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RESEARCH ARTICLE

INTERFIRM STRATEGIC INFORMATION FLOWS IN LOGISTICS SUPPLY CHAIN RELATIONSHIPS[1]

By: **Richard Klein**
Department of Management
College of Business and Behavioral Science
Clemson University
Clemson, SC 29634-1305
U.S.A.
rklein@CLEMSON.edu

Arun Rai
Robinson College of Business
Georgia State University
Atlanta, GA 30303
U.S.A.
arunrai@gsu.edu

Abstract

This paper focuses on strategic information flows between buyers and suppliers within logistics supply chain relationships and on subsequent relationship-specific performance outcomes. Our analysis of dyadic data collected from 91 buyer–supplier logistics relationships finds that buyer and supplier strategic information flows positively impact the relationship-specific performance of both sharing and receiving parties. Specifically, each party gains financially from improved management of assets, reduced costs of operations, and enhanced productivity. Moreover, each benefits operationally from improved planning, control, and flexibility of resources. Buyer dependence on the supplier increases buyer strategic information flows to the supplier. Additionally, buyer IT customization and both buyer and supplier trusting beliefs in the receiving party positively impact strategic information sharing with partners. This study suggests that partnerships for supply chain services engage in cooperative initiatives to generate relational rents and are an alternative to conventional "arms length" transactional exchanges. These partnerships need to be motivated to go beyond the sharing of order-related information (which must occur in transactional exchanges) and to share strategic information (which has the potential for both additional rent generation and risks of misappropriation).

Keywords: Interfirm relationships, dyads, relational view, strategic information flows, IT customization, trust, dependence, relationship longevity, organization size

Introduction

Supply chain vendors have introduced business-to-business (B2B) information technology solutions (Klein 2007; Richard and Devinney 2005) to support buyer relationships (Malhotra et al. 2005; Straub 2004) that range from transactional exchanges to collaborative partnerships (Dwyer et al. 1987). Focusing on collaborative partnerships, the relational view of the firm (Dyer and Singh 1998) posits that participants generate relational rents through such value-adding initiatives as information exchanges across firms. Indeed, IT plays an instrumental role in logistics relationships, as the information shared between partners shapes how relationships are maintained and developed (Jayachandran et al. 2005). While the differences in the opportunities to share information as relationships transition from transactional to collaborative have been discussed (Richard and Devinney 2005), there has been scant scholarly attention on the outcomes of sharing private, strategic information and on the appropriation of

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gains by buyers and suppliers. Furthermore, the relational and technological context that promotes such information sharing requires further examination since safeguarding against opportunism presents a major challenge (Patnayakuni et al. 2006). Thus, while the options available to share information in buyer–supplier logistics supply chain relationships have expanded, our understanding of the forces that guide these behaviors has not.

To address this void in our understanding, we focus on the forces that shape information sharing behaviors in logistics supply chain relationships, which we simply refer to as logistics relationships. In these relationships, a buyer partners with a supplier for the efficient and timely movement of raw materials, components, finished goods, and finances. In fact, these relationships are established to manage the flow of three key resources (i.e., information, goods, and finances) across the supply chain (Chen et al. 2000; Kulp et al. 2004). Thus, while firms are developing supply chain relationships for a variety of processes, such as contract manufacturing, distribution, or new product development, logistics relationships represent an especially interesting context to understand how information sharing behaviors can be promoted. The logistics process is inherently intensive in its use of physical assets and information and requires the management of high process interdependence between buyers and suppliers. Given these characteristics, the logistics industry has seen rapid-fire IT innovation to capture, share, and utilize information better as well as to enable the management of process interdependence between parties.

Past supply chain research has shown how the sharing of order-related information reduces the upstream amplification of errors in forecasting demand signals and reduces the bullwhip effect (Lee et al. 2000). Research also suggests that there is value to sharing strategic information, such as information on production strategies, financial operations, and marketing, which is above and beyond the order-related information required for transactional exchanges. The rationale is that the sharing of such information can enable partnering firms to align strategic actions and adapt their plans and resource positions. For instance, the sharing of sales and inventory information should enable suppliers to better forecast demand and plan production (Seidmann and Sundararajan 1997), especially when demand information cannot accurately be obtained by an analysis of historic order data. However, limited empirical evidence exists with respect to the sharing of the forms of private information that are deemed strategic and to their impacts.

The exchange of strategic information with partners is not, however, without risks. Consider these illustrations. A buyer may share information on its inventory positions with its supplier to inform their production schedule and to facilitate vendor-managed inventory. In doing so, the buyer might be subject to higher pricing due to the visibility of its inventory positions that the supplier now has. A buyer sharing its demand information and marketing strategies with its logistics vendor to enable the vendor to plan capacity better and manage peak periods might be subject to less favorable volume discounts by the vendor. Finally, a vendor may share cost and margin structures with a buyer to measure improvements in the business value that is jointly created in an effort to better coordinate interfirm activities. In the absence of strict confidentiality agreements, the buyer might disclose such shared information to other vendors in order to secure more competitive bids from them.

Accordingly, how does the sharing of strategic information by either buyers or suppliers impact the outcomes realized by each party? Specifically, we are interested in buyer and supplier outcomes that directly result from participation in such exchanges, which we term relationship-specific performance. While the potential for these outcomes is important in order to rationalize the sharing of strategic information, how should firms evaluate whether favorable conditions exist to exchange such information with partners? Here, we explore factors that motivate and enable the sharing of strategic information and that alleviate risk concerns associated with such sharing. In examining these abiding issues, we draw on the relational view of the firm (Dyer and Singh 1998), which focuses on the potential of interfirm initiatives to generate relational rents. This view suggests that specific characteristics of collaborative partnerships—namely, *information/knowledge exchanges*, *complementary resources or capabilities*, *relational asset specific investments*, and *effective governance*—directly (e.g., through information exchanges) and indirectly (e.g., through effective governance)—promote value-adding initiatives within relationships.

We suggest that when logistics partnerships move beyond transactional exchanges, partners share strategic information with one another, thus generating relationship-specific performance outcomes for each. Consistent with the relational perspective, flows of such information represent *information/knowledge exchanges* between partners, and the resulting access to partners' strategic information represents *complementary strategic resources*. Dyer and Singh's (1998) relational perspective describes buyers growing "profits by increasing their dependence on a smaller number of suppliers, thereby increasing the incentives of suppliers to share knowledge and make performance-enhancing investments" (p. 675). Accordingly, we examine the effect that buyer dependence on a supplier has on the sharing of strategic information in the

relationship between the two. We further draw upon characteristics of collaborative partnerships, as outlined in the relational perspective, to identify factors that enable strategic information flows and that mitigate concerns about risks associated with these exchanges. First, buyer IT customization represents *complementary organizational resources and capabilities* as well as *asset-specific technology investments* to exchange strategic information that is idiosyncratic to a relationship. Second, as Dyer and Singh note, trusting beliefs in partners enable informal self-enforcing agreements that are indicative of *effective governance*. Finally, consistent with the relational view of the firm, we employ a dyadic research design in which data were collected from different account managers of a single focal logistics vendor and from their counterparts, namely account managers in different client firms.

This paper proceeds with an elaboration of the types of strategic information flows in supply chain relationships and of the theoretical foundations for our model and each of our hypotheses. We follow this with a description of the research methodology, the data analysis techniques, and the results. We then interpret the findings and their implications for theory, practice, and future research.

Conceptualizing Strategic Information Flows

Information sharing in supply chains has been examined by scholars in information systems, operations management, and marketing, among others. Patnayakuni et al. (2006) provide an extensive review of this literature. Past work on the topic focuses on (1) order-level information sharing in supply chains (Cachon and Fisher 2000; Raghunathan 2001), (2) capabilities of interorganizational IS (Rai et al. 2006; Riggins et al. 1994), (3) asset ownership and contracting arrangements that impact information sharing and process capabilities (Clemons and Hitt 2004; Han et al. 2004), and (4) specific types of performance consequences of information sharing, such as its effects on product design, service quality, and lead-time (Kotabe et al. 2003) as well as on transaction costs (Wang and Seidmann 1995).

Reviewing this literature highlights two important lacunas. First, while past research stresses certain types of information shared between partners, such as information about orders, inventory, or customer demographics, most often prior work does not deal with the sharing of marketing, operations, or financial information. Notably, we see a gap in the literature in why strategic information exchange should occur in buyer–supplier relationships. Second, past studies do not simultaneously investigate strategic information flows between buyers and suppliers, which has hamstrung efforts to understand conditions in which these flows occur and their performance impacts. Accordingly, there is a gap in the literature on what conditions motivate and enable such exchanges, what conditions mitigate risk concerns, and what benefits each party realizes.

Given the focus of our investigation, we will first develop a definition of strategic information. Importantly, Uzzi and Lancaster (2003) differentiate between private and public information. The latter is available in the public domain (e.g., audited financial statements, contractual stipulations, and warrantees) and is verifiable through third parties. Private information, however, is not available in the public domain and/or verifiable through third parties. Thus, we conceptualize strategic information as private in nature and not verified by third parties.

To understand the content of exchange in strategic information flows more fully, we draw on Seidmann and Sundararajan (1997), who define the following classes of private information that are shared among supply chain partners: (1) order, (2) operational, (3) strategic, and (4) strategic/competitive. For parsimony, we refer to the latter three classes of information as strategic for the following reasons: (1) each is private and speaks of a higher level of use than the *order* information exchanged in routine transactions, and (2) these other three classes of information provide managers with information that can be used in what is frequently called *strategic* decision-making. The *operational* class consists of production-related information about resource conditions and plans, the *strategic* class focuses on financial information related to revenue and profit-related metrics, and the *strategic/competitive* class includes marketing-related information for competitive positioning. Accordingly, we conceptualize all information falling into these three classes as a form of strategic information that can be exchanged in logistics relationships. We now draw on the relational view of the firm to examine conditions that promote strategic information flows in logistics relationships.

A Relational Perspective of Strategic Information Flows

The relational view of the firm (Dyer and Singh 1998) advances research in marketing on how transactional

exchange relationships can be developed into collaborative partnerships and on the critical factors for such partnerships (Dwyer et al. 1987; Morgan and Hunt 1994). This theory's key premise is that relational rents and competitive advantages can be generated through value-adding initiatives enabled by interfirm resources and routines. In contrast, the traditional industry structure view of competitive advantage sees rent generation as a by-product of adversarial bargaining and highlights industry barriers to entry as mechanisms to preserve rents (Porter 1980). More recently, the resource-based view recognized firm-level barriers to imitation, acknowledging the power of scarce physical resources, know-how, technology, finances, and intangibles (e.g., reputation) in generating competitive advantages (Wernerfelt 1984). The underlying prescription of this view is that a firm needs to control its critical resources, as it places itself at a disadvantage when it must procure them from others.

In contrast to the industry structure and resource-based views, Dyer and Singh advocate that pairs, or networks, of firms realize gains from their connections, with dyadic- or network-level barriers to imitation preserving these advantages. The distinctive characteristics of such "relational" partnerships include (1) information/knowledge exchanges between parties, (2) complementary strategic and organizational resource or capability combinations, (3) relationship-specific asset investments, and (4) effective relational governance. The mechanisms that subsequently preserve relationally derived performance benefits include causal ambiguity, time compression diseconomies, interorganizational asset interconnectedness, partner scarcity, resource indivisibility, and institutional environments (Dyer and Singh 1998).

Drawing upon the work of Dwyer et al. (1987) and Morgan and Hunt (1994) on collaborative interorganizational relationships as well as the relational view of the firm, we conceptualize how logistics partnerships operate to generate rents. We suggest that flows of strategic information between partners represent the exchange of complementary strategic resources, that this exchange is characterized by time compression diseconomies and is facilitated by asset interconnectedness between partners, and that these complementary strategic resources generate relational rents. Buyer dependence makes the supplier indispensable to the buyer (Richard and Devinney 2005). Additionally, when a buyer sources a significant amount of its logistics requirements from a vendor, it needs to be able to combine vendor resources and capabilities effectively with its own. Greater dependence thus motivates the buyer to generate complementarities with the vendor. Hence, the need for such resource and capability integration between partners promotes strategic information flows. Relationship-specific IT investments undertaken by one or both parties through customization enhance the integration of the supplier's IT solutions and the buyer's IT infrastructure. They also increase the dedicated IT resources that are indivisible and cannot be redeployed outside of the relationship. In effect, these investments increase the interconnectedness of IT assets and enable the flow of strategic information, which is idiosyncratic by nature. Finally, trusting beliefs between partners represent effective governance, as they reduce concerns about the misappropriation of strategic information and promote their flow.

The relational view further focuses the unit of analysis on the pair, or dyad, of firms. This differs significantly from the industry structure view, which focuses on the firm *vis-à-vis* the entire industry (Dyer and Singh 1998). The resource-based view tends to focus on the internal resources of the firm itself, only making comparisons with the industry to see whether the firm holds comparative advantages. Accordingly, our investigation of interfirm relationships requires that the relationship ***itself*** be specified as the focal unit of analysis (Anderson et al. 1994; Chen and Paulraj 2004; Clemons and Row 1993; Dyer and Singh 1998; Straub et al. 2004b). Practical difficulties inherent in dyadic research designs have constrained researchers from developing nuanced theoretical models at this level. However, a more complete understanding of strategic information sharing requires theorizing and testing with relevant constructs pertaining to both the buyer and supplier in a single nomological network.

Research Model and Hypotheses

Figure 1 details our research model. It posits relationships between strategic information flows and relationship-specific performance. When considering conditions motivating strategic information sharing between partners, our model focuses on buyer dependence on the supplier. Additionally, buyer IT customization is one type of relationship-specific asset investment enabling recurring interactions between the two partners, and each party's trusting beliefs in the other are indicative of informal self-enforcing safeguards mitigating potential risk concerns.

Strategic Information Flows and Relationship-Specific Performance

While the sharing of *order* information is necessary for transactional exchanges, the sharing of strategic information can create additional value for partner firms. Wal-Mart is a good example of a firm that has generated rents and created value

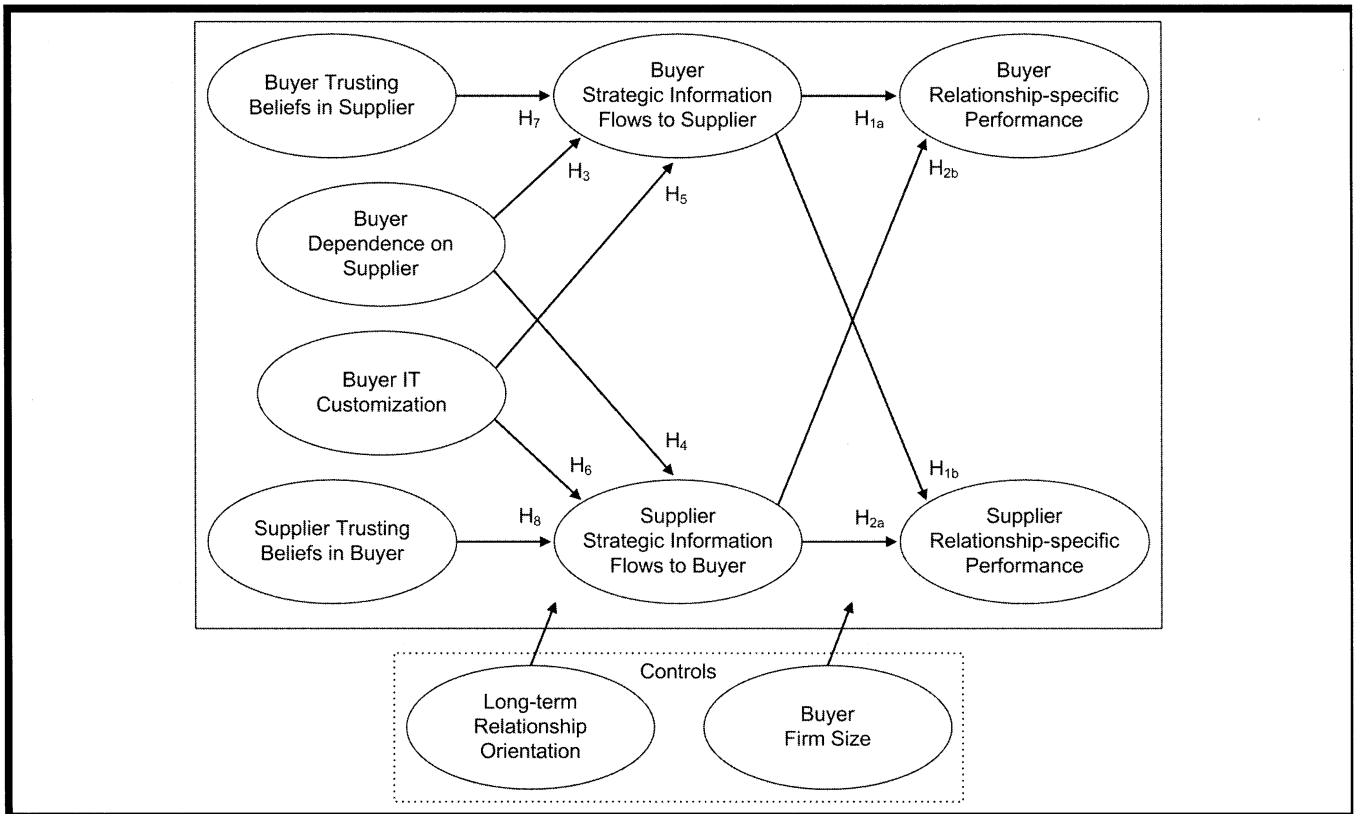


Figure 1. Research Model: Strategic Information Flows in Logistics Supply Chain Relationships

based on the mutual exchange of strategic information with its suppliers (Yoffie and Mack 2005). Such flows can be especially important in non-commodity settings, such as supply chain logistics, in which services are rapidly evolving and customers' requirements are differentiated based on divergent products, processes, segments, and channels.

Earlier we identified three types of strategic information in supply chain relationships: (1) operational, (2) strategic, and (3) strategic/competitive. *Operational* information relates to the deployment of input resources to produce services, such as information about inventory/capacity plans and production schedules. When shared, this information allows partners to optimize input resources globally by streamlining buffers and synchronizing resource allocations. *Strategic* information includes financial metrics on margin structures and costs. When shared, this information enables parties to collaborate on ways to improve economic outcomes and to leverage financial resources for both parties. Finally, *strategic/competitive* information affects firm competitive positioning and planned actions in the market. When shared, this information enables partners to derive benefits by coordinating sales and marketing initiatives with operational requirements.

Partners' strategic information constitutes a complementary resource endowment that can be leveraged to add value within a given relationship. Distinctive resources, such as strategic information, possess the ability to generate additional rents for partners that an individual owning firm could not alone (Dyer and Singh 1998). Indeed, Dyer and Singh posit that the more "sensitive" the resource is, the greater the potential for returns will be when sharing it with partners. Moreover, strategic complementary resources are often only available through partners and not markets, thus sustaining the long-term advantages (Oliver 1997).

To examine the gains derived by the buyer and the supplier from the sharing of strategic information, we focus on each party's relationship-specific outcomes (Dyer and Singh 1998)—that is, the benefits readily and specifically attributable to relationship participation. The IS success model (DeLone and McLean 1992, 2003) specifies that IT impacts should be examined at different levels: individual, organizational, and intermediate points in between (e.g., the business unit). The key argument is that performance outcomes should be examined at a level of specificity that is suitable for the context, so as to mitigate the confounding effect of other

variables. In our context, relationship-specific performance is the appropriate level of specificity, as it focuses on the outcomes realized by each partner that are attributable to participation in the relationship. Broadly, these outcomes can be classified as both tangible and intangible benefits. Specifically, the tangible benefits can include economic outcomes, such as improved asset management, increased productivity, and reduced operating costs. Outcomes can also include intangible aspects of a firm's overall operational capabilities that are more difficult to quantify (Brynjolfsson and Hitt 2000), such as improved production planning, enhanced resource control, and increased flexibility.

Accordingly, we state four hypotheses related to downstream relational outcomes of strategic information flows. These hypotheses posit that the buyer should realize Ricardian rents from high levels of strategic information flows to and from the supplier, while the supplier should see benefits from the flow of strategic information to and from the buyer.

H_{1a}: *The greater buyer strategic information flows to the supplier, the greater buyer relationship-specific performance.*

H_{1b}: *The greater buyer strategic information flows to the supplier, the greater supplier relationship-specific performance.*

H_{2a}: *The greater supplier strategic information flows to the buyer, the greater supplier relationship-specific performance.*

H_{2b}: *The greater supplier strategic information flows to the buyer, the greater buyer relationship-specific performance.*

Buyer Dependence on Supplier and Strategic Information Flows

Interorganizational relationships are based on the premise that partners rely on each other to contribute certain resources that they themselves do not possess in order to meet business requirements (Dwyer et al. 1987). Access to complementary resources, therefore, is indispensable for successful interfirm relationships and is a central tenet of the relational view of the firm. Buyer dependence on a focal supplier is a distinctive element in our model, capturing the extent to which a supplier services the business needs of the buyer over internal resources or competitors. For buyer firms, flows of strategic information from the supplier should be derived as a by-product of the level of buyer dependence on a given supplier. Moreover, dependence should motivate a buyer to share strategic information with its supplier so as to be able to coordinate actions and complement capabilities with them.

Dyer and Singh posit that increased buyer dependence on a supplier serves to motivate the supplier to share more information with the buyer and make additional relationship-specific investments. Such a view is consistent with Bakos and Brynjolfsson's (1993) contention that buyers pursuing greater dependence on a few suppliers provide incentives for the suppliers to make "investments in innovation, responsiveness, and information sharing" (p. 43). Dyer and Singh also note that greater volume and scope of transactions with supply chain partners increases the "efficiency associated with interfirm exchanges" (p. 664), as an absence of recurring interactions limits partners' ability to recognize complementary resources and opportunities for joint innovation and improvement.

Based on the above reasoning, Hypotheses 3 and 4 posit that higher levels of buyer dependence on a supplier promotes higher levels of strategic information flows from buyer to supplier and from supplier to buyer.

H_3: *The greater buyer dependence on a supplier, the more buyer strategic information flows to the supplier.*

H_4: *The greater buyer dependence on a supplier, the more supplier strategic information flows to the buyer.*

Buyer IT Customization and Strategic Information Flows

Interorganizational relationships can generate relational rents through organizational processes that enable strategic knowledge to be transferred across firm boundaries (Dyer and Singh 1998). Specifically, partners' ability to exchange idiosyncratic strategic information to generate relational rents requires the implementation of customized interfirm routines (Dyer and Singh 1998) and tightly integrated processes (Payne and Frow 2005). Such routines and processes, however, require relationship-specific asset investments (Joskow 1988). Moreover, the specialization of assets is a requisite condition for either direct or indirect rent generation (Amit and Schoemaker 1993). In general, IT assets can enable the effectiveness of interfirm processes to capture, integrate, access, and use information (Jayachandran et al. 2005). In the context of buyer relationships with a focal logistics supplier, buyer IT customization constitutes a type of relationship-specific asset investment. Such an investment is directed to support interorganizational collaboration and mutual adjustment, which are infeasible in market exchanges, in contrast to collaborative partnerships (Dyer and Singh 1998).

IT resources used in logistics relationships vary in specificity based on the degree to which they are *generic, configured,* or *customized.* On one end, *generic solutions* facilitate less complex default information exchanges that are standardized across partners and conceivably also include information that is not private. *Configured solutions* differentiate information exchanges based on customer and context. Modular services and parameterized conditions, along with XML-based and messaging standards, can be deployed to meet the differing exchange requirements within each buyer–supplier relationship. Finally, *customized solutions* incorporate highly specialized built-to-order solutions for information exchanges, such as customized routines for electronic data interchange (EDI) or customized B2B interfaces to the partner's enterprise resource planning (ERP) systems.

Strategic information, such as information related to resources, plans, and financial statuses, is highly proprietary, unstructured, and unique to different buyer firms and relational contexts. Naturally, information that is shared in a relationship needs to be structured and exchanged at different levels of detail as well as in different combinations and formats based on the unique characteristics of each relationship. Thus, while B2B solutions have evolved in their flexibility, we argue that the very nature of strategic information requires IT customization for its exchange between partners.

Accordingly, our fifth and sixth hypotheses posit that higher levels of buyer IT customization (i.e., relationship-specific investments of time, money, and effort to customize interorganizational systems) enable greater levels of strategic information flows from buyer to supplier and from supplier to buyer.

H_5: *The greater buyer IT customization in the buyer–supplier relationship, the more buyer strategic information flows to the supplier.*

H_6: *The greater buyer IT customization in the buyer–supplier relationship, the more supplier strategic information flows to the buyer.*

Trusting Beliefs and Strategic Information Flows

Value-creating initiatives are often achieved through the sharing of "valuable, proprietary information" (Dyer and Singh 1998), which only occurs in the presence of a high level of confidence that such information will not be misused (Dwyer et al. 1987). The sharing of strategic information does bring with it potential unintended consequences (Han et al. 2004), in that the receiving partner might misuse information to the detriment of the sharing partner (Clemons and Hitt 2004). Moreover, Dyer and Singh specifically note the opportunities for parties to "free ride" on information acquired from partners. Accordingly, the relational view of the firm posits that effective governance contributes to rent generation through either lower transaction costs or incentives promoting value-creating initiatives. Notably, lower transaction costs, easily replicated by competitors, may not yield a long-term competitive advantage. Further, Dyer and Singh specify that interfirm governance relies on either third-party enforcement or self-enforcing mechanisms. Given the contracting and monitoring costs as well as the complexity involved in third-party enforcement, self-enforcing mechanisms constitute the more effective approach to achieving rent generation (Dyer and Singh 1998).

To accomplish a high degree of cooperation, interfirm alliances regularly employ both "formal" and "informal" self-enforcement governance mechanisms (Gulati 1995). Dyer and Singh categorize formal safeguards as financial and investment hostages (Williamson 1983), while informal safeguards constitute the presence of mutual trust (Uzzi 1997). With formal governance mechanisms, it might be impossible to cover all contingencies necessary for engagement in certain cooperative behaviors; however, parties that have high trusting beliefs, or "trustworthiness," in one another reduce or even eliminate the necessity for covering all contingencies (Dwyer et al. 1987). While trust is defined as the willingness to be vulnerable to the actions of another irrespective of having the ability to monitor or control, trusting beliefs are those characteristics that serve as the basis for trust and engagement in trust-based actions (Mayer et al. 1995). Absent formal control mechanisms, trust in partners facilitates engagement in cooperative interorganizational behaviors, which give rise to a greater degree of risk (Mayer et al. 1995). Ring and Van de Ven (1992) note that the risk inherent in interfirm transactions necessitates that a firm assess their trusting beliefs regarding the other party. Trust further establishes behavioral norms and expectations that reduce the perceived risk of such opportunistic abuses (Granovetter 1985). Here, informal self-enforcing agreements rely upon personal trust relations established among organizational actors (Dyer and Singh 1998), which may be the most effective and economical means to protect relational exchange investments (Uzzi 1997).

Effective governance established through informal safeguards via strong trusting beliefs is a prerequisite for fostering a firm's willingness to engage in collaborative initiatives, such as strategic information sharing (Dyer and Singh 1998).

Hence, Hypotheses 7 and 8 posit that a higher level of trusting beliefs in a party leads to increased strategic information flows to that party.

H_7: The greater buyer trusting beliefs in the supplier, the more buyer strategic information flows to the supplier.

H_8: The greater supplier trusting beliefs in the buyer, the more supplier strategic information flows to the buyer.

Controls

Long-Term Orientation

Past research finds that longevity in a relationship is associated with both trust (Anderson and Weitz 1989) and dependence (Ganesan 1994), two constructs that appear in our model. Additionally, research suggests that longevity creates "experience-based assets," facilitating efficient communication and information exchange (Williamson 1985). Accordingly, we include long-term orientation as a control variable for both strategic information flows and relationship-specific performance.

Buyer Firm Size

Past research argues that compared to smaller firms, larger organizations are less concerned about partner exploitation (Doz 1987). Larger firms also enjoy potential advantages in exploiting the resource endowments of smaller partners and in influencing their information-sharing behaviors (Hitt et al. 2002). Accordingly, we include buyer firm size as a control variable for both strategic information flows and relationship-specific performance.

Research Design

Our study design employs an exploratory phase based on a case study and a subsequent confirmatory phase based on a survey. During interviews in the exploratory phase, both buyers and suppliers provided requisite qualitative data, which we use to develop and validate the survey instrument used in the confirmatory phase.

Measures

The information obtained in the exploratory phase serves as the basis for the development of measures for strategic information flows, relationship-specific performance, buyer dependence on supplier, and buyer IT customization. We adapt McKnight et al.'s (2002) multidimensional measure of trusting beliefs for our context. Further, we conceptualize strategic information flows, relationship-specific performance, and trusting beliefs for both sides of the relational dyad. The measures of each party are distinct, as noted by John and Reve's (1982) critique of construct measurement in dyadic studies. Accordingly, we model and independently capture these variables with respect to the other partner by using different raters on each side of the dyad. Although we employ common scales, the construct definitions (i.e., buyer in supplier and supplier in buyer) differ as buyer and supplier constructs are conceptualized for different focal subjects (Rossiter 2002).

Measures that are caused by a latent construct are reflective (Edwards and Bagozzi 2000), while measures that determine a construct are formative (MacCallum and Browne 1993). To determine if the measure for a construct/subconstruct is reflective or formative, we apply the four rules developed by Jarvis et al. (2003). The first rule stipulates the direction of causality to be from items to construct for formative measures and from construct to items for reflective measures. The second rule maintains that items are interchangeable for reflective measures but not for formative measures. The third rule states that covariance between measures is not necessary for formative measures but is necessary for reflective measures. The fourth and final rule states that reflective measures share common antecedents and consequences, a condition not necessary for formative measures.[2]

To operationalize strategic information flows for both the buyer and the supplier, we specify eight types of shared strategic information as a formative measure. We used the exploratory phase to determine the types of strategic information for the relationship context under examination, namely a focal logistics vendor and its client. We further validated these items through discussions with account managers at the vendor firm and at two of its client firms. Each of the individuals at the vendor and the client firms had five years or more of tenure in their positions. The client firms used the focal vendor and at least one other competitor. Each of these

[2]When there is theoretical ambiguity about the nature of a measure for a construct, vanishing tetrad analysis can be used to statistically inform if a construct's indicators are reflective or formative. For a construct with four indicators, *g, h, i,* and *j*, a tetrad equals the difference between the product of a pair of covariances and the product of another pair of variances, $\tau_{ghij} = \sigma_{gh}\sigma_{ij} - \sigma_{gi}\sigma_{hj}$ (Bollen and Ting 2000). A simultaneous test of the nonredundant tetrads that cannot reject the null hypothesis of a vanishing tetrad is suggestive of reflective indicators, while a test that can reject the null hypotheses is suggestive of formative indicators (Bollen and Ting 2000).

types represents strategic information sharing above and beyond order-related information that is required for transactional exchanges (Seidmann and Sundararajan 1997). Appendix A details the specific information types for the buyer and the supplier that emerged in the exploratory phase.

Similarly, we use a six-item formative measure to assess relationship-specific performance for both the buyer and supplier. Again, we drew upon the exploratory phase to inform the development of applicable performance items, which we subsequently validated through discussions with the vendor and its clients. These performance outcomes include tangible economic outcomes (e.g., improved asset management, increased productivity, and reduced operating costs) and intangible outcomes that are hard to quantify (e.g., improved capacity planning, improved resource control, and increased resource flexibility). Applying the criteria identified by Jarvis et al., we model the measures for strategic information flows and relationship-specific performance constructs as formative.[3]

We assess buyer dependence on supplier by using a single-item, ten-level interval scale on the percentage of the buyer's logistics needs served by the vendor. Single-item measures are justified when there are restrictions on instrument length (Straub et al. 2004a), when the addition of multiple items introduces "wasteful redundancy" (Rossiter 2002) in the presence of a "concrete" measure (Bergkvist and Rossiter 2007), and when constructs are unambiguous and focused (Sackett and Larson 1990). All of these conditions are true for our measurement of buyer dependence, which led us to opt for a single-item measure.

We use three reflective items to measure buyer IT customization. Two of these items assess the extent to which a client employs *generic*, *configured*, or *customized* applications in supporting exchanges with its vendor. The third item measures client customization along a ten-level interval scale that captures the percentage of customized applications used in the relationship.

Finally, Mayer et al. (1995) identify three trusting beliefs that appear frequently in the organizational literature, namely *ability*, *benevolence*, and *integrity*. Ability comprises domain-specific skills, competencies, and/or characteristics; benevolence captures the extent to which partners are believed to act in a positive manner; and finally, integrity encompasses partners' perceived adherence to generally accepted principles. To assess the trusting beliefs a buyer and supplier have in one another, we use these three first-order subconstructs, which in turn determine the second-order construct, trusting beliefs.[4] The measures for the subconstructs meet the four conditions noted for reflective measures. Conversely, the subconstructs of ability, benevolence, and integrity used to measure trusting beliefs meet the four conditions noted for formative measures. Serva et al. (2005) examine rival conceptualizations of trusting beliefs as a single construct; three independent constructs; and a second-order, multidimensional construct with their analysis supporting a multidimensional, second-order conceptualization. In their detailed evaluation of misspecification of formative and reflective measures in the IS literature, Petter et al. (2007) also validate this specification of these trusting beliefs measures. Accordingly, we operationalize the three first-order subconstruct measures of ability, benevolence, and integrity as reflective and the second-order construct measures of trusting beliefs as formative.

Interfirm Dyads as Unit of Analysis

While prior research advocates for the importance of dyadic research designs to investigate phenomena associated with interfirm relationships (Anderson et al. 1994; Clemons and Row 1993; Dyer 1996; Straub et al. 2004b), practical difficulties often lead to collection of data from only one side of the relationship (Malhotra et al. 2005). Focusing on the relationship itself, we collect data from both partners, adopting a "focal supplier" collection strategy as was also employed by Dyer (1996). We selected a Global 500 logistics firm headquartered in the southeastern United States as the vendor site. The firm provides supply chain services to clients in a broad spectrum of industries. Traditionally, logistics vendors have seen their core competency as accurate and timely delivery of goods. Their offerings have expanded to include an increasing number of strategic, IT-related supply chain solutions. In fact, the focal vendor has developed an electronic commerce market segment, which serves as the focus of the current study. The focal vendor has invested not only to develop these IT-enabled supply chain solutions but also to create an infrastructure of skilled high-tech account managers to service client firms. The vendor's account

[3]Our analysis of the nonredundant tetrads (Bollen and Ting 2000) for the strategic information flows, relationship-specific performance, and first-order trusting beliefs construct indicators supports a formative specification of each.

[4]Latent variables with no indicators can be classified as *phantom variables* or as second-order formative constructs. Phantom variables were devised as a methodological mechanism to impose constraints on parameter estimates (Rindskopf 1984). Conversely, second-order formative constructs, unlike phantom variables, are meaningful theoretical constructs (MacCallum and Browne 1993). In our case, trusting beliefs is a well established theoretical construct (Mayer et al. 1995; McKnight et al. 2002), which is formed by the three dimensions of ability, benevolence, and integrity (Petter et al. 2007; Serva et al. 2005).

managers and its dedicated contacts within client firms are responsible for managing the interfirm relationship. The nature of the services provided by the vendor and the structure of its relationship management made the setting well suited for our purposes.

Data Collection

The client and vendor account managers were the most appropriate informants, as they occupy roles that make them knowledgeable about study constructs (Campbell 1955). They typically play a critical role in relationship management and oversee the coordination of information sharing and the customization of workflows (Homburg et al. 2002). The use of client and vendor account managers who are best equipped to provide the information also enables us to minimize informant bias (Huber and Power 1980). Accordingly, our sampling frame includes 183 vendor account managers who oversee one or more clients, each of varying size and complexity. As these account managers oversee multiple clients, one relationship was randomly selected for each of them with respect to the client firm's size, tenure, profitability, or the nature of its interactions. The primary contacts at the 183 different buyer organizations received the client version of the survey instrument from a senior executive at the vendor firm. The vendor account managers also received the survey from the same senior executive, and those who did not initially respond to the survey received follow-up reminders to ensure that vendor responses were obtained for all responding clients.

Table 1 provides a profile of the respondents. Client firm respondents represented a cross-section of major industries and were primarily from higher functional levels (e.g., director and vice president level), with the majority from operational and logistics functions. In total, 132 of the 183 account managers from the vendor side completed the survey for a response rate of 72 percent. On the buyer side, 91 of the 183 account managers responded for a response rate of 49 percent. Pooling both buyer and supplier responses yields a 61 percent overall rate, with 223 out of a potential 366 respondents completing the survey. The final matching of client and vendor respondents resulted in 182 completed buyer and supplier surveys, or 91 usable dyadic surveys. Previous studies that have employed a similar dyadic data collection strategy have achieved an average response rate of approximately 58 percent (Dyer 1996; Fein and Anderson 1997; Johnson et al. 1996).[5] Hence, our study achieved not only a reasonably high number of usable matched responses but also a response rate that is consistent with prior dyadic interfirm research.

Assessment of Survey Bias

Nonresponse Bias

The vendor's senior management sponsors for this project would not allow us to contact client firms personally, thus preventing a robust assessment of nonresponse bias. Nevertheless, tests indicate that nonresponse bias is not likely an issue with our data. We compare construct means between the early and late waves of the survey responses (Armstrong and Overton 1977) and detect no differences across these waves regarding the clients' primary industry, regional location, and number of employees. Moreover, we detect no differences across these waves on the following respondent characteristics: gender; years with the organization; and years of work experience, IT experience, and business relationship management experience (see analyses of variance (ANOVA) results in Appendix B). We also find no differences with respect to the 91 responding and 92 nonresponding client firms on relationship longevity, primary industry, and regional location. In addition, we find no differences between the 132 responding and 51 nonresponding vendor representatives in terms of years with the organization, gender, and each representative's direct supervisor. Finally, we find no variation between the 41 unmatched responding vendor representatives and the 91 matched responding vendor representatives in terms of the client's primary industry, regional location, years with the organization, gender, and their years of overall work, IT, and business relationship management experience (see Appendix B). Based on the collective evidence, we infer that nonresponse bias is not an issue.

Common Method Bias

Steps to safeguard against common method bias include the use of different types of measures across constructs and different scale types for key construct measures (Podsakoff et al. 2003). Specifically, we utilize formative measures for strategic information flows, relationship-specific performance, and trusting beliefs and employ reflective measures for buyer IT customization. In addition to Likert scales, we use interval scales for buyer dependence on supplier and IT customiza-

[5]Dyer's survey of suppliers in the automobile manufacturing industry, for example, yielded 83 usable pairs with a 61 percent response rate for the suppliers and 77 percent for manufacturers. In examining territory and brand choices in manufacturer–distributor relationships, Fein and Anderson obtained 362 usable pairs, with a reported overall response rate of 72 percent. Finally, in studying international cooperative alliances, Johnson et al. realized a 44 percent overall response rate with 98 matched pairs.

Table 1. Respondent Characteristics

Variable	Category	Buyer %	Supplier %
Gender	Female	60.4	71.4
	Male	39.3	28.6
Respondent's Years of Work Experience	1 – 4 years	12.1	12.1
	5 – 8 years	29.7	62.6
	9 – 12 years	20.9	20.9
	13 – 16 years	22.0	1.1
	17 – 20 years	11.0	2.2
	21 – 24 years	3.3	1.1
	25 plus years	1.1	0.0
Respondent's Years of IT Experience	1 – 4 years	63.7	74.7
	5 – 8 years	17.6	24.1
	9 – 12 years	9.9	4.4
	13 – 16 years	5.5	1.1
	17 – 20 years	3.3	0.0
Respondent's Years of Relationship Management Experience	1 – 4 years	47.3	47.3
	5 – 8 years	28.6	39.6
	9 – 12 years	15.4	9.9
	13 – 16 years	4.4	1.1
	17 – 20 years	3.3	1.1
	21 – 24 years	1.1	1.1
Client Firm Respondent's Position	Vice President of Purchasing	2.4	
	Director/Manager of Operations	8.2	
	Director/Manager of MIS	4.1	
	Director/Manager of Logistics/Transportation	37.5	
	Director/Manager (Other)	10.5	
	Other Position	21.3	
Client Firm Representative's Supervisor's Position	President/Owner/Director/Chairman/Partner	6.6	
	Vice President/General Manager	2.8	
	Vice President of Finance	12.0	
	Controller	12.0	
	Vice President of Operations	40.0	
	Vice President of MIS	6.5	
	Vice President of Logistics/Transportation	5.3	
	Vice President (Other)	1.5	
	Director/Manager of Logistics/Transportation	13.3	
Client Organization's Primary Industry	Manufacturing	14.1	
	Banking/Finance/Accounting	9.0	
	Insurance	5.1	
	Real Estate/Legal Services	12.0	
	Wholesale or Retail	26.1	
	Government	3.8	
	Education	1.5	
	Healthcare	7.5	
	Communications	3.4	
	Publishing/Broadcasting/Advertising/Public Relations	8.1	
	Computer/Data Processing	10.3	
Relationship Longevity	1 – 5 years	74.7	
	6 – 10 years	15.4	
	11 – 15 years	3.3	
	16 – 20 years	6.6	
	21 years plus	0.0	

tion. For the control variables, we use an interval scale to measure the client's firm size and a ratio scale to measure the duration of the relationship in years, which is our proxy for the long-term orientation of the relationship. Our data for relationship duration were obtained from the vendor's archival records. Our application of the Harmon one-factor test prescribed by Podsakoff and Organ (1986) results in seven extracted factors from the survey data. No single factor accounts for the bulk of the covariance, leading to the conclusion that common method bias is not an issue.

Analysis and Results

The confirmatory phase of our study includes measurement validation and hypothesis testing. The model includes four constructs with formative measures, one construct with a reflective measure, two second-order constructs with formative measures, and one construct with a single-item measure. We employ structural equation modeling (SEM), which allows for modeling multiple interdependent relationships and second-order constructs (Anderson and Gerbing 1988). We use partial least squares (PLS), a components-based SEM, as it has no distributional assumptions and is flexible to the inclusion of formative and reflective measures in a model (Diamantopoulos and Winklhofer 2001). Additionally, with covariance-based SEM, formative measures can give rise to problems with identification, or ensuring that a solution exists for each parameter within the structural model (Rigdon 1995). To achieve identification may require (1) elimination of structural paths, (2) restriction of construct error terms to zero, or (3) re-specification of the structural model (MacCallum and Browne 1993). In contrast, components-based SEM does not face the statistical identification challenges inherent in covariance-based approaches to formative modeling (Petter et al. 2007). Finally, components-based SEM maximizes the explained variance of endogenous variables in the structural model (Gefen et al. 2000; Chin 1998), which enables us to understand how much variance is explained in the constructs for strategic information flows and in the constructs for relationship-specific performance.

Assessment of Measurement Model

Our reflective measures exhibit good internal consistency and exceed the suggested .7 threshold for Cronbach's alpha (Nunnally and Bernstein 1994), with values of .87 for buyer IT customization; .96, .95, and .91 for each of the three dimensions of buyer trusting beliefs in the supplier; and .89, .92, and .96 for supplier trusting beliefs in the buyer. To evaluate the discriminant validity of the reflective measures, we first conduct an exploratory factor analysis for items related to trusting beliefs. Our results suggest that integrity, benevolence, and competence are distinct dimensions of trusting beliefs (see Appendix C). One supplier integrity item shows a slight cross-loading with supplier benevolence; however, its loading on the integrity dimension clearly exceeds its cross-loading on the benevolence dimension. We also compare inter-construct correlations with the average variance extracted (AVE), or the percentage of overall variance in the indicators captured by the latent construct (Hair et al. 1998). This comparison supports discriminant validity with the square root of the AVE for each measure exceeding correlations between the measure and other measures (see Table 2).

In contrast to reflective measures, formative measures do not need to exhibit internal consistency or reliability (Chin 1998; Gefen et al. 2000; Petter et al. 2007). In fact, multicollinearity among formative indicators can result in nonsignificant items (Diamantopoulos 2006), as multiple indicators may identify the same aspect of a construct (Petter et al. 2007). The variance inflation factor (VIF) is a useful statistic to assess such problems, with values below 3.3 indicative of the absence of multicollinearity (Diamantopoulos and Siguaw 2006). For our formative measures, we find the VIF values to be 2.0 and 1.6 for buyer trusting beliefs in the supplier and supplier trusting beliefs in the buyer, 1.3 and 2.2 for strategic information flows for the buyer and the supplier, and 1.1 and 1.6 for relationship-specific performance for the buyer and the supplier.

Figure 2 shows the weights of formative indicators associated with the constructs for trusting beliefs (2a), strategic information flows (2b), and relationship-specific performance (2c) for the buyer and the supplier. With components-based SEM, weights are estimated based on the overall model. They provide insight into the meaningfulness of the set of formative indicators and their relative importance in the context of the nomology. When n orthogonal formative indicators are specified, the ceiling on their average weight is $\sqrt{(1/n)}$. This average standardized weight is achieved when formative indicators explain all of the variance in a construct. Given three formative indicators for trusting beliefs, the theoretical maximum average weight of these indicators is .58. Similarly, we measure strategic information flows and relationship-specific performance outcomes using eight and six formative indicators; hence the theoretical maximum for each of their average weights is .35 and .41, respectively. The results show that the observed average weights for the formative indicators associated with each construct are favorable: .40 for buyer trusting beliefs in supplier, .36 for supplier trusting beliefs in buyer, .23 for strategic information

Table 2. Matrix of Intercorrelations and Square Roots of AVEs*

Theoretical Variables	Measure Type	1	2	3	4	5	6	7	8	9	10
Buyer Strategic Information Flows to Supplier (1)	Formative	**.87**									
Supplier Strategic Information Flows to Buyer (2)	Formative	.19	**.91**								
Buyer Relationship-Specific Performance (3)	Formative	.20	.19	**.94**							
Supplier Relationship-Specific Performance (4)	Formative	.31	.23	-.03	**.94**						
Buyer Dependence on Supplier (5)	Single Item	.63	.32	.24	.20	**1.00**					
Buyer IT Customization	Reflective	.55	.29	.12	.21	.41	**.89**				
Buyer Trusting Beliefs in Supplier (7)	Formative	.40	.36	.06	.38	.42	.14	**.88**			
Supplier Trusting Beliefs in Buyer (8)	Formative	.59	.40	.02	.25	.36	.29	.40	**.92**		
Controls											
Long-Term Orientation (9)	Single Item	.04	.04	.04	-.04	.10	-.12	.22	-.02	**1.00**	
Buyer Firm Size (10)	Single Item	.05	.05	.06	-.11	-.05	.17	.02	.66	.14	**1.00**

*Square Root of AVEs reported along diagonal in bold.

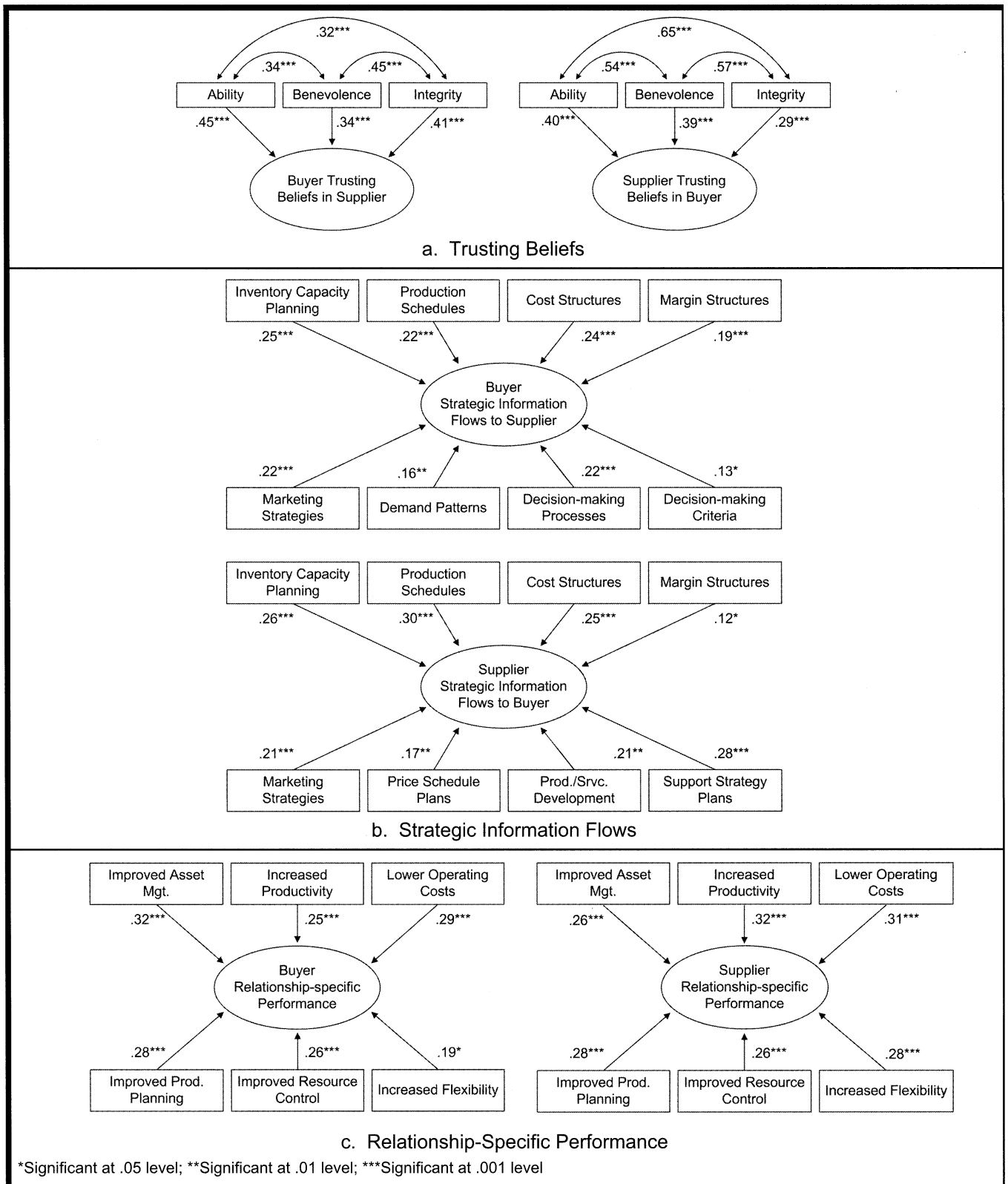
flows from buyer, .20 for strategic information flows from supplier, .26 for buyer relationship-specific outcomes, and .29 for supplier relationship-specific performance outcomes. These average weights are evidence of the importance of each of the formative indicators.

We employ a different procedure to assess the discriminant validity of the formative measures than the AVE analysis used for reflective measures. The AVE presumes that measures will converge, a condition that is not necessary for the formative measures (Jarvis et al. 2003). Hence, we examine item-to-item and item-to-construct correlations for these constructs. Using PLS item weights for individual formative indicators, we compute composite construct scores. These scores, in turn, serve as the basis for calculating item-to-item and item-to-construct correlations and evaluating discriminant validity (Ravichandran and Rai 2000). We find intra-construct item correlations to be greater than inter-construct item correlations. Additionally, the items exhibit stronger correlations with their composite construct scores than with the composite scores of other constructs. Finally, as suggested by Diamantopoulos and Winklhofer (2001), the formative items for constructs should correlate with "a global item that summarizes the essence of the construct" (p. 272). High correlations with a global item and low correlations with other constructs provide additional evidence of discriminant validity. Cumulatively, these results suggest that the instrument has acceptable measurement properties.

Hypothesis Testing

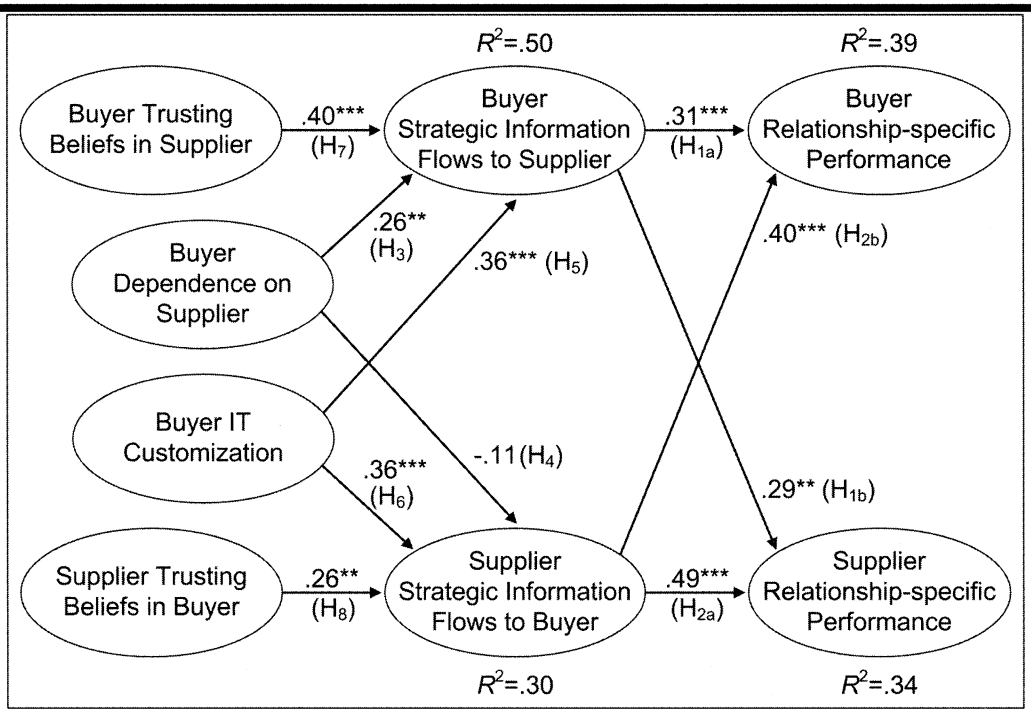
Figure 3 shows the PLS structural model results. The model accounts for 50 percent of the variance in buyer strategic information flows to the supplier and for 30 percent of the variance in supplier strategic information flows to the buyer. Additionally, it accounts for 39 percent of the variance in buyer relationship-specific performance and for 34 percent of the variance in supplier relationship-specific performance.

In terms of the structural paths, the results support H_1 and H_2. Strategic information flows positively and significantly impact relationship-specific performance for both the buyer and supplier. While the results support H_3 (buyer dependence on supplier positively impacts buyer strategic information flows to the supplier), they do not support H_4 (there was no significant direct effect detected for buyer dependence on supplier strategic information flows to the buyer). Further, the results support H_5 and H_6, as the positive relationships between buyer IT customization and both parties' strategic information flows are significant. Finally, supporting H_7 and H_8, the results show significant direct effects for both buyer



*Significant at .05 level; **Significant at .01 level; ***Significant at .001 level

Figure 2. Formative Indicator Weights



	Path Coefficients			
Controls Applied	BSIFS	SSIFB	BRSP	SRSP
Long-Term Relationship Orientation	.00	-.08	.11	-.10
Buyer Firm Size	-.10	.12	-.06	.08

Buyer Strategic Information Flows to Supplier (BSIFS)
Supplier Strategic Information Flows to Buyer (SSIFB)
Buyer Relationship-Specific Performance (BRSP)
Supplier Relationship-Specific Performance (SRSP)

*Significant at .05 level; **Significant at .01 level; ***Significant at .001 level

Figure 3. Partial Least Squares Results

trusting beliefs in the supplier and supplier trusting beliefs in the buyer on the corresponding strategic information flows between parties.[6]

Appendix D details the results for the control-variables-only model, the theoretical-variables-only model, and the full model. With respect to the control variables, neither long-term orientation nor buyer size has a significant influence on the mediating or dependent variables. We speculate that long-term orientation does not directly influence strategic information sharing or relationship-specific performance. Rather, long-term orientation influences other relational properties, such as trusting beliefs and buyer IT customization, which influence strategic information flows and other forms of cooperative behavior that are proximate determinants of relationship-specific performance outcomes.[7] Similarly,

[6] We evaluate the statistical power or the probability that tests correctly reject the null hypothesis (Baroudi and Orlikowski 1989; Marcoulides and Saunders 2006). We find power values, for $\alpha = .01$, in excess of the .80 recommended threshold (Cohen 1992) for both the theoretical and full models (see Appendix D).

[7] A post hoc analysis suggests that long-term orientation is an antecedent to buyer trust in the supplier.

Table 3. Pseudo F Test for Effect Size of Theoretical Variables

Construct	ΔR^2	f^2	F-statistic	Effect Size
Buyer Strategic Information Flows	.46	.9200	78.200*	Large
Supplier Strategic Information Flows	.25	.3571	30.357*	Large
Buyer Relationship-Specific Performance	.35	.5738	48.770*	Large
Supplier Relationship-Specific Performance	.28	.4242	36.061*	Large

*Significant at .001 level.

size of the organization (i.e., relative differences in size or bargaining power) may again impact strategic information sharing or relationship-specific performance only through their influence on other relational properties that serve as proximate antecedents to them.

To test the additional contribution of the theoretical variables when added to the control-variables-only model, we examine the incremental changes in R^2. We measure the effect size and significance of the change in variance explained between models using an f^2 statistic, which we calculate by dividing $(R^2_{\text{full model}} - R^2_{\text{control variables}})$ by $(1 - R^2_{\text{full model}})$ (Chin et al. 2003). A small effect size is .02, medium approaches .15, and large approaches .35 (Cohen 1992). Subsequently, we calculate a pseudo F-statistic with $(k\text{-}c, N\text{-}k\text{-}c)$ degrees of freedom, where N is the sample size (91), k is the number of parameters estimated for the full model, and c is the number of parameters estimated for the control-variables-only model (Cohen 1988). The addition of the theoretical variables adds significantly to explaining the variance in the strategic information flows and the relationship-specific performance constructs (see Table 3).

Our sample size of 91 matched dyads raises the question about potential bias in parameter estimates due to the consistency at large property. We employ ordinary least squares (OLS) path analysis (Asher 1983) to evaluate if the results are similar to the PLS analysis. We specify four OLS regression models to test the direct and indirect effects of the antecedent variables and employ composite scores of items for the first-order constructs and composite scores of the first-order constructs for the second-order constructs. We observe that the OLS path analysis results are consistent with the PLS results. We should note that OLS was not chosen as our primary analysis tool for three reasons: (1) it assumes independent error terms across equations (Pedhazur 1997), (2) it does not make a distinction between formative and reflective measures, and (3) it uses a composite score instead of multi-item measures for constructs.

Discussion

We draw upon the relational view of the firm and employ a dyadic research design to investigate the performance consequences and antecedents of strategic information flows between buyers and suppliers in collaborative relationships. We demonstrate that buyers and suppliers realize performance benefits through the flow of strategic information from one party to the other. For both the buyer and the supplier, this sharing results in financial gains from improved asset management, lowered operating costs, and increased productivity as well as in operational capability gains from improved planning, increased resource control, and enhanced process flexibility. Grounded in game theory, the prisoner's dilemma posits that sharing or withholding information leads to distinctly different outcomes, with cooperation in sharing information potentially maximizing benefits to both parties, while withholding information has the potential to punish one or the other party or both (Deutsch 1958; Lave 1962). In moving past transactional exchanges, collaborative partnerships require firms to engage in cooperative initiatives in pursuit of rent generation (Morgan and Hunt 1994). Our results suggest that given certain conditions, there is significant value to be garnered by each party through cooperatively sharing strategic information and complementing their strategic information with that of their partner.

While our model accounts for 30 percent of the explained variance in buyer relationship-specific performance and for 39 percent in supplier relationship-specific performance, the remaining unexplained variance merits additional consideration. To examine the influence of strategic information flows further, we conduct a post hoc analysis of the interaction effects that buyer strategic information flows to supplier and supplier strategic information flows to buyer have on the relationship-specific performance of each partner. As reported in Table 4, we observe a .06 change in the variance explained for buyer relationship-specific performance for a medium effect size and a .14 change in the variance

Table 4. PLS Results of Post Hoc Information Flows Interaction Effects

	Full Model				Interactions Added			
	Mediators		*Dependent Variable*		*Mediators*		*Dependent Variable*	
	BFIS	SSIFB	BRSO	SRSO	BSIFS	SSIFB	BRSP	SRSP
Theoretical Variables								
BSIFS			.31***	.29**			.28***	.25**
SSIFB			.40***	.49***			.36***	.44***
BSIFS × SSIFB							.28**	.43***
Buyer Dependence on Supplier	.26**	-.11			.32***	.05		
Buyer IT Customization	.36***	.36***			.40***	.38***		
Buyer Trusting Beliefs in Supplier	.40***				.36***			
Supplier Trusting Beliefs in Buyer		.26**				.24*		
Controls								
Long-Term Relationship Orientation	.00	-.08	.11	-.10	.09	-.08	.12	-.07
Buyer Firm Size	-.10	.12	-.06	.08	-.10	.12	-.10	.05
R^2	.50	.30	.39	.34	.50	.30	.45	.48
Change in R^2							.06	.14
Cohen's f^2							.11	.27
F-statistic							7.589	22.885
Effect Size							Medium	Large

Buyer Strategic Information Flows to Supplier (BFIS)
Supplier Strategic Information Flows to Buyer (SSIFB)
Buyer Relationship-Specific Performance (BRSP)
Supplier Relationship-Specific Performance (SRSP)

*Significant at .05 level; **Significant at .01 level; ***Significant at .001 level

explained for supplier relationship-specific performance for a large effect size. Thus, the inclusion of this interaction term results in substantial increases in the variance explained for both buyer and supplier outcomes. Interestingly, the buyers within our initial analysis (i.e., without the interaction) see higher relationship-specific performance gains than the supplier (see item mean values in Appendix A). More dramatic increases in the variance explained for suppliers because of the interaction term may reflect the additional benefits that the vendor realizes by aggregating information that is shared by their client firms.

Our results also suggest that buyers who have a greater dependence on the supplier are more likely to share strategic information with them, as they have a greater motivation to achieve synergy with the vendor's resources and capabilities. While the industry structure view sees buyers maximizing their bargaining power through increased numbers of suppliers and only limited dependence on any one supplier (Porter 1980), the relational view posits that buyers profit from increased concentration of sourcing with a supplier (Dyer and Singh 1998). However, within our study this sourcing dependence does not promote the sharing of strategic information by the supplier. A buyer who sources a high volume and large scope of services from a supplier is motivated to share strategic resources with them to achieve complementarities (Dyer and Singh 1998). Hence, we see increases in buyer flows of strategic information to the supplier with increases in buyer dependence. However, our results suggest that increases in buyer dependence do not translate into increases in supplier's motivation to reciprocate with the sharing of its strategic information. As shown in Appendix A, the higher mean values for strategic information flows from supplier to buyer, rather than from buyer to supplier, suggest that the logistics industry may now have evolved to a point where buyers have baseline expectations for information sharing from suppliers.

Additionally, in a different relational context (e.g., manufacturer–distributor alliance), dependence may operate in a manner similar to trusting beliefs, with each party's dependence on the other shaping their exchange behaviors. We do not examine the impact of supplier dependence on strategic information sharing, as Dyer and Singh posit buyer dependence on the supplier motivates both parties to engage in value-creating initiatives. Further, our research design uses one focal vendor firm, which is one of the largest in the logistics industry and has limited dependence on any single customer, thus precluding an examination of supplier dependence. It will be instructive to examine both buyer dependence and supplier dependence in future research.

Our results support the argument that asset-specific investments enhance the richness of interfirm collaboration (Joskow 1988). This finding is also consistent with Dyer and Singh's contention that organizational complementary resources and capabilities serve to enable value creation through strategic complementary interfirm resource combinations. Specifically, our results suggest that IT customization (an organizational complement) enables flows of strategic information (a strategic complement) between buyer and supplier. This information is, by nature, idiosyncratic to different relationships and cannot be shared without the customization of systems. Dyer and Singh further note potential cumulative, or "snowball," effects resulting from the interconnectedness of a given relationship-specific investment with other investments. We speculate that buyer IT customization efforts are "bundled" with earlier supplier investments in developing IT services, configured IS, and related technological capabilities (Russell 2002). These supplier investments effectively make subsequent relationship-specific buyer investments "economically viable" (Dyer and Singh 1998).

Finally, trusting beliefs in relational partners increases strategic information flows to the respective partner, which supports Dyer and Singh's proposition that effective governance fosters a willingness to engage in cooperative initiatives. We find that a buyer and supplier who perceive that their partner acts with benevolence and integrity, in addition to being competent, are more likely to share strategic information. In our conceptualization, we differentiate between order-related information, which must be shared in transactional exchanges, and strategic information, which has great potential to generate additional rents but also has risks of misappropriation. The sharing of private, strategic information can be dangerous for firms, as it potentially leads to unintended consequences (Han et al. 2004). Our results provide insights into how trusting beliefs create the necessary environment in which partners move past concerns of opportunism.

We also observe a noteworthy pattern related to trusting beliefs and the sharing of strategic information. The construct mean values (see Appendix A) show that even though the buyer trusts the vendor more than the vendor trusts the buyer, it is the vendor who shares far more strategic information with the buyer. Moreover, trusting beliefs have a greater impact on promoting strategic information flows from buyer to supplier than from supplier to buyer (see path coefficients in Figure 3 or Appendix D). Given the structure of the logistics market, long-standing business practices within the industry may find dominant suppliers sharing a significant amount of information related to operations, finances, and marketing with their customers. However, buyer sharing of such information may be shaped much more by trust-related considerations in the relationship.

Contributions

Digitally enabled collaborative relationships are an alternative to conventional arms-length relationships for supply chain services. Such partnerships go beyond the sharing of order-related information, which facilitates transactional exchanges, to share strategic information, which has the potential to generate additional rents for partners. Thus, an understanding of the performance potential and the essential enablers and safeguards of strategic information flows will aid firms in making meaningful choices between transactional exchanges and collaborative partnerships and to focus relationship management initiatives.

Our work constitutes one of the first efforts within the IS community to draw upon the relational view to examine the role of information systems in interorganizational relationships and to evaluate how strategic information flows yield advantages for participants. Our theorizing draws on the characteristics of collaborative partnerships as outlined by Dyer and Singh, and our results provide strong support for the core tenets of the relational view in the context of logistics partnerships. The characteristics of collaborative partnerships as detailed within the relational view suggest new perspectives for understanding interfirm phenomenon beyond the traditional industry structure and resource-based views.

We also collect dyadic data and, by so doing, add to the thin pool of such research in the IS literature (Clemons and Row 1993; Kirsch et al. 2002; Klein et al. 2007; Malhotra et al. 2007; Straub et al. 2004b). Additionally, our approach to theorizing and the research design should prove to be a beneficial template to researchers investigating other phenomenon spanning organizational boundaries. Many past IS studies on interorganizational relationships have captured

the perspectives of both parties in their theoretical models but have collected data about the relationship from one firm's perspective (e.g., Gosain et al. 2004; Grover et al. 2003; Malhotra et al. 2005, 2007; Rai et al. 2006). While Klein et al. (2007) used a dyadic research design, they conceptualized constructs and operationalized measures in terms of total magnitude and symmetry across parties in a relationship. Here, consistent with the relational view, our model incorporates constructs to capture the beliefs, behaviors, and outcomes of both parties in a relationship, and our empirical study uses a dyadic design to test this model.

Practical Implications

From a practical perspective, our results yield actionable guidelines for the management of logistics relationships. First, account managers in buyer and supplier firms should focus on strategic information that promotes rent generation through sharing with partners. Specifically, the evidence suggests that going beyond the sharing of order-only information can result in benefits for both parties. The exchange of information related to operations, including inventory levels and market actions (e.g., new product launches and market entry initiatives), can enable buyers and suppliers of logistics solutions to leverage their complementary resources and capabilities. Accordingly, sharing such strategic information can result in additional benefits for both parties, namely lower obsolescence or spoilage rates for buyers and more efficient asset utilization for suppliers.

Second, managers can track and share relationship-specific measures related to financial outcomes, such as cost and margin structures, at the relationship level. The integration of buyer ERP applications with vendor systems can facilitate access to such measures. The sharing of such measures will enable buyers and suppliers to evaluate collaboratively as to how the flows of strategic information influence inventory turn rates and operational efficiencies and how these measures relate to financial outcomes.

Third, customization of IT establishes the digital capability for the flows of strategic information that are idiosyncratic to a given relationship. Consider how many FedEx clients use a standardized online tracking application to find out transaction-related information, such as their package delivery status (Russell 2002). However, leading logistics vendors, including FedEx, have developed customized solutions, or service-oriented architectures, to encapsulate IT services and configure solutions in an effort to meet the differentiated collaboration needs of their customers (Russell 2002). Such IT solutions can enable the flows of more strategic information within these partnerships.

Fourth, each partner firm must cultivate trust in the other through recurring interactions to mitigate concerns about the risks of opportunism. While firms must demonstrate their functional and technical capabilities to their partners, they must also recognize that conveying concern for partner firms and adherence to high ethical standards are critical to fostering trusting beliefs. Repeated engagements between buyer and supplier can reinforce beliefs about ability, benevolence, and integrity, ultimately mitigating concerns about the risks of sharing strategic information. Hence, informal, self-enforcing mechanisms are a viable alternative to third-party enforcement when pursuing risky information sharing initiatives.

Limitations and Future Research

Our focus on a single logistics vendor firm and its clients is a limitation as both the buyer dependence on supplier and the buyer IT customization constructs are assessed from only the buyer side of the relationship. Future research should replicate this study with other vendors and their clients, while also examining other sourced services and measuring constructs from the perspective of the firms that participate in the relationship. Moreover, despite the inherent difficulties in devising and implementing strategies to collect data from both parties to a relationship, future work should attempt data collection from both suppliers and buyers within the same study.

In examining organizational phenomenon, researchers frequently seek response data from informants within firms. The use of multiple informants within the same organization improves both the quality of response data and the validity of the findings (Van Bruggen et al. 2002). Not seeking out multiple informants from each side constitutes another limitation of our work. Future efforts should attempt to obtain access to multiple informants from each responding organization.

While we focus on IT assets and resources, subsequent research should investigate other resources and capabilities as well as their complementarities facilitating interorganizational value creation. The relational perspective (Dyer and Singh 1998) is a viable, rich explanation of interfirm relationships, and finding evidence in other contexts supporting the relational view, as well as evidence for or against our proposed model, is important for scientific verification. Here

again, we see our work as a first step, as elements of the relational view outlined by Dyer and Singh suggest new perspectives for informing academic inquiry into a broad range of interorganizational phenomenon.

Researchers should also evaluate other theoretical perspectives on the evolution and outcomes in interorganizational relationships. For instance, work within marketing proposes quasi-Darwinian selection (Eyuboglu and Buja 2007), suggesting that some interorganizational associations are the result of Darwinian selection and survivor bias. Here, the selection process, when applied to either the relationship as a whole or a specific interfirm initiative, is influenced by individual partner actions, by viable alternatives for the buyer and/or supplier, and by external market adversities. Future research should evaluate the impact of Darwinian selection factors on buyer and supplier choices, the evolution of supply chain relationships, and their outcomes.

Ultimately work needs to expand the unit of analysis from dyadic relationships to business networks (Straub et al. 2004b; Tapscott et al. 2000). Such an approach should yield insight into how network topologies and relational ties along with their IT enablers shape cooperative behaviors as well as the creation and appropriation of value. While studies that embrace this business network approach offer significant promise for novel contributions, the inherent complexities and subsequent difficulties in collecting and examining data expand exponentially with the inclusion of growing numbers of network participants (Iacobucci and Hopkins 1992).

Conclusion

We theorize and provide evidence that flows of strategic information from buyer to supplier and from supplier to buyer in logistics relationships yield performance gains for both parties. When a lead logistics provider and its buyers share strategic information, both parties gain in terms of financial performance (e.g., operating costs, asset management, and productivity) and in terms of improvement to capabilities (e.g., production planning, resource control, and process flexibility). Thus, while the sharing of transactional information is necessary to streamline transactional exchanges (Lee et al. 2000), the sharing of strategic information can be leveraged to generate additional rents. There are important conditions that promote the flows of strategic information between a vendor and buyer. First, buyer dependence provides an incentive for the buyer to strive for greater complementarities of resources and coordination of strategic initiatives with the supplier and, consequently, to share strategic information with the supplier. Second, asset-specific IT investments that customize IT resources to the relationship establish the digital mechanisms for the exchange of unstructured, sensitive, and relationship-specific strategic information. Third, and finally, trusting beliefs related to the ability, benevolence, and integrity of the receiving party address concerns of opportunism, thus promoting the exchange of strategic information.

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About the Authors

Richard Klein is an associate professor in the Department of Management at Clemson University's College of Business and Behavioral Science. His research has been published in top journals, including *Decision Sciences*, *European Journal of Information Systems*, *Journal of Management Information Systems*, and *Journal of Operations Management*. Dr. Klein has presented his work at national and international conferences, including the Annual Meeting of the Academy of Management, the Americas Conference on Information Systems, the European Conference on Information Systems, and the Institute for Operations Research and the Management Sciences Annual Meeting. He serves as an associate editor for *European Journal of Information Systems*.

Arun Rai is Regents' Professor and the Harkins Chair in the Center for Process Innovation and the Department of Computer Information Systems at the Robinson College of Business, Georgia State University. His research focuses on understanding interorganizational relationships and IT-enabled innovation. His articles have appeared in *Management Science, MIS Quarterly, Decision Sciences, European Journal of Operations Research, IEEE Transactions on Engineering Management, Information Systems Research, Journal of Management Information Systems*, and others journals. He serves as a senior editor for *Information Systems Research* and as an associate editor for *Journal of MIS*. He has also served as a senior editor for *Journal of Strategic Information Systems* and as an associate editor for *Management Science* and *MIS Quarterly*. His research has been sponsored by leading corporations, including A. T. Kearney, Bozell Worldwide, Daimler-Chrysler, Deutsche Bank, Gartner, Georgia-Pacific, IBM, Intel, UPS, SAP, and SunTrust.

Appendix A

Constructs and Measures

	Observed Range	Mean	Standard Deviation	Observed Range	Mean	Standard Deviation
Strategic Information Flows	**Buyer to Supplier**			**Supplier to Buyer**		
Our organization shares the following types of information with this business partner:						
• Inventory/capacity planning	1–7	2.86	2.61	1–7	5.23	.96
• Production schedules	1–7	3.12	1.80	1–7	5.00	1.08
• Cost structures	1–7	2.73	2.15	1–7	4.59	1.21
• Margin structures	1–7	2.40	2.71	1–7	4.67	1.22
• Marketing strategies	1–7	3.31	1.96	1–7	5.07	.67
• Demand patterns	1–7	3.01	2.05			
• Decision-making processes	1–7	2.85	2.33			
• Decision-making criteria	1–7	2.90	1.89			
• Pricing schedules plans				1–7	4.99	1.30
• Product/services in development				1–7	5.10	1.80
• Support strategies				1–7	4.80	1.10
Relationship-Specific Performance	**Buyer**			**Supplier**		
Our organization has realized the following performance outcomes as a result of our interactions with this business partner:						
• Improved asset management	1–7	4.77	1.54	1–7	3.97	1.56
• Increased productivity	1–7	4.98	1.55	2–7	4.07	1.61
• Lower operating costs	1–7	5.09	1.55	1–7	4.07	1.66
• Improved production planning	1–7	5.05	1.51	1–7	4.19	1.66
• Improved resource control	1–7	4.84	1.61	1–7	3.98	1.61
• Increased flexibility	2–7	5.13	1.57	1–7	4.10	1.70
Buyer Dependence on Supplier	**Buyer**			*N/A: data collected from one logistics vendor*		
• Percentage of our overall logistics needs serviced by this business partner.	1–10	6.67	2.207			
Buyer IT Customization	**Buyer**			*N/A: data collected from one logistics vendor*		
• Our organization uses uniquely built or customized, rather than canned or generic, applications to facilitate information exchanges with our partner.	1–7	4.48	1.73			
• The applications that are used to facilitate information exchanges with our partner can be described on a scale from generic to customized.	1–7	4.46	1.66			
• What percentage of applications are customized, i.e., developed expressly to manage interactions and flows of information between your organization and this business partner?*	1–7	3.77	1.57			

*The third IT customization item employed a 10-point ordinal scale that specified the percentages of applications from 0–10% to 91–100%. For analysis, this measure was rescaled to a 1-7 range, so that all three items for IT customization ranged from 1 through 7.

	Observed Range	Mean	Standard Deviation	Observed Range	Mean	Standard Deviation
Trusting Beliefs	**Buyer in Supplier**			**Supplier in Buyer**		
Ability						
• Our business partner is competent and effective in their interactions with our organization.	2–7	4.74	1.55	2–7	4.51	1.71
• Our business partner performs all of their roles very well.	2–7	4.97	1.52	2–7	4.53	1.58
• Overall, this business partner is capable and proficient.	2–7	4.98	1.53	2–7	4.56	1.50
• In general, this business partner is knowledgeable about their industry and business operations.	2–7	4.98	1.58	2–7	4.62	1.86
Benevolence						
• Our organization believes that this business partner would act in our best interest.	2–7	5.47	1.45	2–7	4.58	1.63
• If our organization required help, this business partner would do their best to provide assistance.	2–7	5.42	1.57	2–7	4.66	1.63
• This business partner is interested in our organization's well being and not just its own.	2–7	5.30	1.52	2–7	4.82	1.56
Integrity						
• This business partner is truthful in their dealings with our organization.	2–7	5.34	1.37	2–7	4.88	1.52
• Our organization would characterize this business partner as being honest.	3–7	5.49	1.26	2–7	4.90	1.58
• This business partner keeps their commitments.	2–7	5.24	1.39	1–7	4.74	1.58
• This business partner is sincere and genuine.	2–7	5.18	1.36	2–7	4.91	1.61

Appendix B

ANOVA Test for Nonresponse Bias

(1) Early Versus Late Respondents					
Factor	**Group**	**Sum of Squares**	**Mean Square**	***F***	**Sig.**
Primary Industry	Between	6.500	6.500	.413	.521
	Within	2421.109	15.721		
	Total	2427.609			
Primary Location	Between	.841	.841	.268	.606
	Within	483.518	3.140		
	Total	484.359			
Number of Employees	Between	.732	.732	.149	.700
	Within	756.877	4.915		
	Total	757.609			
Years with the Organization	Between	18.701	18.701	1.975	.162
	Within	1458.273	9.469		
	Total	1476.974			
Gender	Between	.008409	.008409	.044	.835
	Within	29.735	.193		
	Total	29.744			
Years Work Experience	Between	25.952	25.952	1.223	.270
	Within	3266.638	21.212		
	Total	3292.59			
Years IT Experience	Between	.655	.655	.221	.639
	Within	456.492	2.964		
	Total	457.147			
Years Relationship Management Experience	Between	28.999	28.999	1.831	.178
	Within	2439.226	15.839		
	Total	2468.224			

(2) Responding Versus Nonresponding Client Firms					
Factor	**Group**	**Sum of Squares**	**Mean Square**	***F***	**Sig.**
Client Organization Primary Industry	Between	.895	.895	.056	.814
	Within	2906.624	16.059		
	Total	2907.519			
Client Organization Primary Location	Between	.731	.731	.252	.616
	Within	524.297	2.897		
	Total	525.027			
Relationship Longevity	Between	.06894	.06894	.008	.930
	Within	1601.188	8.846		
	Total	1601.257			
(3) Responding Versus Nonresponding Vendor Representative					
Factor	**Group**	**Sum of Squares**	**Mean Square**	***F***	**Sig.**
Years with the Organization	Between	21.537	21.537	.468	.318
	Within	1579.720	8.728		
	Total	1601.257			
Gender	Between	.003865	.003865	.020	.888
	Within	35.406	.196		
	Total	35.410			
Supervisor	Between	.009931	.009931	.001	.975
	Within	1769.617	10.112		
	Total	1769.627			
(4) Unmatched Versus Matched Vendor Respondents					
Factor	**Group**	**Sum of Squares**	**Mean Square**	***F***	**Sig.**
Primary Industry	Between	123.528	123.528	.896	.306
	Within	2033.714	15.644		
	Total	2157.242			
Primary Location	Between	6.139	6.139	1.174	.243
	Within	367.157	2.824		
	Total	373.295			
Years with the Organization	Between	62.621	62.621	.462	.304
	Within	962.008	7.400		
	Total	1024.629			
Gender	Between	.004924	.004924	.026	.871
	Within	24.238	.186		
	Total	24.242			
Years Work Experience	Between	39.750	39.750	1.354	.247
	Within	3817.492	29.365		
	Total	3857.242			
Years IT Experience	Between	43.226	43.226	1.185	.233
	Within	370.069	2.847		
	Total	413.295			
Years Relationship Management Experience	Between	42.441	42.441	.024	.878
	Within	2431.468	18.704		
	Total	2431.909			

Appendix C

Exploratory Factor Analysis Results

Items	Dimension	1	2	3	4	5	6
BTS1	Ability, Buyer in Supplier	**.71**	.22	.25	.03	-.09	.10
BTS2		**.80**	.29	.28	.12	-.10	.14
BTS3		**.76**	.30	.33	.18	-.21	.13
BTS4		**.84**	.31	.26	.21	-.07	.12
BTS5	Benevolence, Buyer in Supplier	.31	**.69**	.22	.02	.19	.17
BTS6		.22	**.72**	.24	.01	.18	.13
BTS7		.29	**.64**	.22	.19	.01	.14
BTS8	Integrity, Buyer in Supplier	.27	.17	**.73**	.07	.01	.05
BTS9		.21	.23	**.80**	.05	.01	-.03
BTS10		.20	.18	**.76**	.04	.02	.03
BTS11		.18	.20	**.69**	.05	.01	-.02
STB1	Ability, Supplier in Buyer	-.05	-.01	.13	**.68**	.21	.31
STB2		-.02	.01	.14	**.68**	.31	.26
STB3		-.09	-.01	.19	**.72**	.21	.22
STB4		-.08	.02	.09	**.78**	.31	.31
STB5	Benevolence, Supplier in Buyer	.19	.01	.02	.35	**.89**	.27
STB6		.18	-.06	.01	.21	**.69**	.38
STB7		.10	-.02	.03	.29	**.78**	.32
STB8	Integrity, Supplier in Buyer	.09	.07	.01	.19	.47	**.66**
STB9		.14	.05	.01	.31	.33	**.77**
STB10		.10	.04	.03	.21	.38	**.69**
STB11		.09	.07	.02	.27	.22	**.80**

Appendix D

Partial Least Squares Results for Control Variable Only, Theoretical and Full Models

	Control Variables Only Model				Theoretical Variables Only Model				Full Model			
	Mediators		*Dependent Variable*		*Mediators*		*Dependent Variable*		*Mediators*		*Dependent Variable*	
	BSIFS	SIFB	BRSP	SRSP	BSIFS	SSIFB	BRSO	SRSO	BSIFS	SSIFB	BRSP	SRSP
Theoretical Explanatory Variables												
Buyer Strategic Information Flows to Supplier (BSIFS)							.31***	.29**			.31***	.29**
Supplier Strategic Information Flows to Buyer (SSIFB)							.41***	.47***			.40***	.49***
Buyer Dependence on Supplier					.27**	-.10			.26**	-.11		
Buyer IT Customization					.34***	.36***			.36***	.36***		
Buyer Trusting Beliefs in Supplier					.38***				.40***			
Supplier Trusting Beliefs in Buyer						.26**				.26**		
Controls Applied												
Long-Term Relationship Orientation	.20*	.03	.20*	.09					.0	-.08	.11	-.10
Buyer Firm Size	.03	.20*	.04	.21					-.10	.12	-.06	.08
R^2	.04	.05	.04	.06	.49	.28	.39	.33	.50	.30	.39	.34
Power Analysis												
f^2, Effect Size					.96	.39	.64	.49	.99	.43	.64	.52
λ, *F*-distribution Parameter					91.27	36.94	60.10	46.30	97.00	41.57	61.38	49.45
Power					.99	.98	.99	.99	.99	.99	.99	.99

Buyer Relationship-Specific Performance (BRSP)
Supplier Relationship-Specific Performance (SRSP)

*Significant at .05 level; **Significant at .01 level; ***Significant at .001 level

Note: The power analysis of significance test assesses the probability of rejecting the null hypothesis given a population effect size (ES), significance criterion (α), and sample size (*N*) (Cohen 1992). Cohen (1988) suggests a power specification of .80 or greater, as lower levels increase the risk of Type II errors. For multiple regression and correlation analysis, statistical power analysis can be assessed through non-centrality parameter of the non-central *F* distribution (λ) (Cohen 1988).