Information Technology and Supply Chain Collaboration: Mediating Effects of Existing Relationships between Partners

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Abstract

Previous studies suggest that information technology (IT) is critical to the development of collaboration between supply chain partners. Our study posits that the effect of IT is not predetermined by its technological capabilities. Rather, its effect on interorganizational collaboration is the *emergent* properties of the interplay between IT and existing relationships between partners. Based on the literature, we selected four dimensions of supplier-retailer relationship (trust, interdependence, long-term orientation, and information sharing) to investigate the mediating effect of existing relationships on the efficacy of IT. Using case research that involved direct observation and systematic interviews with five pairs of suppliers and retailers, we verified that existing formative contexts between partners both enable and constrain the effect of IT on interorganizational collaboration. In addition, IT and stabilizes the reinforces already existing interorganizational structures and arrangements. Overall, the results suggest that cooperative formative contexts between partners should precede the IT-based interorganizational linkage effort.

1. Introduction

There have been many studies of the role, impact and benefits of information technologies (ITs) or interorganizational information systems (IOS) on interorganizational relationships and supply chain [3,45,47]. ITs are often viewed as enablers for supply chain integration. Previous studies have reported positive effects of ITs on such dependent variables as partner relationship, collaboration, supply chain performance, etc. [2,50,51]. In these studies, ITs are shown to have some explanatory/predictive power. Yet, missing from these studies is an analysis of existing partner relationships and their impact on the effect of ITs on those dependent variables. This may lead organizations and managers to form the mistaken belief that IT investment will automatically bring supply chain integration, better collaboration with partners, and ultimately higher organizational performance.

The purpose of this paper is to shed light on the importance of existing interorganizational relationships in the effects of ITs in supply chain collaboration. We posit that the IT effect is not predetermined, and existing business relationships between supply chain partners play an important role in determining the effects of ITs on interorganizational collaboration. We begin with a literature review pertinent to interorganizational collaboration. Accordingly, we have selected four factors critical to the use of ITs and developed a conceptual model to illustrate the significant role of existing relationships between partners as an important moderator of the IT effect on interorganizational collaboration. A case study of five supplier-retailer pairs is presented to verify the conceptual model. Finally, several theoretical and practical implications are discussed.

2. Literature Review

2.1 IT as Enabler of Interorganizational Collaboration

There have been an increasing number of studies of IT's effect on supply chain and interorganizational relationships [2,6,18,53]. For example, Bakos and Brynjyoolfsson [2] propose that IT deployment in supply chains leads to closer buyer-supplier relationships. Stump and Sriram [50] provide empirical evidence that the use of IT is associated with the overall closeness of buyersupplier relationships. Subramani [51] reports a positive relationship between an IT-based supply chain and organizational benefits. Grover et al. [18] suggest that the decision to use IT within the dyad could encourage the commitment to establishing relational behavior. Their results show that IT decreases transaction costs between buyers and suppliers and creates а more relational/cooperative governance structure.

On the other hand, a small number of studies have reported no association or no change in the buyer-supplier relationships with IT implementation [28,32]. Based on a survey of 400 supply chain professionals, Jayaram and Vickery [28] report the absence of a significant link between EDI and interorganizational relations. In a study by Carr and Smeltzer [6], several interviewees said that the use of IT may decrease trust-based interorganizational partnerships. There is evidence that the use of IT removes a human element in buyer-supplier interaction, while trust is built on human interaction. The remainder of this section draws relevant literature from information systems (IS) and organizational studies in regard to the effects of existing social and organizational contexts on supply chain collaboration.

2.2. The Mediating Role of Existing Interorganizational Relationship

To study the effect of IT on supply chain collaboration, the structurational or institutional view of technology [31,42] appears promising among the various views of technology in the literature. Most studies in this view have avoided the pitfall of technological determinism – "technology enables supply chain management" – widely shared among researchers in supply chain management. Those researchers have also emphasized the analysis of social and historical contexts in which technology is deployed and used. Consequently, the outcome of IT is inherently emergent through the interplay between social and technical elements rather than predetermined by one or the other.

In understanding IT in social and organizational contexts, Orlikowski [41] posits that institutional properties influence humans in their interaction with technology. People draw upon existing institutional properties in IT development and use. Ciborra and Lanzara [10] propose the notion of formative context, that is "the set of institutional arrangements and cognitive imageries that inform the actors' practical and reasoning routines in organizations" (p. 61). They suggested that formative contexts significantly influence an organization's IT-based innovations, including IT development and use. The formative contexts in an interorganizational setting social are and or interorganizational existing business contexts relationships between partners. Others [e.g., 9,11,49] also note the significance of existing structures or the installed base in understanding the IT effect.

DeSanctis and Poole [11] offered a viable approach called Adaptive Structuration Theory that allows one to examine the role of IT in organizational change. This approach views IT as one kind of social structure with many other structures (e.g., tasks, organizational environments) in an organization. They argued that the effect of IT is influenced not only by the technology itself but also, more importantly, by existing institutional properties and arrangements or the contexts within the use of IT. In the next section, we discuss "interorganizational formative contexts" or existing business relationships between partners in a supply chain.

3. Conceptual Model of IT Effect and Business Relationships

studies 13,21,23] Many [e.g., developed characterization of interorganizational relationships influenced by the theoretical underpinnings of transaction cost theory [54]. Oliver [40] and Mohr and Spekman [37] have also investigated interorganizational relationships through dimensions other than transaction cost, for instance, by synthesizing the literature and identifying characteristics of interfirm relationship for partnership success. Our approach to discussing interorganizational formative contexts is similar to that of Mohr and Spekman in that we draw upon and synthesize the literature of interorganizational collaboration in marketing, organization studies, operations management and information systems and choose four key dimensionsinterdependence, long-term orientation trust, (or commitment) and information sharing-that prove to have both theoretical and empirical support from previous studies [e.g., 25,34,e.g., 37,55] for characterizing existing business relationships between partners. One essential factor found to be critical for interorganizational relationship in the literature is mutual dependence or interdependence between parties. The mutual dependence of a company on a partner refers to the firm's need to maintain a relationship with the partner to achieve its goals [24]. Interdependence exists when one party does not entirely control the supply chain operations. Interdependence is positively related to a firm's long-term relationship orientation [34]. This idea is rooted in resource dependence theory [43].

<u>Trust</u> plays a key role in any organizational relationship [39,44]. Trust exists when a party believes that its partner is reliable and benevolent [24]. There has been a noticeable increase in the importance of trust in different forms of interorganizational relationships in management literature [46]. The need for trust between partners has been identified as an essential element of buyer-supplier relationships [1].

Studies recognize long-term orientation or commitment predictor for successful as а interorganizational relationships [4,12,13]. Long-term orientation refers to parties' willingness to exert effort in developing long-term relationships. Such willingness is frequently demonstrated by committing resources to the relationship, which may occur in the form of an organization's time, money, facilities, etc. Studies have shown that successful partnerships result when both buyers and suppliers demonstrate a willingness to commit assets to a set of future transactions [13]. Productivity gains in the supply chains are possible when firms are make transaction or relation-specific willing to investments, an important indication of commitment. Transaction-specific investment might enhance coordination and cooperation between partners [4,12].

Several studies suggest that successful buyersupplier relationships are associated with high levels of *information sharing* [e.g., 5,36]. Mohr et al. [27] recognize the importance of communication in interorganizational relationships. Information sharing (quality and quantity) refers to the extent to which critical and proprietary information is communicated to one's supply chain partner. More open sharing of information is indicated by the willingness of both parties to share important, even proprietary information [5]. More open and collaborative information sharing was found to lead to positive effects on interfirm relationship.

We propose a conceptual model for the effect of IT on supply chain collaboration, drawn from the literature (Figure 1). This model recognizes that the investment and use of IT between partners (e.g., suppliers and buyers) enables interorganizational collaboration. However, IT itself does not have full explanatory/predictive power over interorganizational collaboration, but rather the IT effect is mediated through an existing interorganizational relationship characterized by four dimensions: trust, interdependence, long-term orientation/commitment and information sharing. Thus, the IT effect is understood as the *emergent* properties of the interplay between IT and an existing interorganizational relationship. The next section presents a case study of five supplier-retailer pairs conducted to verify this model.

Figure 1. A Conceptual Model of IT Effect on Interorganizational Collaboration



4. Case Illustration

A case study with five supplier-retailer pairs in Taiwan was performed to illustrate the conceptual model of IT effect on interorganizational collaboration. The data collection and analysis of the case study followed the instructions from previous studies [14,35,56]. A case study protocol was designed and used to guide the interviews and data collection. It consists of questions pertaining to the interorganizational contexts presented earlier, company background, and business environment information. To measure the levels of supplier-retailer collaboration and engagement in various dimensions (interdependence, long-term orientation, information sharing, and trust), the case protocol also solicits subjective ratings (low, medium, high) and specific examples to justify the ratings. A similar rating system was previously used for rating degrees of commitment and information exchange [25,26]. The protocol was reviewed and pre-tested by a group of researchers, senior managers in the supplier firm, and a few retailers.

Data collection relied on multiple sources, including interviews, direct observation, documentation and archival records. In all cases, we met with at least two interviewees, including account managers and salesmen in the supplier firm, in order to reduce confirmation bias. One researcher wrote up notes from the visit and the other researcher verified those notes. Data analyses were guided by the conceptual model proposed earlier and were performed at two levels. Within-case analysis involved the description of individual supplier-retailer pairs regarding the four dimensions and IT capabilities in the conceptual model. Cross-case syntheses included creating word tables and different matrix displays of the data for cross-case patterns and comparisons.

4.1 Case Background

Johnson & Johnson (J&J) in Taiwan was selected as the supplier in this study. J&J is a global company with headquarters in the US. It is one of the leading suppliers for baby products and personal care products in Taiwan. J&J-Taiwan (JJT) has more than 100 employees who are primarily responsible for sales, customer service, distribution, and accounting activities. The J&J headquarters coordinates production with factories in Malaysia, China, and New Zealand to support the demand in Taiwan. The entire J&J Corporation has implemented an enterprise information system to achieve integration with worldwide facilities and suppliers. JJT's demand chain includes more than 60 traditional grocery stores, convenience stores, wholesalers, and large discount retail stores.

Five of JJT's retailers were selected for the case study, and they represented a wide variety of business relationships, sizes, supply chain operations, IT capabilities and levels of collaboration. Table 1 displays background information on these five retailers. Retailer A is a small traditional retailer with four stores located in four major cities in Taiwan. Retailer A's products include baby items, personal care items, cosmetics and groceries. The business is family owned and operated without much use of information technology. Retailer B offers cosmetics, personal care and apparel products. Since its establishment in 1985, its sales have grown consistently, and it currently has 15 stores with more than 300 employees. Retailer C is the largest retailer in Taiwan with more than 2,000 convenience stores. It is the first retailer to introduce the concept of convenience stores in Taiwan, which represents the fastest growing retailer type in the last few years. Retailer D is a retailing giant based in Hong Kong with more 3,000 outlets in 16 countries in Asia and Europe. It opened its first store in Taiwan in the late 1970s and has become a leading health and beauty retailer with over 220 stores in 2000. Retailer E is a leading international retailer with more than 7,000 stores located in over 28 countries. Headquartered in France, it started its operations in Taiwan in the late 1980s.

Tał	ole	1.	Suppl	ier	and	Reta	iler	Bac	kgrou	nd	Int	forma	ation
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forecasting, VMI, and category management [48]. Among those activities, problem solving and promotion are regarded as primitive collaboration, while VMI and category management require extensive collaboration.

The collaboration in Case #1 (JJT-A) focuses primarily on operational activities such as problem solving and promotion, while JJT and Retailer E (Case #5) engaged in a strategic level of collaborative activities such as VMI and category management. Consequently, Case #1 received a "low" rating from the interviewees and Case #5 was rated "high". The rest of the three cases (JJT-B, JJT-C, and JJT-D) fall between the two extremes, as their collaborations were limited to forecasting and joint planning.

(2) <u>Interdependence</u>. The rating for interdependence is generated based on the significance of sales and the level of business dependence between supplier and retailer [20]. The resulting rating is: A (low),

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	Supplier	Retailer							
		Α	В	С	D	Ε			
	Johnson	(Specialty	(Drug	(Convenience	(Drug	(Hypermarket)			
	&	store)	store)	store)	store)				
	Johnson,								
	Taiwan								
	(JJT)								
Number of	100	35	200	3177	10,000	3,000			
Employees									
Headquarters	USA	Taiwan	Taiwan	Taiwan	Hong	France			
					Kong				
Sales	US \$120	US \$5	US \$7	US \$220	US	US \$180			
	million	million	million	million	\$110	million			
					million				
Duration of the		14 years	10	18 years	23	14 years			
relationship with			years		years				
JJT									
Retailer IT		e	d, e	a, b, c, d, e, f,	a, b, e,	a, b, c, d, e, f,			
Capabilities*				g, h	f, h	g, h			

B (low), C (medium), D (high), and E (high). Both A and B account for an insignificant volume of JJT's sales, the business but relationship with JJT is critical to its profits and sales. The level of interdependence is low in the first two cases compared to the other three retailers: C, D and E. Retailers D and E are JJT's largest and second largest retailers, respectively. D is the retailer largest of cosmetics and skin care products in Taiwan,

* Relevant IT: a. ERP; b. EDI; c. POS; d. Electronic payment; e. Barcoding; f. Automatic replenishment; g. Automatic forecasting; h. ASNs

4.2 Existing Relationships and Level of Collaboration

Table 2 summarizes the existing relationships and level of collaboration between JJT and its five retailers. Each case represents a pair of supplier and retailer with specific levels of collaboration gauged by four dimensions: interdependence, trust, long-term orientation, and information sharing of business.

(1) <u>Collaboration</u>. The rating for collaboration was developed based on (1) managers' subjective ratings of level of collaboration and (2) specific examples of collaborative activity including problem solving, promotion campaign, display design, joint planning,

while E is the largest discount retailing chain in Taiwan. They both offer JJT important marketing channels. In addition, JJT is a primary supplier to D and E, and the business relationship has been very profitable for both retailers. The case of C is interesting in many respects. Both the supplier and the retailer receive satisfactory profit from this business relationship; however, C owns more than 3,000 convenience stores in Taiwan and has numerous substitute suppliers available to meet its needs. Consequently, C does not rely on JJT for its business, and there is clear power asymmetry in this relationship. JJT, on the other hand, values C's channel and works harder to please C to maintain the relationship. Overall, the interdependence of the relationship with C is lower than that with D and E.

 Table 2. Existing Interorganizational Relationships

 between Partners

Dimensions	JJT-Retailer	JJT-Retailer	JJT-	JJT-Retailer	JJT-
	Α	В	Retailer C	D	Retailer E
<i>Interdependence</i> (Degree of dependence on this relationship regarding profit & sales volume, Availability of alternative suppliers)	Rating: Low a. JJT is critical to A but not the other way around. b. JJT considers terminating the relationship.	Rating: Low a. JJT is critical to B but B is less important to JJT's sales. b. It is a profitable relationship.	Rating: Medium a. C has more power with alternative suppliers. b. JJT needs C's business and channel.	Rating: High a. D is J&J's biggest retailer. b. Each side appreciates & understands the importance of this relationship.	Rating: High a. E is JJT's second biggest retailer. b. Both appreciate & understand the importance of this relationship.
Long term orientation (Resource investment; Top management commitment and support)	Low a. JJT plans to terminate the relationship b. Lack of effort in developing long term relationship	Low a. Low resource investment & focus b. Lack of effort in developing long term relationship	Medium JJT wants to establish long-term relationship but SE shows less commitment.	High Both want to establish long-term relationship	High Both sides have committed to establishing long-term relationship.
<i>Trust</i> (Benefit/risk sharing; Partner's reliability & benevolence)	Low a. Experience of late payment and pricing disagreement. b. Trust exists among low-level employees.	Low a. Experience of late payment and forward buying. b. Trust exists among low-level employees.	Medium a. Top management uses contract to establish mutual trust. b. Conflicts over shelf display and return goods.	Medium/High a. Top management uses contract to establish mutual trust.	High a. Rarely breaks contractual agreement. b. Both sides feel mutually reliable.
Information Sharing (Quantity, quality and content of information sharing)	Low Very little information sharing	Low/Medium a. Share sales and promotion information. b. No policy to back up or support the sharing.	Medium Share promotion plan & inventory.	High a. Share promotion, inventory and payment information. b. CEOs meets to ensure the sharing of information.	High a. Share promotion, inventory and payment information. b. CEOs meets to ensure the sharing of information.
Collaboration (a. Problem solving, promotion campaign, display design, b. Joint planning & forecasting, c. VMI, Category mgmt)	Low a. Problem solving, promotion campaign	Low a. Problem solving, promotion campaign, display design	Medium a & b. Joint planning, forecasting	Medium a & b. Joint planning, forecasting	High a & b & c. VMI, Category management

(3) **Long-term** orientation/commitment. The rating for the long-term orientation and commitment was developed based on top management's willingness to develop long-term relationships and the amount of investment in the relationships [13]. The resulting rating is: A (low), B (low), C (medium), D (high), and E (high). In the JJT-A and JJT-B relationships, resource investment and top management support to develop a long-term relationship are minimal. CEOs in JJT show very little

process of making similar financial commitments to upgrade their inventory systems. Both D and E committed a variety of assets to a set of future transactions. Somewhere in the middle ground, both C and JJT endeavored to improve its own planning capability and operations efficiency, but insufficient effort was made to achieve integration between the supplier and retailer. Top management meets once a month to review current contracts, but C perceives no need to alter the status quo,

current business relationship with both retailers and have refused to invest in inventory systems and promotion activities. Top management from JJT and the two retailers seldom meet, and most decisions are delegated to mid- and low-level employees. JJT considered has terminating its business relationship with A. Meanwhile, JJT displays some interest in working with B but has not given high priority to making investments to improve the В relationship. has requested help from JJT for upgrading its inventory systems, but JJT is reluctant to make any further investments.

interest in upgrading

By contrast, both D and E display greater willingness and credible commitment in establishing longterm relationships with JJT. Top management from both sides meet every week to discuss major collaboration projects, such as new sales promotions. E and JJT invested in a new inventory system improve supply to chain efficiency. D and JJT are currently in the since managers are already pleased with the profit from the current business relationship. They do not believe any additional investment in the relationship is needed. The data gathered indicate that this business relationship is indeed mutually profitable and efficient, even with the medium level of commitment to collaboration.

(4) Trust. The rating of trust was developed based responses from the interviewees regarding (1) on subjective ratings of various aspects of trust [24], and (2) specific examples relevant to mutual trust. Each interviewee was asked to rate the respective retailers regarding benevolence and credibility (e.g., the levels of keeping business promises and commitment, providing reliable information, considering the other side's benefits, and treating each other with sincerity). The ratings for Retailers A and B were supported by their frequent engagement in forward buying, price war, and missing payment. Overall, the other three retailers would not deliberately reduce retail prices without prior discussion with JJT, and they are very reliable about on-time payment. Retailer C occasionally has disputes with JJT regarding shelf display and return goods. D and E seldom violate contractual agreements, and E has engaged in a few profit sharing plans with JJT.

An interesting observation is that the "source" of trust is different among the five cases. In the cases of A and B, trust is established through frequent on-site interactions between low-level employees. Nevertheless, the benefits from this informal personal level of trust are limited since A and B are highly centralized, and lowlevel employees do not have authority in making supply chain-related decisions. Furthermore, such trust could be strained whenever there is a turnover in employees. In contrast, the trust in the cases of C, D, and E is clearly demonstrated by top management and supported by corporate policies. The level of trust is not significantly affected by the turnover at lower employee levels. Therefore, when we take into consideration the source of trust, C, D, and E have more "stable" trust established at top management levels.

(5) **Information sharing**. The rating for the information sharing was developed based on the amount and quality of information exchanged [38]. The resulting rating is: A (low), B (low/medium), C (medium), D (high), and E (high). In the cases of A and B, there is no formal communication system, and most of the information sharing occurs via informal personal interactions. Since store employees or even store managers have no authority to divulge sales data, the content of the information shared is mostly past sales data that have few strategic implications. In contrast, the quantity, quality and content of information sharing are better with C, D, and E. All these retailers share forecasting, inventory, market, promotion and consumer trend information. D and E display the most willingness to cooperate as they provide

JJT access to real time demand data and coordinate their order fulfillment policies for the benefit of the supplier.

4.3 Supply Chain-Related IT Capabilities

Supply chain-related information technology (IT) capabilities refer to the level of IT competence to support supply chain related operations such as inventory systems. JJT has implemented an SAP system and developed a high degree of internal information integration. The last row in Table 1 summarizes the IT capabilities possessed by these five retailers. The rating for the supply chainrelated IT capabilities is: A (low), B (low), C (high), D (medium), and E (high). Neither A nor B was equipped with proper IT systems to support the cooperation with JJT. Manual operations, phone, and fax machines were used to track the stock level and manage the filling of orders. In the cases of A and B, for example, inventory decisions were made based on a very primitive approach. Namely, JJT's salespersons visited retail stores weekly and suggested order size to the retailers on the spot. Upon approval from the headquarters of the retailers, orders were confirmed, and JJT salespersons instructed their customer service center to arrange delivery. No computers were used to reach the decisions. Everything was done manually or by phone.

In contrast, D provides JJT with inventory status and applies EDI for order placement. However, it is E who has the most advanced inventory system, co-management inventory (CMI) systems, and has utilized more information technologies such as EDI, electronic invoicing and barcoding. The CMI systems monitor inventory level and automatically place new orders. Replenishment is triggered by sales data. JJT has access to E's sales and inventory information stored in the CMI systems.

JJT-C presents a scenario where a firm possesses advanced information technology but does not apply it to improve supply chain operations. Retailer C has an ERP system integrating its sales, accounting and warehouse data. There is a high degree of internal integration. However, C has not attempted to apply its high IT capabilities to improve supply chain efficiency with JJT. For instance, C uses EDI solely for the transmission of purchase and shipping information, while E is using OR throughout much of its merchandise logistics. C has a computerized system to manage its order fulfillment process. Its warehouse checks continuously the inventory level and sends order placement information to JJT's customer service center directly. The retailer's advanced inventory system enables JJT to remove the retailerspecific inventory, resulting in major demand chain efficiency improvement. However, C maintains and manages its own inventory system without relinquishing control of key replenishment decisions to JJT.

4.4 IT Effect on Interorganizational Collaboration

As previously discussed, the level of collaboration for JJT-A and JJT-B is very low. Sales personnel and store employees have high personal interaction that cannot, however, produce meaningful co-planning activities because of the lack of support from the corporate level. There is scant coordination of strategic planning, inventory management and demand forecasting between JJT and these two retailers. The rest of three retailers have higher levels of coordination with JJT. High-level managers have frequent meetings to discuss market trends and competition, to resolve differences in pricing and discount, and to participate in new product development or promotion planning. For instance, E has invited JJT to participate in its "category management" project to maximize the company's sales in three product categories: baby cleaning, baby hygiene, and facial foam. This project involves multiple departments from both sides. They must cooperate in activities and decisions related to sales (promotion campaigns, sales forecasting, product package design and media commercials), channel (store promotion and shelf display arrangement), and delivery. In order to implement this category management project, E was "forced" to share more internal information (e.g., individual store sales, supplier breakdown) with JJT. The last row in Table 2 displays the collaborative activities engaged in by various supplier-retailer pairs. When the levels of information sharing are compared, it is interesting to see how top management's support for information sharing in JIT-C and JIT-D encouraged various collaborative activities.

For a very different reason, the collaboration with Retailers C and D is not as extensive and is primarily restricted to problem solving, sales promotion campaigns, and exclusive territory negotiation. As discussed earlier, C has high IT capabilities and is in a position to engage in more collaboration with JJT. Nonetheless, the relatively low levels of trust and interdependence became the major barrier to developing a collaborative supply chain. C has multiple suppliers, and its business with JJT accounts for only 15% of its total sales. Moreover, C has experienced initial success in reducing inventory and increasing fill rate resulting from its new ERP systems even without any collaboration with retailers. Consequently, the company is more reluctant to share information with JJT for more advanced collaboration. In contrast, the JJT- D collaboration has not reached its potential for a completely different reason. As indicated in Table 1, D is still lacks necessary IT capabilities to implement more advanced inventory systems such as VMI, nor can it engage in any sort of strategic planning or category management with JJT. However, while the current collaboration projects between JJT and D are scant, the high level of trust and interdependence seems to motivate managers for further improvement.

5. Discussion

Figure 2 summarizes the case study findings. The results seem to support the positive link between the level of supply chain-related IT capabilities and supply chain collaboration in the proposed conceptual model (Figure 1). It suggests that existing relationships between partners have significant impact on the level of supply chainrelated IT capacities and use. As shown in the case of A and B, low levels of trust, interdependence, information sharing and commitment between JJT and the retailers are linked with the low level of IT utilization for supply chain and consequently the relatively low level of interorganizational collaboration. The other three supplier-retailer pairs possess advanced IT capabilities for information sharing and inventory systems. Retailer E, particularly, based on high levels of trust, commitment, longer-term orientation and information sharing, is able to utilize fully its IT capabilities to develop effective communication channels with the suppliers. In contrast, despite high IT capabilities, the JJT-C pair failed to utilize capabilities to enhance the supplier-retailer IT collaboration. JJT-D could not establish a higher level of collaboration with JJT due to its current IT capabilities. Limitations in IT capabilities or in the existing relationships between the supplier and retailer could impede the development of effective interorganizational information systems, and consequently the level of collaboration was lower than that of E.





The JJT-C example indicates that non-cooperative, non-close formative contexts embedded in an interorganizational relationship are negatively related to the IT effect on interorganizational collaboration. In this situation, IT has little value for interorganizational collaboration. Rather, cooperative and close relations are antecedents to facilitating collaborative supply chain activities between partners. Hart and Saunders [30] suggest that expanded information exchange using EDI may be contingent on one particular dimension - trust - in our conceptual model. Clearly, without trust an IT-based interorganizational linkage would facilitate collaboration only at an operational but not at a strategic level. Evidently, it is not only the degree of trust but also of the other three interorganizational dimensions upon which the IT effect is contingent. Regardless of the level of trust between partners, for example, the low level of interdependence is negatively related to the IT effect as demonstrated by JJT-A, JJT-B, and JJT-C. Low interdependence is generally related to less demand for information sharing, more likelihood of opportunistic behavior between partners, and low commitment.

In line with the discussion above, it may be the case that while IT does not necessarily increase the level of interorganizational collaboration per se, it is rather likely to stabilize existing (cooperative) formative contexts between suppliers and buyers. As it appears from two pairs (JJT-D and JJT-E), the use of IT may leverage and reinforce existing cooperative, close partnership characteristics, such as trust [22,29], information sharing, long-term orientation/commitment and interdependence. IT itself does not produce new formative contexts but rather tends to reproduce existing ones. There may be self-reinforcing mechanisms where existing formative contexts between partners are reinforced by (and reinforce simultaneously) the use of ITs.

Overall, our study indicates that without necessary interorganizational characteristics or formative contexts, the *institutionalized* adoption of IT [52] does not lead to interorganizational collaboration. Thus, companies need to examine carefully the nature of the interorganizational relationship prior to seeking an IT-based interorganizational linkage.

6. Conclusions and Implications

During the past few years, the industry press and academic literature have been exhorting organizations to move away from arm's-length relationships and move toward long-term collaborative strategic partnerships with business partners. Related to this new type of buyersupplier relationship, organizations and researchers have paid considerable attention to the role of information technology facilitating interorganizational for collaboration and supply chain management. This been variously described phenomenon has as "interorganizational systems," "information partnerships" and electronic integration [3]. Many previous studies have suggested that IT has a positive impact on collaboration between partners [3,15,51], and among organizations

there has been an over-reliance on IT in trying to facilitate supply chain collaboration [16].

Our study has posited that the effect of IT is not predetermined by its technological capabilities (e.g., easy, cheap and fast connection between partners). Rather, its effect on interorganizational collaboration is the *emergent* properties of the interplay between IT and existing relationships between partners. The case study with five supplier-retailer pairs illustrates that existing formative contexts between partners both enable and constrain the positive effect of IT on interorganizational collaboration. Particularly in the case of JJT-C, the formative contexts characterized by lack of trust, information sharing and long-term orientation/commitment impeded the utilization of IT and minimized the positive IT impact.

This finding has important implications for managers. Unlike the popular technology imperative view [33], IT tends to reinforce and stabilize, rather than radically change, existing institutional properties between partners. Thus, the IT effect may be "softly determined" by existing formative contexts between partners rather than by IT itself. Moreover, IT, in close and cooperative formative contexts, is likely to reinforce and stabilize the already existing interorganizational structures and arrangements and positively affect the level of interorganizational collaboration. In this sense, cooperative formative contexts (e.g., trust, commitment, information sharing) between partners should precede an IT-based interorganizational linkage effort.

The important managerial implication is that managers must understand that successful supply chain collaboration needs the support of both technical and social factors. This demands a shift in the mindset of supply chain systems from a technology-focused or lowlevel integration to a more holistic one. Specifically, a socio-technical approach is demanded in studies and practices of both supply chain collaboration and interorganizational information systems [7]. In fact, our study indicates that, while IT is a necessary component for successful supply chain management, interorganizational formative contexts can become more important than IT itself for successful IT-based interorganizational linkage. Then the natural response may be a quick fix of existing non-cooperative relationships, such as lack of trust, communication and commitment. However, this is not the case since formative contexts are seldom replaceable all at once; rather, they change in a piecemeal fashion as suggested by some commentators [10,49]. Therefore, the potential benefits of cooperation, coordination and supply or buyer base rationalization may never be realized because the necessary technological and organizational changes to improve coordination of product flow are not being widely or rapidly adopted. This paradoxical situation warrants further investigation.

This study also provides important implications for IOS planning. Proper IOS use and planning for supply chain management is becoming more important. However, IOS planning is still in its infancy [17]. An IT-based interorganizational linkage significantly differs from internal information systems and is more challenging due to the nature of different technical infrastructures, cooperative issues, etc. [17,19]. A buyer/supplier is likely to deal with a group of diverse suppliers/buyers, and the types of relationships are very diverse. Our results indicate that a universal IOS strategy and practice may not be effective. It is important for organizations to understand that they are dealing with partners with different business relationships and IT capabilities. Therefore, effective IT-based interorganizational linkage requires developing portfolios of buyer-supplier relationships in terms of formative contexts and supply chain-related IT capabilities and then choosing the right IOS and the right level for its use, as suggested by Choudhury [8]. Another important question for managers is which IT strategy and practices its organization should choose in different interorganizational contexts and according to IT capabilities. Future study of this topic can offer managers some practical guidelines regarding IT strategy in the context of utilizing IT for supply chain/interorganizational collaboration.

Finally, we note a few limitations of this study. While we selected five pairs of suppliers and retailers, in order to generalize the findings, more case data need to be collected. Our case data relied on a single Asian country. Thus, case data from one or more Western countries are needed to generalize the findings further. This crossnational comparison might reveal the potential impact of national differences (e.g., national culture, countryinterorganizational business practices, and specific societal uniqueness in buyer-supplier relationships). Moreover, while we found no other important relationship factors in this study, future research must validate the selection of these four dimensions on a broader empirical level. A relevant research issue worthy of further study would examine the correlations between the four relationship factors. In other words, is a low level of trust always associated with a low degree of information sharing? Despite this and other potential limitations, we believe that this study offers important implications for supply chain research and practice by shedding light on importance the of existing interorganizational relationships in the effects of information technology in supply chain collaboration.

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