facilitates information exchange.

Hypothesis 3c: Interfirm systems integration facilitates interfirm coordination.

Responsiveness of the Partnership

The responsiveness of the partnership is defined as the extent to which the firm, collectively with the channel member for whom SCCS is deployed, reacts to environmental changes or new market developments. Today's complicated marketplace requires reliable, efficient, and collaborative response from the supply chain as a collection of partners, and an advanced SCCS and interfirm systems integration are expected to be critical factors (Roberts and Mackay 1998). Thus, this study focuses on the role of SCCS innovations in enhancing responsiveness of the supply chain partnership.

In a discussion of how technology affects firm capability, Clemons and Row (1993) contend that "just-in-time inventory techniques with key suppliers or customers are reducing channel inventories and improving system responsiveness" (p. 73). That is, an efficient SCCS enhances responsiveness of the partnership for which the system is deployed by helping channel partners accommodate market changes or customer requests in a timely manner through efficient information exchange and coordination activities (Clemons and Row 1992). Therefore, we argue that information exchange and coordination that are improved by SCCS innovations facilitate responsiveness of the partnership.

Hypothesis 4a: Information exchange facilitates responsiveness of the partnership.

Hypothesis 4b: Interfirm coordination facilitates responsiveness of the partnership.

Market Performance as the Ultimate Outcome

The firm's market performance is adopted as the ultimate outcome variable in this study. It is measured by sales growth, market development, and product development (Sarkar et al. 2001). SCCS innovations are expected to affect market performance positively through their influence on channel capabilities. A good communication system should help firms respond to customer requests (Rogers et al. 1993) and outperform in the market through on-time delivery, efficient ordering procedures, customer alertness (Stank et al. 1999), timely assessment of customer needs (Stank et al. 1999), and more broadly market orientation (Hernandez-Espallardo and Arcas-Lario 2003). Lewis (2001) argues that interfirm channel systems improve market performance of firms because they permit "large scale tracking of customer preferences" (p. 7), which should be associated with stronger channel capabilities, including information exchange, coordination activities, and responsiveness of the partnership. Therefore, we argue that interfirm coordination, information exchange, and responsiveness of the partnership as channel capabilities contribute to firm market performance through improved sales growth and development of new markets and products (Stank et al. 1999).

Hypothesis 5a: Information exchange facilitates market performance.

Hypothesis 5b: Interfirm coordination facilitates market performance.

Hypothesis 5c: Responsiveness of the partnership facilitates market performance.

Partner Criticality as a Moderator

Although a firm may have numerous channel partners, not all are equally important for the success of the firm (Anderson, Havila, and Salmi 2001). Depending on the criticality of the partner, the level of information exchanged and/or the degree of strategic integration should vary, because sharing and integrating more than necessary with channel partners could result in a leakage of competencies.

Moreover, commitment and trust between partners depend on "shared values" and "relationship benefits" (Morgan and Hunt 1994: 22). That is, the importance of one channel partner may affect the other partner's commitment to the relationship in terms of information exchange, coordination, and strategic integration. Firms are willing to share information and integrate systems and activities especially with key partners in order to strengthen the relationship (Anderson et al. 2001). Therefore, when a channel partner is not at all crucial to the success of a focal firm, SCCS innovations have a less effect on channel activities with the partner than with a very critical channel partner.

Hypothesis 6: The effect of applied technological innovations and administrative innovations on information exchange and interfirm coordination is greater when the partner is more critical to the firm.

RESEARCH METHOD

The Sampling Frame

This study examines supply chain partnerships at the business unit level, from the perspective of both selling and buying firms. Ideally, informants need to have some knowledge of SCCS innovations, the degree of system and activity integration with channel partners, any enhancement of channel capabilities the firm has experienced, and the firm's market performance. Thus, the most appropriate informant is the supply chain manager, but not all firms have a combined position. Some organizations still separate procurement functions from logistics activities. Therefore, qualified respondents are supply chain

TABLE 1
Characteristics of Responding Firms

	Number of Respondents	*Percentage*
Industry		
Automotive	17	9.2
Computer and communication	24	13.0
Consumer products	33	17.9
Chemical	9	4.9
Electronic equipment	17	9.2
Industrial machinery	29	15.8
Medical equipment	12	6.5
Other	39	21.2
Not reported	4	2.2
Total	184	100.0
Annual sales		
< $100 million	52	28.3
$101 million to $499 million	43	23.4
$500 million to $999 million	20	10.9
$1 billion to $4.99 billion	30	16.2
> $5 billion	21	11.5
Not reported	18	9.8
Total	184	100.0
Number of employees		
< 500	67	36.4
500 to 999	24	13.1
1,000 to 4,999	41	22.3
5,000 to 10,000	16	8.7
> 10,000	26	14.1
Not reported	10	5.4
Total	184	100.0

managers, logistics managers, or procurement/purchasing managers.

After considering various trade associations, we sought cooperation from the Council of Logistics Management, which provided a list of member companies. We eliminated consultants, freight forwarders, and third-party logistics companies, which left a pool of 1,949 managers. A preliminary request with a URL link to the Web survey was e-mailed to these managers, asking their participation. There were 223 undeliverable e-mails, and another 5 managers indicated that they were not interested. Ten days later, a reminder with a URL link was sent out. From these two requests, 264 responses were received within our 3-week deadline, for an effective response rate of 15.3 percent (264/1,726). Only 184 responses were included in the final analysis because of missing variables, so the usable response rate with listwise deletion is 10.7 percent.

Respondents are from various major industries, such as consumer products (17.9%), industrial machinery (15.8%), computer and communication (13.0%), automotive (9.2%), electronic equipment (9.2%), medical equipment (6.5%), chemical (4.9%), other (21.2%), and not reported (2.3%). Table 1 provides information about responding firms.

In an effort to assess nonresponse bias in the sample, we compared industry distribution (i.e., manufacturing vs. retailing) of the population with that of the respondents. In the total membership of the Council of Logistics Management, the manufacturer-retailer ratio is 6.17 to 1, whereas among our respondents, it is 5.96 to 1. We conducted a chi-square test, and the result reveals a chi-square value of .027 ($p > .05$). This indicates that our respondents are not significantly different from the sampling frame in terms of industry distribution. Therefore, it appears that nonresponse bias does not pose a problem for the current study.

It is always possible that some degree of common method bias may exist given the nature of perceptual data using a single source of information. Consequently, we conducted a test for potential common method bias using the hierarchically nested covariance structure model (e,g., Cote and Buckley 1987). According to the results, as reported in Table 2, variances from both construct items (or traits) and method are present. This suggests that a portion of the covariance originates from the method used in data collection. However, the mean percentages of variance explained by the construct items (70.9%) and by the common method factor (4.1%) indicate that common method bias is relatively minor (Lee, Sirgy, Brown, and Bird 2004). Therefore, we conclude that common method bias is not posing a major threat to the study.

Measures

We adopted measures from the literature whenever possible, but some scale development was necessary. The procedure suggested by Churchill (1979) was used for scale development. First, the domain of each construct was clearly defined in terms of what would be included or excluded. Second, the literature was searched to locate any relevant scales. If none were available or appropriate, new measures were developed. Multiple items were used for each construct to increase reliability.

The scales for applied technological innovation for SCCS are adapted from Gatignon and Xuereb (1997). None were available for administrative innovation for SCCS, so we developed this measure. Interfirm systems integration scales are adapted from Bowersox et al. (1999) and capture the degree of systems integration for collaborative forecasting and planning.

Measures from Mohr and Sohi (1995) are used to assess information exchange between channel partners. Scales for partner coordination were developed. Responsiveness of the partnership measures are adapted from Bello and Gilliland (1997) and McGinnis and Kohn (1990), with adjustments from the firm to the partnership level. For market performance, scales are adopted from Sarkar et al. (2001): sales growth, market development,

TABLE 2
Assessment of Common Method Bias

Model	χ^2	df	p	*CFI*	*NNFI*	*RMSEA*
M1: Null model	3,383.627	231	.00	NA	NA	NA
M2: Trait-only model	252.832	188	.00	.979	.975	.044
M3: Method-only model	1,807.669	209	.00	.493	.440	.205
M4: Trait and method model	193.038	166	.07	.991	.988	.030
Model comparison	$\Delta\chi^2$	Δdf	*p*		*Conclusion*	
Testing for the presence of trait factors						
M1-M2	3,130.795	43	< .01		M1 > M2	
M3-M4	1,614.289	43	< .01		M3 > M4	
Testing for the presence of a method factor						
M1-M3	1,575.958	22	< .01		M1 > M3	
M2-M4	59.452	22	< .01		M2 > M4	

NOTE: CFI = Comparative Fit Index; NNFI = Non-Normed Fit Index; RMSEA = root mean square error of approximation; NA = not applicable.

and product development. Finally, measures for partner criticality were developed to assess the partner's importance in terms of meeting customer requirements, long-term benefits, and the focal firm's core competency.

Assessment of Measures

Confirmatory factor analysis (CFA) was carried out as part of a two-step approach (Anderson and Gerbing 1988) to investigate the validity of each construct. Particular attention was given to the scales we developed. A nested CFA was performed for applied technological innovation and administrative innovation for SCCS and for interfirm systems integration to evaluate their structural relationships alone, using EQS for Windows 5.7b. In the purification process, some items that were weakly loaded on their respective constructs were eliminated. Furthermore, items that were cross-linked to multiple constructs were deleted for discriminant validity, based on the multivariate Lagrange multiplier (LM) test. At least three purified items for each construct remained and were included in the CFA model. The CFA results revealed an excellent fit between the model and the data set (χ^2 = 44.593 on 32 *df*, Comparative Fit Index [CFI] =.992, and root mean square error of approximation [RMSEA] = .047). Items loaded on each hypothesized construct significantly, as expected, and the findings for convergent and discriminant validity were acceptable, as all correlations between constructs were significantly different from 1 (Bagozzi, Yi, and Phillips 1991).

Another CFA model was estimated for channel capabilities (information exchange, coordination, and responsiveness of the partnership) and market performance. The same purification process was employed, and the CFA results indicated a very good fit between the CFA model and the data set (χ^2 = 61.891 on 48 *df*, CFI = .990, and RMSEA = .040). Again, all items loaded significantly on the respective constructs, and no problems with convergent and discriminant validity emerged.

Based on the two models, another CFA with all constructs was carried out. The results yielded excellent fit indexes (χ^2 = 252.832 with 188 *df*, CFI = .979, Normed Fit Index [NFI] = .925, and RMSEA = .044). As part of a unidimensionality assessment, convergent and discriminant validity at both the item and the construct level was evaluated. For convergent validity, the standardized loading of each item must be greater than .5 (Fornell and Larcker 1981). For discriminant validity, all correlations between two constructs should be significantly less than 1, and item-level correlations between constructs are expected to be insignificant (Bagozzi et al. 1991). According to the results, items were loaded appropriately on their respective constructs, and no standardized loading was less than .5, which indicates an adequate level of convergent validity for each construct.

Moreover, in terms of discriminant validity, all correlations between constructs were significantly different from 1 (Bagozzi et al. 1991). Thus, construct-level discriminant validity for the model was established. Subsequently, discriminant validity at the item level was assessed using primarily the LM test. The assessment was important because scales for administrative innovation and systems integration were developed, among others, for the current study. The LM test results indicated that no item from one construct is correlated with items from other constructs significantly. Therefore, item-level discriminant validity for the CFA model was also established.

As a final step to assess the unidimensionality of each construct (Churchill 1979; Fornell and Larcker 1981), composite reliability was calculated using the formula suggested by Fornell and Larcker (1981). As shown in Table 3, all figures are above .8, which indicates that

TABLE 3
Measures and Composite Reliabilities

Construct	*Measure*[a]	*Loading*	*Composite Reliability*
Applied Technological Innovation	Please circle the number that best reflects your agreement with the following statements regarding information technology at your business unit (BU) for supply chain communication systems (SCCS).		.9304
	My BU uses the most advanced information technology (IT) for SCCS.	.894	
	Our IT for SCCS is always state-of-art technology.	.903	
	My BU is very proactive in adopting or developing advanced IT for SCCS.	.914	
Administrative innovation	Please circle the number that best reflects your agreement with the following statements regarding the ability to receive benefits from SCCS in your BU.		.8904
	Relative to competitors, our technical knowledge for SCCS is clearly superior.	.852	
	My BU uses IT for SCCS in a way that competitors cannot imitate easily.	.772	
	My BU exploits IT for SCCS better than competitors.	.934	
Interfirm systems integration	Please circle the number that best reflects your agreement with the following statements regarding the functionality of your SCCS.		.9283
	Our SCCS has built-in functions to collaborate on forecasting and planning with our partner.	.766	
	My BU can forecast and plan collaboratively with our partner through SCCS.	.941	
	Our SCCS allows us to project and plan future demand collaboratively with our partner.	.902	
	Collaboration in demand forecasting and planning with our partner is always possible through our SCCS.	.928	
Information exchange	Please circle the number that best reflects your agreement with the following statements regarding your information exchange with your primary partner.		.8910
	To what extent is your information exchange with your primary partner:		
	Inadequate — Adequate	.919	
	Incomplete — Complete	.909	
	Not credible — Credible	.728	
Interfirm coordination	Please circle the number that best reflects your agreement with the following statements regarding your efficiency of transaction coordination activities.		.8865
	My BU is more efficient in coordination activities with our partner than are our competitors with theirs.	.868	
	My BU conducts transaction follow-up activities more efficiently with our partner than do our competitors with theirs.	.964	
	My BU spends less time coordinating transactions with our partner than do our competitors with theirs.	.702	
Responsiveness of the partnership	Please circle the number that best reflects your agreement with the following statements regarding the responsiveness of your supply chain (i.e., your BU and your partners together).		.8680
	Compared to our competitors, our supply chain responds more quickly and effectively to changing customer or supplier needs.	.872	
	Compared to our competitors, our supply chain responds more quickly and effectively to changing competitor strategies.	.880	
	Compared to our competitors, our supply chain develops and markets new products more quickly and effectively.	.728	
Market performance	Please circle the number that best reflects your agreement with the following statements.		.8680
	My BU performs much better than competitors in sales growth.	.771	
	My BU performs much better than competitors in market development.	.904	
	My BU performs much better than competitors in product development.	.807	
Partner criticality[b]	Please circle the number that best reflects your agreement with the following statements regarding your primary partner.		.8470
	Our partner is important for meeting customer requirements	NA	
	Our partner is critical for our BU's long-term benefit	NA	
	Our partner is important for our BU's core competency.	NA	

CFA model goodness-of-fit indexes:
$\chi^2 = 252.832$ on 188 *df*
CFI = .979
NFI = .925
RMSEA = .044
90% confidence interval of RMSEA (.028, .057)

NOTE: CFA = confirmatory factor analysis; CFI = Comparative Fit Index; NFI = Normed Fit Index; RMSEA = root mean square error of approximation; NA = not applicable.
a. For all measures, 7-point Likert-type scales were used (1 = *strongly disagree*, 7 = *strongly agree*).
b. Partner criticality, a moderator, was not included in the CFA, as the moderating effect was assessed with a nested model. The reliability report is Cronbach's alpha.

measures adopted for each construct are reliable (Fornell and Larcker 1981). Table 3 also lists items covered in the CFA model and their standardized loadings.

STRUCTURAL MODEL RESULTS

With the acceptable measurement model, we proceeded to estimate the structural model. A full latent variable model with items adopted from the overall CFA model was estimated (Anderson and Gerbing 1988), as the nature of the research strongly favors the use of structural equation modeling (SEM). The results revealed a very good fit between the theoretical model and the empirical covariances provided by the sample ($\chi^2 = 264.394$ on 194 *df*, CFI = .978, NFI = .922, and RMSEA = .045). These indexes are well above acceptable levels, so it can be concluded that hypothesis testing based on this model is reliable.

According to the results, applied technological innovation for SCCS has a positive effect on interfirm systems integration ($p < .05$), as stated in Hypothesis 1a. Hypothesis 1b postulates that administrative innovation for SCCS has a positive effect on interfirm systems integration, and it is also supported ($p < .05$). The mediating role of information exchange is predicted in Hypotheses 2a, 2b, and 2c. Specifically, the positive effect of applied technological innovation for SCCS on information exchange as proposed in Hypothesis 2a is not empirically supported ($p > .05$). We found, however, that administrative innovation for SCCS facilitates information exchange ($p < .05$) as claimed in Hypothesis 2b. Furthermore, interfirm systems integration affects information exchange positively ($p < .05$), as Hypothesis 2c postulated.

Unlike the claim of Hypothesis 3a, applied technological innovation for SCCS does not enhance interfirm coordination directly ($p > .05$). In contrast, administrative innovation for SCCS affects interfirm coordination positively ($p < .05$), as stated in Hypothesis 3b. Also, there is a positive effect of interfirm systems integration on interfirm coordination ($p < .05$), as stated in Hypothesis 3c. Information exchange between channel partners has a positive influence on interfirm coordination ($p < .05$), as anticipated by Hypothesis 3d.

We tested a positive effect of information exchange and interfirm coordination on responsiveness of the partnership with Hypotheses 4a and 4b. According to the results, information exchange facilitates responsiveness of the partnership ($p < .05$), as expressed in Hypothesis 4a. Interfirm coordination is also expected to affect responsiveness of the partnership positively (H4b), and it is supported ($p < .05$).

Hypotheses 5a, 5b, and 5c relate firm channel capabilities to market performance of the firm. We found a positive effect of information exchange on market performance ($p < .05$), as stated by Hypothesis 5a. However, interfirm coordination facilitates market performance only indirectly. That is, the results reveal the positive effect of responsiveness of the partnership on market performance ($p < .05$), as posited in Hypothesis 5c, but not the direct positive effect of interfirm coordination on market performance that is claimed in Hypothesis 5b ($p > .05$). Table 4 summarizes the results of hypothesis testing.

The moderating influence of partner criticality on the effect of applied technological and administrative innovations for SCCS on channel capabilities (i.e., information exchange and coordination) was assessed by a two-group analysis with the same EQS version. To minimize sample size issues, a model with fewer constructs was employed. That is, responsiveness of the partnership and market performance were dropped, since the primary objective of the two-group model is to investigate any moderating effects of partner criticality on the relationship between SCCS innovations as firm resources and channel capabilities.

The results indicate a very good fit of the two-group model with the covariances provided by the data ($\chi^2 = 221.733$ on 197 *df*, CFI = .990, NFI = .915, and RMSEA = .026), but we found no significant difference at the 5 percent level across the two groups for any of the constrained paths. Therefore, Hypothesis 6 is not supported. Table 5 reports the results of the two-group analysis.

DISCUSSION

We postulated that both applied technological and administrative innovations for SCCS will facilitate channel capabilities: information exchange, coordination, and responsiveness of the partnership. However, it appears that applied technological innovation for SCCS does not facilitate information exchange or coordination directly, as Hypotheses 2a and 3a were not supported. Applied technological innovation is only helpful when its effect is mediated by interfirm systems integration, as suggested by Hypotheses 1a, 2c, and 3c. That is, only when applied technological innovation enhances interfirm systems integration for effective collaborative forecasting and planning does it affect interfirm information exchange and coordination positively. Therefore, firms should consider applied technological innovation to the extent they need to improve systems integration with partners.

Some results confirm the importance of a strategy for SCCS. First, the effect of applied technological innovation for SCCS on channel capabilities is mediated by interfirm systems integration, which implies strategic IS adoption (Swanson and Ramiller 1997). In other words, interfirm systems integration can be viewed as an outcome of IS innovations aimed strategically at improving the channel

TABLE 4
Proposed Hypotheses and Test Results

Hypothesis	*Standardized Parameter Estimate*	*Conclusion*
Hypothesis 1a: Applied technological innovations facilitate interfirm systems integration.	.394*	Supported
Hypothesis 1b: Administrative innovations facilitate interfirm systems integration.	.223*	Supported
Hypothesis 2a: Applied technological innovations for SCCS facilitate information exchange with the focal firm's channel partner.	.067	Not supported
Hypothesis 2b: Administrative innovations for SCCS facilitate information exchange with the focal firm's channel partner.	.259*	Supported
Hypothesis 2c: Interfirm systems integration facilitates information exchange.	.235*	Supported
Hypothesis 3a: Applied technological innovations enhance interfirm coordination with the focal firm's channel partner.	−.175	Not supported
Hypothesis 3b: Administrative innovations enhance interfirm coordination with the focal firm's channel partner.	.434*	Supported
Hypothesis 3c: Interfirm systems integration facilitates interfirm coordination.	.308*	Supported
Hypothesis 3d: Information exchange facilitates interfirm coordination.	.289*	Supported
Hypothesis 4a: Information exchange facilitates responsiveness of the partnership.	.157*	Supported
Hypothesis 4b: Interfirm coordination facilitates responsiveness of the partnership.	.610*	Supported
Hypothesis 5a: Information exchange facilitates market performance.	.202*	Supported
Hypothesis 5b: Interfirm coordination facilitates market performance.	−.024	Not supported
Hypothesis 5c: Supply chain responsiveness facilitates market performance.	.458*	Supported
Structural model goodness-of-fit indexes:		
χ^2 = 264.394 on 194 *df*		
CFI = .978		
NFI = .922		
RMSEA = .045		
90% confidence interval of RMSEA (.030, .057)		

NOTE: SCCS = supply chain communication systems; CFI = Comparative Fit Index; NFI = Normed Fit Index; RMSEA = root mean square error of approximation.
*$p < .05$.

network. Applied technological innovation without such a focus would deliver no additional value in terms of interfirm information exchange and coordination. Second, the direct influence of administrative innovation on channel capabilities also suggests the importance of a clear strategic objective with SCCS innovations (Swanson and Ramiller 1997). These advocate that firms should introduce SCCS innovations with clear objectives in mind.

The ability to make use of SCCS through administrative innovation adds value directly to channel capabilities, as suggested by Hypotheses 2b and 3b. In addition, the effect of administrative innovation on channel capabilities is mediated by interfirm systems integration, since Hypothesis 1b was supported. Obviously, administrative innovation does not play the same role as applied technological innovation. Actually, it reveals the relative importance of administrative innovations that reflect a firm's managerial processes better than applied technological innovations. Finding administrative innovations more important than applied technological innovations for channel activities is in line with what both RBV literature (Barney 1991) and IS literature (Swanson and Ramiller 1997) claim.

In terms of interfirm systems integration, several interesting findings emerge from this study. It appears that such integration is a necessary accompaniment to derive an adequate return from applied technological innovation. Similarly, the effect of applied technological SCCS innovation on responsiveness of the partnership may be questionable without the mediation of interfirm systems integration. The omission of such a key mediating variable may explain why some researchers warn that IT investments yield little or no improvement in firm productivity (Kettinger et al. 1994), since favorable returns are less likely to be explained in the absence of a key mediator.

We examined the total effects of SCCS innovations on both responsiveness of the partnership and market performance from the EQS output. According to the results, the total effects of applied technological innovation on responsiveness of the partnership and market performance are not significant in statistical terms ($p > .05$). In contrast, administrative innovation plays an important role, as its total effects on both responsiveness of the partnership and market performance are significant ($p < .05$). These results clearly show that applied technological innovations and administrative innovations have distinctive effects on channel capabilities as well as market performance.

We found no support for the moderating role of partner criticality in the effect of IS resources (applied technological innovation, administrative innovation, and interfirm systems integration) on channel capabilities. This result

TABLE 5
Two-Group Analysis of the Moderating Effects of Partner Criticality

Hypothesis 6: The effect of applied technological innovations and administrative innovations on information exchange and interfirm coordination is greater when the partner is more critical to the firm. (not supported)

	Standardized Parameter Estimate[a]			
Individual Path	*Low Partner Criticality Group (73 Cases)*	*High Partner Criticality Group (110 Cases)*	*Univariate Chi-Square Difference*	*Conclusion*
Applied Technological Innovation → Interfirm Systems Integration	.410	.392*	.001	Not supported
Applied Technological Innovation → Information Exchange	–.004	.065	.044	Not supported
Applied Technological Innovation → Interfirm Coordination	–.107	–.144	.234	Not supported
Administrative Innovation → Interfirm Systems Integration	.094	.283*	1.562	Not supported
Administrative Innovation → Information Exchange	.317	.238	.282	Not supported
Administrative Innovation → Interfirm Coordination	.259	.501*	1.311	Not supported
Interfirm Systems Integration → Information Exchange	.047	.336*	1.913	Not supported
Interfirm Systems Integration → Interfirm Coordination	.352*	.233*	.868	Not supported

Structural model goodness-of-fit indexes:
χ^2 = 221.733 on 197 *df*
CFI = .990
NFI = .915
RMSEA = .026

NOTE: CFI = Comparative Fit Index; NNFI = Non-Normed Fit Index; RMSEA = root mean square error of approximation.
a. Two-tailed test for the difference from zero.
*$p < .05$.

suggests that IS resources have the same influence on information exchange and interfirm coordination regardless of the importance of the partners. The result may imply that the importance of a channel partner does not dictate how IS resources are deployed in current management practices. According to the results, it is possible the importance of effective information exchange and interfirm coordination across all channel members dominates channel relationships.

MANAGERIAL IMPLICATIONS

One valuable insight for managers is that reliance on applied technological innovations alone does not improve supply chain capabilities directly, both in terms of information exchange and interfirm coordination activities. Yet generation of internal knowledge and skills in an effort to use SCCS better than competitors through administrative innovations renders direct improvements in channel capabilities. This conclusion is further supported by the total effects of applied technological innovation and administrative innovation on both responsiveness of the partnership and firm market performance. For responsiveness of the partnership, the total effect of applied technological innovation is not significant ($p > .05$), whereas that of administrative innovation is significant ($p < .05$). Similarly, for market performance, there is no significant total effect of applied technological innovation ($p > .05$), but we find a significant total effect of administrative innovation ($p < .05$). These results suggest that managers need to be aware of the differences in the way these two types of IS innovations influence performance.

These results suggest that advanced technology, by itself, does not lead to competitive advantage. Rather, a firm's IS with contexts built in facilitates competitive advantage. Only when the SCCS is customized to the supply chain's needs through administrative innovations, does it become unique and inimitable and does it offer competitive advantage. These findings shed light on the growing contention that not all IT innovations enhance productivity or firm performance. Managers ought to invest in internal knowledge and skill accumulation, or administrative innovations, to improve channel capabilities and, ultimately, market performance.

The study also reveals the critical role of interfirm systems integration in identifying the effect of applied technological innovation. Interfirm systems integration mediates the effect of applied technological innovations on channel capabilities, while applied technological innovation does not affect channel capabilities directly. These results suggest that applied technological innovations should be accompanied by interfirm systems integration. Consequently, managers should be aware that applied technological innovation for SCCS should address interfirm connectivity (Bowersox et al. 1999), such as system-aided collaborative planning or forecasting.

Information exchange seems to be a cornerstone for other channel capabilities and market performance. Our

results indicate that its influence on coordination, responsiveness of the partnership, and market performance is significant. That is, high-quality information exchange not only helps coordinate with channel partners but also improves responsiveness of the partnership and market performance. Yet we also found that effective interfirm coordination improves responsiveness of the partnership but not market performance directly. Therefore, it is important for managers to understand the different role of key channel activities in improving responsiveness of the partnership and market performance.

The study findings also suggest that partner criticality does not moderate the effects of IS resources on channel capabilities. That is, the effects of IS resources on information exchange and coordination are independent of the criticality of the channel partner. These insignificant moderating effects could result from the possibility that firms are striving for the most effective interfirm information exchange and coordination activities with all channel partners regardless of the importance of the partners. Firms deploy SCCS innovations for all channel partners rather than selectively with critical partners only. Most likely, it is cost-effective to introduce the same innovations for all channel partnerships since customizing the innovations according to the criticality of the partners requires additional financial and human resources. However, the result could also imply that firms are exchanging information and coordinating channel activities more than necessary with less critical partners, which could result in competence leaking.

THEORETICAL IMPLICATIONS

The study offers several implications for theory. First, the findings confirm the RBV argument (Barney 1991) in the context of IS resources and supply chain relationships. We empirically examined applied technological innovation as distinct from administrative innovation (Swanson 1994). Although the IS literature distinguishes these concepts, the extent to which they operate differently was yet to be explored. Therefore, this study makes a valuable contribution to the literature by investigating different types of IS innovations empirically in the context of an important area of firm activities, supply chain management.

Second, this study bridges the IS and RBV literature. Applied technological innovation, obviously a more imitable resource by competitors than administrative innovation, has no significant direct or indirect influence on firm market performance, as claimed by the RBV literature (Barney 1991). In contrast, administrative innovation, which relies on a firm's internal knowledge and use of IS, and cannot be easily imitated by competitors, has a greater effect on firm performance than applied technological innovation, as argued by the RBV. By comparing and contrasting those two types of innovations for SCCS empirically and by pointing out their distinctive roles, we connect two major streams of research.

Third, another finding is that coordination facilitates responsiveness of the partnership but not market performance directly. This is interesting, because the literature discusses coordination as a possible antecedent of firm performance (Mohr and Nevin 1990). Instead, it appears that its influence is totally mediated by responsiveness of the partnership.

Although we found no direct link between applied technological innovation and information exchange and coordination, the indirect path through interfirm systems integration reveals a significant connection. Our mediation model explains the reports of weak or no link between IT investments and firm performance or productivity (Kettinger et al. 1994).

LIMITATIONS AND FUTURE RESEARCH

Several limitations of the study should be acknowledged. First, the study employed perceptual data from a single informant in each of the firms surveyed. This raises an issue of possible biases. Although we did not find any significant evidence for common method bias, it is possible that other types of bias including social desirability bias could have influenced the results of the current study. In addition, because of the perceptual nature of the data, the reported results may have been inflated. Therefore, we recommend several alternative research designs for future research. These would include the use of objective data (e.g., firm performance), multiple informants, and longitudinal data. Such alternative research designs should provide more concrete evidence for the effects of IS innovations.

In the present research, we viewed interfirm integration as two separate processes—systems integration and activity integration. That is, this study adopted interfirm systems integration as a distinct type of IS resource. However, the relationship between them is yet to be explored. Interfirm systems integration may be an antecedent to activity integration, or the latter may evoke the former. Future research should explore this possibility.

This study found no support for the moderating effect of partner criticality on the influence of IS resources on channel capabilities. Future research may consider other variables, including industry and stages of technology deployment, as possible moderators. For instance, a supply chain for consumer goods may not receive as much benefit from advanced IT as a chain in the construction industry. The deployment of new technology may be a sufficient condition for deriving competitive advantage in

one industry, but only a necessary condition in another. Likewise, the stages of technology adoption (e.g., early, intermediate, or advanced) may affect how IT deployment influences channel activities.

The role of IT in contemporary business cannot be overemphasized, but it is equally important to understand how ISs affect business activities. This study attempted to clarify the conditions under which firms are more likely to receive returns from their IS innovations in the context of supply chain relationships, linking the view of RBV with that of the IS literature. The findings suggest that managers need to focus on appropriate types of IT innovations to enhance supply chain activities and organizational performance.

ACKNOWLEDGMENTS

We thank the editor, George Zinkhan, and three anonymous reviewers for valuable comments that improved earlier versions of this article.

REFERENCES

Anderson, Helen, Virpi Havila, and Asta Salmi. 2001. "Can You Buy a Business Relationship? On the Importance of Customer and Supplier Relationships in Acquisitions." *Industrial Marketing Management* 30 (7): 575-586.

Anderson, James C. and David W. Gerbing. 1988. "Structural Equation Modeling in Practice: A Review and Recommended Two-Step Approach." *Psychological Bulletin* 103 (3): 411-423.

Bagozzi, Richard P., Youjae Yi, and Lynn W. Phillips. 1991. "Assessing Construct Validity in Organizational Research." *Administrative Science Quarterly* 36 (3): 421-458.

Barney, Jay. 1991. "Firm Resources and Sustained Competitive Advantage." *Journal of Management* 17 (1): 99-120.

Bello, Daniel C. and David I. Gilliland. 1997. "The Effect of Output Controls, Process Controls, and Flexibility on Export Channel Performance." *Journal of Marketing* 61 (1): 22-38.

Bowersox, Donald J., David J. Closs, and M. Bixby Cooper. 2002. *Supply Chain Logistics Management*. New York: McGraw-Hill.

———, ———, and Theodore P. Stank. 1999. *21st Century Logistics: Making Supply Chain Integration a Reality*. East Lansing: Michigan State University and Council of Logistics Management.

Brynjolfsson, Erik. 1993. "The Productivity Paradox of Information Technology." *Communications of the ACM* 36 (12): 67-77.

———and Lorin Hitt. 1996. "Paradox Lost? Firm-Level Evidence on the Returns to Information Systems Spending." *Management Science* 42 (4): 541-558.

Churchill, Gilbert A., Jr. 1979. "A Paradigm for Developing Better Measures of Marketing Constructs." *Journal of Marketing Research* 16 (1): 64-73.

Clemons, Eric K. and Michael C. Row. 1992. "Information Technology and Industrial Cooperation: The Changing Economics of Coordination and Ownership." *Journal of Management Information Systems* 9 (2): 9-28.

———and———. 1993. "Limits to Interfirm Coordination Through Information Technology: Results of a Field Study in Consumer Packaged Goods Distribution." *Journal of Management Information Systems* 10 (1): 73-95.

Closs, David J. and Katrina Savitskie. 2003. "Internal and External Logistics Information Technology Integration." *International Journal of Logistics Management* 14 (1): 63-76.

Collis, David J. 1994. "Research Note: How Valuable Are Organizational Capabilities?" *Strategic Management Journal* 15 (Special Issue): 143-152.

Cote, Joseph A. and M. Ronald Buckley. 1987. "Estimating Trait, Method, and Error Variance: Generalizing Across 70 Construct Validation Studies." *Journal of Marketing Research* 24 (3): 315-318.

DiMaggio, Paul J. and Walter W. Powell. 1983. "The Iron Cage Revisited—Institutional Isomorphism and Collective Rationality in Organizational Fields." *American Sociological Review* 48 (2): 147-160.

Esper, Terry L. and Lisa R. Williams. 2003. "The Value of Collaborative Transportation Management (CTM): Its Relationship to CPFR and Information Technology." *Transportation Journal* 42 (4): 55-65.

Fornell, Claes and David F. Larcker. 1981. "Evaluating Structural Equation Models With Unobservable Variables and Measurement Error." *Journal of Marketing Research* 18 (1): 39-50.

Gatignon, Hubert and Jean-Marc Xuereb. 1997. "Strategic Orientation of the Firm and New Product Performance." *Journal of Marketing Research* 34 (1): 77-90.

Grant, Robert M. 1996. "Toward a Knowledge-Based Theory of the Firm." *Strategic Management Journal* 17 (Winter Special Issue): 109-122.

Hernandez-Espallardo, Miguel and Narciso Arcas-Lario. 2003. "The Effects of Authoritative Mechanisms of Coordination on Market Orientation in Asymmetrical Channel Partnerships." *International Journal of Research in Marketing* 20 (2): 133-152.

Kettinger, William J., Varun Grover, Subashish Guha, and Albert H. Segars. 1994. "Strategic Information Systems Revisited: A Study in Sustainability and Performance." *MIS Quarterly* 18 (1): 31-58.

Lee, Dong-Jin, M. Joseph Sirgy, James R. Brown, and Monroe Murphy Bird. 2004. "Importers' Benevolence Toward Their Foreign Export Suppliers." *Journal of the Academy of Marketing Science* 32 (1): 32-48.

Lewis, Ira. 2001. "Logistics and Electronic Commerce: An Interorganizational Systems Perspective." *Transportation Journal* 40 (4): 5-13.

——— and Alexander Talalayevsky. 1997. "Logistics and Information Technology: A Coordination Perspective." *Journal of Business Logistics* 18 (1): 141-156.

Malone, Thomas W., Joanne Yates, and Robert I. Benjamin. 1987. "Electronic Markets and Electronic Hierarchies." *Communications of the ACM* 30 (6): 484-497.

McGinnis, Michael A. and Jonathan W. Kohn. 1993. "Logistics Strategy, Organizational Environment, and Time Competitiveness." *Journal of Business Logistics* 14 (2): 1-23.

Mohr, Jakki and John R. Nevin. 1990. "Communication Strategies in Marketing Channels: A Theoretical Perspective." *Journal of Marketing* 54 (4): 36-51.

———and Ravipreet S. Sohi. 1995. "Communication Flows in Distribution Channels: Impact on Assessments of Communication Quality and Satisfaction." *Journal of Retailing* 71 (4): 393-416.

Morgan, Robert M. and Shelby D. Hunt. 1994. "The Commitment-Trust Theory of Relationship Marketing." *Journal of Marketing* 58 (3): 20-38.

Mukhopadhyay, Tridas, Surendra Rajiv, and Kannan Srinivasan. 1997. "Information Technology Impact on Process Output and Quality." *Management Science* 43 (12): 1645-1659.

Porter, Michael E. and Victor E. Millar. 1985. "How Information Gives You Competitive Advantage." *Harvard Business Review* 63 (4): 149-160.

Powell, Thomas C. and Anne Dent-Micallef. 1997. "Information Technology as Competitive Advantage: The Role of Human, Business, and Technology Resources." *Strategic Management Journal* 18 (5): 375-405.

Roberts, Bob and Mike Mackay. 1998. "IT Supporting Supplier Relationships: The Role of Electronic Commerce." *European Journal of Purchasing & Supply Management* 4 (2/3): 175-184.

Rogers, Dale S., Patricia J. Daugherty, and Theodore P. Stank. 1993. "Enhancing Service Responsiveness: The Strategic Potential of EDI." *Logistics Information Management* 6 (3): 27-32.

Sarkar, MB, Raj Echambadi, and Jeffrey S. Harrison. 2001. "Alliance Entrepreneurship and Firm Market Performance." *Strategic Management Journal* 22 (6/7): 701-711.

Stank, Theodore, Michael Crum, and Miren Arango. 1999. "Benefits of Interfirm Coordination in Food Industry Supply Chains." *Journal of Business Logistics* 20 (2): 21-41.
Swanson, E. Burton. 1994. "Information Systems Innovation Among Organizations." *Management Science* 40 (9): 1069-1092.
———and Neil C. Ramiller. 1997. "The Organizing Vision in Information Systems Innovation." *Organization Science* 8 (5): 458-474.
Taylor, David A. 2003. "Supply Chain vs. Supply Chain." *Computerworld* 37 (November 10): 44-45.
Truman, Gregory E. 2000. "Integration in Electronic Exchange Environments." *Journal of Management Information Systems* 17 (1): 209-244.

ABOUT THE AUTHORS

Daekwan Kim (dkim@cob.fsu.edu) is an assistant professor of marketing and international business in the College of Business at Florida State University. He received his Ph.D. from Michigan State University. His research interests include the impact of information technology on channel relationships and marketing strategies, role of information technology in global supply chain management, channel relationships, global brand management, and family conglomerates in emerging markets.

S. Tamer Cavusgil (cavusgil@msu.edu) is University Distinguished Faculty and the John W. Byington Endowed Chair in Global Marketing, the Eli Broad Graduate School of Management, Michigan State University. His research interests include international marketing strategy, coordination in the global company, and emerging markets. He is the founding editor of *Advances in International Marketing* and a governor of the Academy of Marketing Science.

Roger J. Calantone (rogercal@msu.edu) is the Eli Broad Chaired University Professor of Business and is University Distinguished Faculty at Michigan State University. He is program director of the university specialization program in Information Technology Management and is also adjunct professor of economics. His publications and research are mostly in the areas of product design and development processes, decision support systems, and organization process metrics and control.