Inter-organizational information sharing: The role of supply network configuration and partner goal congruence

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Abstract

This paper presents a theoretical framework to investigate the relationships between the design of a supply network (SN) and inter-organizational information sharing (IIS). We distinguish between four different types of inter-organizational information sharing. These concepts are developed using a two-dimensional classification scheme consisting of varying levels of the volume of information shared and the strategic importance of this information in an organizational context. Theoretical arguments and analysis of secondary data are used to develop propositions regarding the association between SN configurations and IIS types, and the role of coordination structure in such associations.

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1. Introduction

Supply chains are now more aptly described as ‘supply networks’ and can involve extremely complex configurations. Supply networks offer opportunities to gain improved performance and to mitigate inefficiencies (Corbett et al., 1999; Corbett, 2001; Dyer and Nobeoka, 2000; Kotabe et al., 2002; Zhao et al., 2002). However, these benefits cannot materialize unless managers are able to understand the causes of these competitive pressures and are willing to implement innovative strategies to correct them (Lee et al., 1997a,b). Thus, it is critical for managers to realize that:

“Top-performing companies distinguish themselves from the ordinary by their ability to anticipate where in the chain lucrative opportunities are likely to arise...”
and to invest in the capabilities and relationships to exploit them ... superior market and technological forecasting ability and superior competency portfolio management (that is, supply chain design) are critical functions for the organization” (Fine, 1998: 76).

One source of this ability to anticipate opportunities is inter-organizational information sharing (IIS). Inter-organizational information sharing (IIS) involves sharing across firm boundaries, and is needed since organizations are unable to generate all of their required resources internally. Firms must therefore interact with other organizations that control these critical resources so that they can compete effectively in their environment (Yuchtman and Seashore, 1967). When information is shared in inter-organizational networks, it can result in a more efficient flow of goods and services (Anand and Mendelson, 1997; Dyer and Nobeoka, 2000; Lee et al., 1997a), reduced inventory level, and lower costs (Yu et al., 2001), which benefits the overall network. For example, Walmart shares point-of-sale information with their suppliers and transmits orders electronically to the relevant supplier when inventory for an item falls to a predetermined minimum level of stock (Lancioni et al., 2000). This IIS reduces carrying costs of inventory, facilitates quick response for inventory replenishment and allows suppliers to better plan their production schedules, and reduces lead times (Stevenson, 1994).

Several researchers have discussed the idea that IIS leads to improved performance of the supply network (Cachon and Fisher, 2000; Chen, 1998; Gavirneni et al., 1999; Lee et al., 2000). However, it is difficult for firms to reap these benefits unless they have a better grasp of the antecedents of IIS that influence its effectiveness. This is an area in which firms need guidance so that they can effectively channel resources to their knowledge and information sharing activities. The ability of managers to coordinate the complex network of business relationships that exist between parties involved in the supply network is critical to the success of a firm (Drucker, 1998; Lambert and Cooper, 2000).

Economics of organizational design suggests that organizational structure, and by extension, the configuration of a SN is an important factor in influencing the nature of IIS. The organizational behavior perspective suggests that partner characteristics would play a key role also. The relationship between intra-organizational structure and information sharing has been discussed by Anand and Mendelson (1997). In this paper, we focus on the relationship between IIS and the configuration of the supply network and partner characteristics.

Supply network configuration includes various network patterns (like dyadic, multi-channel, and multi-stage), the location of the firm(s) in question within the network, and the coordination structure in place to manage the relationships between the firms, while partner characteristics involve the issue of goal congruence between the firms in a network. The network patterns, which can have one or more stages, and range from the simple dyadic to the multi-channel network within a single stage, create varying levels of complexity, and hence differing environments for information sharing. Further, location of the firm(s) within a network creates different information needs and different consequences due to the distortion in the flow of information. Managing the flow of information effectively requires close attention to the coordination mechanism established among the member firms in a network. The degree of centralization is likely to affect the nature and amount of information that gets shared across the network. Similarly, the degree to which the partner firms perceive a match in their goals may impact the nature and amount of information they are willing to share with each other.

An understanding of the types of IIS, and knowledge of the relationship between IIS types and SN configuration and partner characteristics is thus vital for effective management of the SN. To help fill this gap in the literature, our paper will focus on the following research question: How do supply network (SN) configuration and partner characteristics influence inter-organizational information sharing (IIS)?

The remainder of the paper is organized as follows. In Section 2, we discuss a typology for IIS that was developed based on existing literature. Section 3 covers the methodology used to develop the propositions that are put forth in Sections 4 and 5. In Section 4 we discuss the relationship
between the design of the SN and IIS, while Section 5 addresses the moderating role of coordination structure. Section 6 includes our final discussion and conclusions.

2. Inter-organizational information sharing

2.1. Prior work

Among the measures that have been used to assess IIS are the degree or amount of information shared (Aviv, 2002; Gavirneni et al., 1999), the scope of information shared (Seidmann and Sundararajan, 1998) and the level of intensity of the relationship between partners (Spekman et al., 1998).

2.1.1. Degree of information sharing

Gavirneni et al. (1999) consider three different types of IIS—no information sharing, partial information sharing and full information sharing. With no information sharing the supplier only has information on the orders received from the buyer and must utilize historical data to augment the order information when preparing demand forecasts. In the case of partial information sharing the demand distribution faced by the retailer and the retailer’s inventory policy are known. Finally with full information sharing, the supplier also receives instantaneous information on the retailer’s demand. This analysis, while highlighting the additional benefits obtained from IIS, looks only at the supplier’s perspective and so does not consider the gains, if any that can accrue to the buyer. In addition, the focus on only the amount of information shared (none, partial, full) does not provide sufficient tools to make any assertions on the impact of sharing different types of information. For instance, are there scenarios under which the sharing of strategic information is advantageous to the buyer or the seller, or to the total network? Does this change when competitive information is shared?

2.1.2. Scope of information sharing

Seidmann and Sundararajan (1998) provide a framework for answering some of the above questions. They identify four levels of IIS that can exist in virtually integrated organizations, such as across firm boundaries, where advances in information technology enable coordination of information flows between partners. These levels are labeled as transactional, operational, strategic, and strategic and competitive. Each higher level incorporates information from the lower levels. The lowest level involves the exchange of only transactional type of information such as prices and order quantities utilizing EDI or similar technology. At this transactional level, no advantage is gained from information sharing related to firm-specific operations, since the focus is on logistic process improvements, which can be accomplished effectively by each partner acting independently. The next level incorporates the sharing of operational information, which usually occurs in situations where another partner can more effectively utilize valuable information possessed by one partner, since the receiving partner has the requisite expertise and/or resources. For instance, the use of a VMI system facilitates the transfer of the responsibility for inventory management from the buyer to a supplier who has more experience managing large product inventories and has first-hand knowledge of the production schedule for the products.

The sharing of information leads to strategic benefits, in addition to operational benefits, above the second level. At the third level, the information shared has minimal value to the partner owning the information but can provide strategic benefits when used by another party and also operational benefits for the donating partner. This is evidenced when a supplier is given access to a retailer’s POS data of all product sales from that supplier. Such information allows the supplier to increase demand forecasting accuracy, and gather information on sales patterns. As a result, operations are more efficient for both parties and plans for new product development and sales expansion strategies in the case of the receiving partner are better. At the topmost level the information shared is strategic and competitive. Here, the partner possessing the information can gain minimal benefit from the information if it is not shared. However the other party can gain strategic and competitive
benefits. This can occur for instance when the supplier has access to the buyer’s POS information on sale of products from other suppliers in addition to information on their own product sales.

The arguments posited by Seidmann and Sundararajan (1998) provide some useful insights on understanding how the scope of information shared can benefit the buyer/supplier relationship but the role of the amount of information shared is unclear. This factor should be addressed as it relates to the information processing capacity of firms, which is considered to be an important dimension in the design and structure of organizations (Tushman and Nadler, 1978).

2.1.3. Intensity of relationship

Spekman et al. (1998) analyze buyer–supplier strategies and propose that information sharing varies depending on the level of intensity of the relationship. Intensity is characterized by the strategic importance and the complexity of the relationship (financial, commercial) between the parties. The dimension using strategic importance of the relationship is similar to the levels of IIS proposed by Seidmann and Sundararajan (1998). The sharing relationship evolves from one in which there is cooperation (low strategic importance, low complexity) to one where there is full collaboration (high strategic importance, high complexity). When both the strategic importance and complexity are low, no information is shared, resulting in an arms-length relationship in which there are open-market negotiations. At the cooperation level only essential pieces of information are exchanged and there is the tendency for longer term contracts to be established. The co-ordination phase (high strategic importance, low complexity) involves the exchange of workflow and information. This facilitates the smooth flow of operations between the partners thus allowing provisions for Just-in-Time and EDI systems. As trust and commitment deepen, the intensity level of the relationship increases further, to the point where collaboration occurs. At this level, the information shared incorporates strategic plans, future designs and R&D. Although this is an evolutionary process, Spekman et al. maintain that it is not necessary for all relationships to strive for collaboration since the relationship may not require that high level of intensity to accomplish the common goals of the partners. Similar to other measures that neglect consideration of the magnitude of the information flow, this measure does not provide sufficient ammunition to be able to explain some of the information sharing dynamics as the size of the network grows.

2.2. Proposed IIS typology

Based on a synthesis of the above literature we propose a two-dimensional matrix to classify IIS (Table 1), which looks at both the level of the strategic importance of information shared and the volume of information shared. We exclude transactional types of arrangements between partners, which typically involve arms–length relationships in which no information is shared beyond the transaction, since the focus of this paper is on information sharing. As shown in Table 1, when only operational information is shared, we classify the IIS as Type 1 and Type 2 for low and high volume sharing respectively. Similarly, when information shared is of high strategic importance, we classify the IIS as Type 3 or Type 4 for low and high volume sharing respectively.

When both the strategic importance and the volume of information shared are low, the risks involved are also low and the potential benefits from increased operating efficiency are great. For instance, if the relationship deals with products that are well established and have a stable demand with little need for significant redesign, then information requirement is minimal, and has low strategic value. As the volume of information increases the transaction costs associated with having to process this additional information may be substantial compared to the marginal increases in operating efficiency. This high volume and low strategic

<table>
<thead>
<tr>
<th>Information volume</th>
<th>Organizational scope</th>
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<tr>
<td>High</td>
<td>Strategic: Type 4</td>
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<td></td>
<td>Operational: Type 2</td>
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<tr>
<td>Low</td>
<td>Strategic: Type 3</td>
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<td>Operational: Type 1</td>
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importance IIS occurs in situations of frequent information flows, such as for sequential processes. When strategic importance is high and the volume of information shared is low, partners work primarily independently but require information periodically, as occurs in the phase following the joint development of a new product design. The risk of misappropriation of the information shared is low since mechanisms can easily be implemented to prevent this from happening. Type 4 IIS can be observed in constantly changing markets, where the need arises for frequent sharing of strategic information. As the volume of information increases, the risk of misappropriation of information and opportunities for leakage increase so that these relationships will require high levels of trust and commitment.

3. Research methodology

We use Eisenhardt’s (1989) case-study-based grounded theory development as the approach for this research study. Specifically, Pare’ and Elam (1998) developed a more detailed guideline for researchers using this approach, which ‘relies on past literature and empirical data as well as on the insights of the researcher to make incrementally more powerful theories’. Purao et al. (2002) have used this approach in the area of information systems development, and note that the method is not tied to specific disciplines, and is appropriate for multidisciplinary work as in the present study. The empirical data may be obtained from either primary or secondary sources.

3.1. Appropriateness of secondary data analysis

Analysis of evidence from a secondary source allows researchers to use existing data that was collected for a prior study to pursue a concept that was not the primary intent of the original study (Frankfort-Nachmias and Nachmias, 1996). Such data sources generally include a firm’s public reports such as annual reports, internal documents from companies, documents from government and regulatory agencies, and published academic research (Harris, 2001). Qualitative analysis using secondary data sets, normally comprised of interviews and observations, has been performed in several disciplines including psychology (Pudifoot, 1996), and operations research (Joldersma and Roelofs, 2004). Harris (2001) points out that in cases where data about a specific time period in history is critical, primary sources will be hampered by what they can recall of that time, whereas secondary sources can provide evidence of what actually happened at that time. Further, secondary data, since it was by definition not collected for the express purpose of the study in question, are less likely to be biased in regard to the propositions or hypotheses of the study. Various other benefits of secondary data analysis have been pointed out by researchers, such as relatively low cost (Hakim, 1982), ease of testing for reliability (Frankfort-Nachmias and Nachmias, 1996), and triangulation for increased credibility of the findings (Cowton, 1998).

3.2. Process of analyzing secondary data

Yin (1989) has discussed two general approaches for case analyses—first, on the basis of specific theoretical propositions or hypotheses, and second, for developing a case description. Yin also discusses three dominant modes of analyses for case study data, namely, pattern-matching, explanation building, and time-series analysis. Explanation building (a special case of pattern-matching) deals with finding causal links between variables, and is the mode of analysis adopted in this paper to discover whether the relationships outlined in the propositions are consistent with the case data. This helps to put the new propositions on a more sound footing, although it does not constitute a proof.

As a more specific methodology for analysis of qualitative data, we followed some key steps outlined by Janesick (1994). First, we identified and tabulated key phrases and statements in the cases that spoke directly to the variables that were being studied in our propositions. This included statements made by the interviewees that were reported by the original authors of the case study, and their interpretations. The second step was to interpret those phrases and statements in light of our expec-
tations based in theory, to see if they helped us bring those expectations into sharper focus. Both within-case (for Propositions 1a–1d) and cross-case (for Propositions 2 onwards) analyses were performed. Finally, to strengthen our analysis, we explored the issues of face validity and construct validity of our interpretations. Such validity cannot be proven (Babbie, 1995), but only demonstrated subjectively through past experience with similar data or contexts, or established theories (Krippendorf, 1980). The key questions we considered were whether our interpretations were credible, and if there were other interpretations that might explain the data. Each of the authors of the current study made our own interpretations, and then triangulated those with each other and with the interpretations of the authors of the original case studies, where possible, to reach a consensus.

Our overall approach was to first use existing theories found in the literature relevant to information sharing in SNs, to frame our propositions regarding the types of IIS likely to be associated with various SN configurations, and the moderating role of coordination structure. Transaction cost/agency theory and information and communications theory were among the theories whose implications for information sharing behaviors in SNs were considered and built upon. The expectations from the theoretical arguments were then checked against empirical data obtained from case studies found in the literature.

Secondary data, based on case studies by Choi and Hong (2002), was used in this study. They used three case studies in the automobile industry to understand the structure of networks and how they function by examining in depth the formalization, complexity, and coordination across three real supply networks. The case studies report details of three different supply networks—Honda Accord (Fig. 1), Acura CL/TL (Fig. 2), and DaimlerChrysler (DCX) Grand Cherokee (Fig. 3). As they report, these SNs are for the center console assembly, which was a major enough component to have strategic importance. They collected data between December 1997 and October 2000 using semi-structured interviews, observations made during tours of the plants, and documents such as bill of materials (BOM), vendor agreement form, pre-source package (PSP), and supplier performance rating sheets. Interviews were conducted with at least three individuals (sales representative, operations manager or materials manager and the buyer) involved with the console assembly in each supplier company. Both top-tier (or stage 1, the immediate supplier to the final assembler) and some of the second-tier (or stage 2—the suppliers to stage 1) supplier companies were included in the study. Qualitative analysis of this secondary data was used in Sections 4 and 5 of this paper to further strengthen our propositions.

4. Supply network design theory and propositions

Supply networks usually involve complex interdependencies between firms that require proper coordination in order to be effective (Nassimbeni, 1998). Supply network design is a strategic activity that can impact the success of companies and even industries; thus it is very important that it be managed properly (Fine, 2000). For instance, Fine notes that IBM’s decision to respond to the challenge from Apple Computer by introducing the personal computer in the late 1970s impacted the whole industry. The result was a significant move from a vertically integrated structure to a horizontal/modular structure. Owing to the new modular architecture introduced in the PC, many new companies were able to manufacture subsystems for the industry, which ultimately led to a shift in focus from the IBM computer to the IBM-compatible personal computers, and a host of new competitors.

The strategic importance of networks has led to the expansion of the supply chain concept to incorporate supply networks (Lamming et al., 2000). A supply network can be defined as:

“[a network] nested within wider inter-organizational networks and consists of interconnected entities whose primary purpose is the procurement, use and transformation of resources to provide packages of goods and services” (Harland et al., 2001).

Or as

“a complex adaptive system: it is emerging, self-organizing, dynamic, and evolving” where “a
complex adaptive supply network is a collection of firms that seek to maximize their individual profit and livelihood by exchanging information, products, and services with one another” (Choi et al., 2001).

Both definitions indicate the complex nature of these supply networks; however, the latter definition goes a step further by introducing the concept of a flexible system that changes in response to the needs of the business, and one in which firms take a more active role in facilitating the change process. The supply network can have multiple stages and in each stage it is possible to reduce duplication of effort and unnecessary activities by focusing on congruent objectives. This enhances the potential for success when critical information is shared between supply network partners (Spekman et al., 1998). Supply network design is traditionally viewed as a network configuration that is primarily concerned with the collaboration between firms on facility selection and allocation of products to selected sites. In this paper we examine
the influence of supply network configuration and partner characteristics on IIS (Sections 4.1 and 4.2), as well as the moderating role of coordination structure (Section 5). Fig. 4 illustrates the conceptual model.

4.1. Supply network configuration

The extant literature identifies three key dimensions to describe complex SNs—vertical structure (number of stages), horizontal structure (number of channels), and location in the network (Harland, 1996; Lambert et al., 1998; Randall and Ulrich, 2001; Spens and Bask, 2002). By studying these factors we can get a better understanding of the types of interactions that can occur between network partners. For these interactions, goods and services flow in one direction; payments flow in the opposite direction; and information flows in both directions.
4.1.1. Number of channels

Inter-organizational relationships can be studied as three different configurations (Fig. 5), identified by Van de Ven and Ferry (1980). These are described as follows:

(a) A dyadic network involves the interaction between two firms (e.g. 1 supplier and 1 wholesaler).

(b) A multiple dyadic network involves the interaction of one firm with several other firms (1 to N or N to 1). This can take the form of 1 supplier and N-wholesalers or N-suppliers and 1 wholesaler, for example. Here the N-participants can also be competitors. An example of the 1 to N interaction is the relationship between an airline and several independent travel agencies.

A many to many (or multi-channel) network is one where several firms interact with several other firms (M to N). Here we could have M-suppliers linked to N-wholesalers with competition possible within the M and the N-groups.

In the above configurations we have only considered patterns for a single stage relationship between two layers of the network. The number of suppliers contributes to the complexity of the supply network (Beamon, 1999), so in a single stage relationship, the dyadic network will experience the least complexity, and the multi-channel network the most.

Transaction cost theory argues that a firm investing in highly specific assets is susceptible to opportunistic behavior from its exchange partner unless protective safeguards are put in place to prevent such behavior from occurring (Williamson, 1985). Vertical integration is suggested as the traditional safeguard when both asset specificity and uncertainty are high. In a dyadic relationship where the survival of the relationship depends on both parties, it is expected that the high level of interdependence and commitment to an ongoing relationship will motivate exchange parties to behave, according to transaction cost theory, as if they were in the same firm. The theory argues that this will reduce transaction costs to a level close to that existing under vertical integration. The information and communications theory (ICT), which speaks to the intent and complexity of communication and the degree of richness of such communication, would suggest that such highly interdependent relationships require richer information sharing between the partners. These two theoretical perspectives put together lead to the expectation that partners in a dyadic relationship will share strategic level information.

For example, Honda shares strategic information with partners JFC and CVT (Choi and Hong, 2002), with whom they have established long term strategic relationships. Honda and Yamamoru formed a joint venture in the United States, which eventually became CVT. As for JFC, since it holds
a key patent of a damping mechanism of the cup holder assembly, Honda’s engineers work closely with them in the development of the assembly. Honda is known to discuss strategic issues at business planning meetings with key suppliers. Information related to management attitudes, absenteeism, employee turnover, is shared and plans are discussed with suppliers. It has a ‘guest engineer’ program to lead product development when a supplier sets up the design shop. This is a mechanism put in place by Honda to foster richer communication that involves human interaction and facilitates an ongoing exchange of ideas to shape the supplier’s decisions so that they are in line with Honda’s overall goals.

Similarly, in the Acura SN, Intek, provides Acura with a 3-year projection of sales and investments, while getting feedback from Acura on their long-term strategic plans. Acura originally chose Intek because it needed a company with experience in Japan, to gain strategic synergies between operations in both Japan and North America.

In the DCX network, DaimlerChrysler has a relationship with Textron that dates back to the 1960s, and they have maintained a strategic relationship despite several mergers for both firms. It is understood by both parties that Textron will remain their key supplier, barring any extraordinary circumstances. Textron’s engineers may on occasion begin working with DCX’s engineers in DCX’s design studio even before the contracting document is sent to Textron formalizing the agreement. The document is eventually sent to Textron without any competitive quotes being sought by DCX.

Each of the above relationships between the final assembler and the first stage supplier are illustrations of IIS that is strategic in nature, and reinforces our expectation that strategic information sharing occurs in dyadic relationships, leading us to the following proposition:

**Proposition 1a.** Organizations involved in a single-stage dyadic network are likely to engage in strategic IIS (Types 3 and 4).

As the number of suppliers increases, it becomes more difficult to cultivate close relationships between partners. Contrary to the case of the dyadic network where survival depends on both parties, the other networks can still survive if one party decides to withdraw from the relationship. However, such partners may not be as committed to the long-term survival of the relationship and thus lack the motivation to make the effort to collaborate and share strategic level information. In addition, according to agency theory, management and coordination costs will tend to be higher. Due to the increased burden of coordination, there is a need for sharing and processing of greater amounts of information. There is a tradeoff between coordination costs and information delay (Aoki, 1986). Transaction cost theory would suggest that to maintain the viability of the alliance, the total costs must be low enough to be market competitive. Coordination science argues that one way to manage the conflicting pressures of processing more information while keeping costs low is to decentralize, and share operational rather than strategic information.

For instance, in the Honda SN, CVT and several of its suppliers—Emhart, Garden State, Mil liken, Honda Trading, and Plasco seem to share only operational information. These second-tier suppliers may have shared strategic information with Honda and CVT during the initial network formation. However, once the network was in place, there is no indication that any of these firms shared strategic information with CVT. For instance, Emhart and Garden State were both chosen by Honda, and even though they technically are suppliers to CVT, the pricing agreements between Emhart and Garden State and Honda are unknown to CVT. CVT is still responsible for managing Emhart’s work for quality and delivery. Thus the IIS in this single-stage multi-channel configuration between CVT and its suppliers seemed to primarily involve operational data, with little sharing of strategic information. Also, a large volume of operational information is shared between CVT and its various suppliers, for coordination purposes. This lends credence to our next proposition.

**Proposition 1b.** Organizations involved in a single-stage multi-channel network are likely to engage in high-volume, operational IIS (Type 2).
4.1.2. Number of stages

In addition to the single-stage it is also possible to have multi-stage relationships. The simplest of these is a multi-stage dyadic network with a chain that extends from raw material supplier to end customer, with only one firm at each stage. In this configuration, relationships exist primarily between firms located next to each other in the network, except during the startup of the network, when firms from many stages may get together. In general, multi-stage network relationships involve both a horizontal and a vertical dimension to the network configuration. Beginning with the focal firm, there are partners upstream (immediate suppliers, second-stage suppliers, and so on to the raw material suppliers) and partners downstream (immediate customers, second-stage customers, and so on until the final consumers), representing the vertical dimension. At each stage, there may be multiple channels (the horizontal dimension). For example, Honda Motor Co. has multiple suppliers, each of who in turn may have multiple suppliers, and so forth.

The multi-stage network relationships involve much more complexity and multiple interactions across several stages in the supply network. The sheer size of the network necessitates a large volume of information flow between partners. In these arrangements, it is difficult to identify the optimal state owing to the complex ("rugged") and dynamic nature of the network patterns ("landscape"), that send conflicting signals to the members in the supply network (Choi et al., 2001). With so many stages and suppliers, maintaining efficient operations becomes very challenging owing to different levels of interaction, varying informational needs, and incompatible goals. The increased complexity increases the coordination and information processing costs (Radner, 1993).

Using external sources to coordinate the information flow through the SN as complexity increases can mitigate some of these difficulties (Lee and Whang, 2000). For instance, one can use banks to coordinate payments, and inter-organization systems such as the Sabre airline reservation system to coordinate the flow of information among airlines, travel agencies, customers, rental car companies and hotels (Premkumar, 2000). However much of the requirements that are unique to particular relationships cannot be handled through this method as inherent in these types of arrangements are standard operating policies and procedures to handle large volumes of information and maintain some semblance of order and uniformity.

This situation is a more intensive form of the single stage multi-channel network discussed in Proposition 1b, in terms of the information sharing requirements. Consequently the implication of transaction cost theory, that the network of relationships can only stay competitive by lowering cost, is even stronger in a multi-stage network. Similarly, the means for achieving that, according to coordination science, is once again to decentralize, with information sharing primarily geared towards improving operational efficiency.

From our analysis of the case study data, we saw that strategic information sharing takes place between the final assemblers and their top-tier suppliers, with the assemblers getting intimately involved in design issues. However, as in the case of the Honda SN, the top-tier suppliers seem to have some difficulty communicating with the next tier of suppliers and have complained that the lower tier suppliers are more loyal to Honda and less responsive to them on issues such as quality and delivery. During the formalization phase, it is reasonable to interpret that the firms are in dyadic relationships. Later, the dyads become chains, and finally, larger networks. The move from dyadic relationships to chains, and then to supply networks brings with it additional complexity. It can be surmised from the report of the original study that as the span of control increases, strategic information sharing is reduced. More information is shared regarding the details of scheduling, pricing, logistics, etc. across multiple stages. Evidence culled from the DCX supply network indicates that regular meetings take place between the final assembler, the top-tier supplier and the second-tier suppliers on matters dealing with "quality, pricing, delivery, etc.", indicating that while some strategic information may be shared, the emphasis, when the overall SN is considered, is on operational IIS, leading us to Proposition 1c.
Proposition 1c. The greater the number of stages in a SN, the greater the volume of operational information shared (Type 2 IIS).

4.1.3. Location of the firm within the SN

Each participant has a location in the supply network that can range from a location upstream near the initial source of raw materials to one downstream, close to the consumer, or somewhere in between (Lambert and Cooper, 2000). A firm’s location in the supply network can affect its experiences and consequently its interactions with others in the network.

For instance, the pace of technological change, or ‘clockspeed’, differs dramatically in industries and is also uneven across the supply network (Fine, 1998). He notes that the entertainment industry has one of the fastest clockspeeds, with the half-life of motion pictures ascertained just days after launch. The automobile industry however, has a much slower clockspeed of 4–8 years before the retooling of a model. According to Fine, firms further downstream, that is, closer to the consumer, experience greater clockspeed amplification. In markets with fast clockspeeds, low barriers to entry and low switching costs can dramatically reduce first mover competitive advantage as competitors quickly produce close substitutes.

Demand volatility, bargaining power, and agency costs also differ depending on a firm’s location in the network and all of these factors have an impact on IIS. The concept known as the “bullwhip effect” (Lee et al., 1997b) argues that the further upstream a firm is in the supply network (away from the consumer), the greater the demand volatility due to an amplification of the distortion of information For instance, in a network with a retailer, a manufacturer of finished goods, and a parts supplier, the retailer will have the least demand volatility and the parts supplier the most. Demand volatility is essentially a problem of high error in forecasting. This demand volatility causes production schedules to be inefficient. Such volatility can be reduced if members in the supply chain provide upstream members with access to sell-through data, and information on the status of inventory (Lee et al., 1997a). In other words, upstream firms have a greater need for operational information from the firms closer to the customer. Walmart is a well known example of a retailer that uses checkout scanners to provide POS data via satellite to its suppliers (Lancioni et al., 2000; Stevenson, 1994).

Firms located further downstream are more likely to share competitive and strategic information since the buyer who is further downstream has more relative bargaining power. This is due to the greater possibility that substitutes will be available, thus providing a wider choice of sources from which to procure the required goods (Seidmann and Sundararajan, 1998). Unlike upstream firms that face the problem of information distortion, downstream firms face the need to respond quickly to market conditions. Such firms need to be more agile and flexible. Such flexibility in responding to changing markets requires innovation of products and/or processes, which over time, shapes the strategies of these firms. According to innovation theory, reduction in cycle times for bringing new innovations to fruition can be achieved through methods like “concurrent engineering”. In such an approach, team work is essential, with decision rights being shared between partner firms. This would entail the sharing of strategic decision-making.

The data from the case studies shows that strategic information sharing, whether in the Honda or the DCX network, seems to occur downstream with both Honda and DCX involved in such sharing—Honda with its immediate top-tier supplier, and DCX with suppliers 2 stages deep. In all cases, there is no indication of strategic IIS occurring further upstream, close to the raw material supplier. Further investigation is needed in this regard. However, based upon the implications of the theory discussed above, we make the following proposition:

1 For digital goods, the idea of a physical SN may not be as relevant, if the product goes directly from the producer (developer) to the consumer. Thus the location of the firm in the SN may not even be an issue.
Proposition 1d. In a Supply Network, firms located close to the consumer (downstream) are more likely to engage in strategic IIS (Types 3 and 4), while firms located close to the suppliers of raw material (upstream) are more likely to engage in operational IIS (Types 1 and 2).

4.2. Partner goal congruence

A partnership is defined as a strategic relationship between firms that share common goals, and work for mutual benefit (Mohr and Spekman, 1994). This definition suggests the importance of congruent goals in partner relationships. Consequently we focus our discussion in this section on goal congruence. Goal congruence is the degree to which the partner firms are jointly involved in the achievement of a goal.

Central to the notion of goal congruence is agency theory (Jap, 2001), which assumes that both the shareholders and managers who are agents for the shareholders act in their own self-interests (Jensen and Meckling, 1976). Consequently these parties may act opportunistically when there is information asymmetry. This theory has been applied to relationships that involve parties external to the organization (Harris and Raviv, 1978) and is thus relevant to inter-organizational relationships. When inter-organizational relationships are formed, it has the potential of creating further divergence of interest, owing to divergent interests between the new member and that of the other members. For instance, in the case of a buyer/supplier relationship, buyers are interested in achieving purchases that are cost-effective while suppliers are more focused on high profit margins (Jap, 2001). Although the potential exists for opportunistic behavior, governance mechanisms such as goal congruence can mitigate this type of behavior and lead to superior performance that is mutually beneficial. Goal congruence is defined as the degree to which firms believe that common goals can be achieved, after multiple interactions that help them understand each other’s constraints and opportunities (Jap, 1999).

The realization that “common goal accomplishment” is possible has proven beneficial for firms such as Baxter Healthcare Corporation and Xerox. A common goal commitment of creating optimal inventory levels and non-price benefits, between hospitals and Baxter, resulted in reduced investment in inventory and lower operating costs for the hospitals; Baxter gained market share, increased revenue and customer loyalty. Mutual benefit was also achieved in the case of Xerox where both parties committed to developing customized processes and components. Xerox gained a 10% reduction in manufacturing costs while suppliers, in addition to sales and volumes guarantees, gained a better understanding of Xerox’s needs.

As networks increase in complexity there is greater potential for conflicting goals. While it is to be expected that firms in a network will differ on some of their goals, there should be commonality on the goals that are important to the efficient functioning of the relationship (Anumba et al., 2000). In situations where there is goal congruence, firms will share strategic information in order to achieve goals that are mutually beneficial since knowledge-sharing routines are a source of competitive advantage (Dyer and Singh, 1998).

In the absence of any common goals firms will have no incentive to participate in IIS. This non-participation can be attributed to the firm’s assessment of prohibitively high costs in relationship to the benefits and the potential for reduced bargaining power arising from involvement in IIS.

The case data reveals a close relationship between Honda and CVT, and between Honda and JFC, as well as between DCX and Textron. It further reveals that these dyads show a good degree of goal congruence. Textron has shown great trust in DCX due to a long history of shared goals. Textron, for instance, has on occasion developed a new program without an explicit contract, relying on the belief that their goals will be congruent with those of DCX. Similarly, CVT and JFC have been Honda’s partners for a long time. However, JFC and CVT do not necessarily show the same level of trust with each other, even though each one individually is loyal to Honda. Both JFC and CVT accuse each other of missing deadlines and being unresponsive to inquiries. Thus, the strategic element of the partnership that each firm shares
with Honda seems to be missing from their partnership with each other.

The data also shows that goal congruence can suffer a setback with the pressure to cut cost from final assembly companies. DCX, for instance, wants to meet their cost reduction targets of an average of 3%, which they view as justified, but is not as desirable to suppliers who perceive the negotiation process as “cut throat”. On the one hand we have a manager at DCX Grand Cherokee saying that:

“In general (suppliers) have a lower overhead, and at the same time the vehicle prices have been coming down. We have to shell out rebates on brand new vehicles in the order of several thousand dollars... We are asking our suppliers to share the pressure we feel from the market end.”

But the suppliers who are seeing their profit margins dwindle paint a different picture:

“DaimlerChrysler wants more and more content with less and less money. Negotiations are really tough. For certain items we just plain give up to get things rolling.”

This difference in views between the final assemblers and suppliers, and the feelings of inequity detected by the primary researchers provide some indication that suppliers believe that their best interests are not being served. In fact one supplier, in the Grand Cherokee network, considered severing the relationship if profit margins got any leaner. Such negotiations with emphasis on cost reduction imply a relationship that involves exchanges of more operational rather than strategic information.

While there is an indication of some goal mismatch on cost reduction, such mismatch seems to be more an aberration than the norm. The presence of long-term relationships between all three final assemblers and their immediate suppliers suggests that such disagreements are overshadowed by the common goals that they share. It is evident that these relationships are built upon a lot of exchanges of strategic information.

Proposition 2. The greater the goal congruence between firms, the greater will be the strategic nature of IIS they engage in. As goal congruence increases, firms move toward type 4 IIS.

For each of the SN configurations and the associated IIS types proposed in this section, special attention needs to be paid to the role of the coordination mechanisms, since information structure is a key component of coordination (Anand and Mendelson, 1997). Coordination Science is gaining ground as an area of research in its own right (Malone and Crowston, 1994), and has implications for the economics of organizational design. In Section 5, we consider coordination structure as a moderating variable in the relationships between SN configurations and IIS types.

5. The moderating effect of coordination structure

The efficiency with which information is used depends on how information is shared within the organization (Aoki, 1986). This argument can be extended to the sharing of information between organizations in a SN. According to coordination science, this sharing is facilitated by the requisite coordination structure, which entails managing the interdependencies between activities. Efficient distribution of information is critical to supply networks and provides benefits such as lower network-related costs, and increased responsiveness within the network (Kopczak and Johnson, 2003). Anand and Mendelson (1997) identify two key determinants of a firm’s structure: decision rights and information structure.

Decision rights determine where the locus of authority resides for making decisions, that is, “who” (which organization, in a SN context) makes the decision. Two extremes on this continuum are centralization and decentralization. In a highly centralized structure the locus of authority resides at a single point, while in a highly decentralized structure the locus of authority is dispersed (Robbins, 1990). For example, the degree of centralization in a supply network context can be determined by the amount of authority that the final assembler has over the suppliers in the network (Choi and Hong, 2002). When the locus of authority for making decisions resides with the final
assembler, the supply network is centralized. In the decentralized structure each supplier can independently make its own decisions. As the supply network grows and becomes more complex, there can be greater strain on centralized decision-making, since a single point of contact is unable to effectively handle all decision-making activities.

Information structure refers to the type of information available to the decision maker. Anand and Mendelson (1997) refer to the use of local and global information, or a hybrid of the two, for decision-making purposes within a SN. A SN with centralized authority is associated with the use of global information, while a decentralized one will rely on local information for decision-making, even though mismatches can occur, as studied by Anand and Mendelson (1997). We refer to the above combinations of decision and information structures as 'centralized coordination structure' and 'decentralized coordination structure', respectively.

According to Robbins (1990) the decision on the appropriate level of centralization will depend on situational factors. In a decentralized supply network structure firms are able to respond quickly to changes at their individual location, which is an important capability to have when the local environment is susceptible to rapid changes. Such a structure offers opportunities for the decision maker to incorporate the local information when making decisions. A decentralized supply network structure is also more appropriate when there are characteristics that are unique to a particular location or firm, which need to be considered before making a decision. As such it cannot be easily captured in a centralized system owing to the specific (or tacit) nature of its knowledge. For instance in some liquor stores sales data on each store is collected and that information is used to analyze store performance, and forecast reorder amounts cognizant of local drinking habits and tastes. One of the drawbacks of a decentralized structure is the likelihood for misalignment between the interests of an individual firm and those of the network, which result in agency problems. Thus the costs incurred in inducing the firm to adjust its interest to match those of the network can be high (Anand and Mendelson, 1997).

In contrast, the centralized structure is more appropriate when the decision maker needs to take actions that benefit the total network, rather than the special interests of individual firms. This structure is also more suitable when there are distinct economies of scale, or a need for using standard products and procedures. Mervyns, a large department store, uses POS data from all of their stores for centralized demand trend analysis and to make purchasing decisions. Wal-Mart uses a combination of approaches, where POS data is collected for all the stores but local managers can use their specific knowledge on products that are identified as price sensitive, to set prices that are below those of their local competitors (Anand and Mendelson, 1997).

The centralized structure also has its challenges, as it is costly to gather information that is tailored to meet the needs of individual firms. Such information is however necessary to get optimal performance in the supply network. For instance a supplier may receive POS data from retailers but also needs to be told about a promotion that a retailer is planning to mount in the near future, so that the correct replenishment decision can be made (Aviv, 2002). Another challenge with a centralized structure is that entities that are under the control of the central authority tend to display more loyalty to the authorized body, which makes it difficult to get cooperation between firms in the network on issues such as those related to quality and delivery (Choi and Hong, 2002).

As we will see in the ensuing discussion, the degree of centralization within a supply network may affect the strength of the relationship between various configurations of the SN and the types of IIS associated with them.

5.1. Single stage dyadic networks

Building on the arguments from coordination science, we posit that centralization will support an intensification of the information exchange, whether strategic or operational, for the decision right holder to maintain control. For simple dyadic networks, as agency theory would argue, centralization will tend to strengthen the strategic information sharing relationship, since it gives the
controlling firm an incentive to share strategic information with less likelihood of agency problems. For more complex multi-channel and multi-stage networks, the information exchange, which is primarily operational, as discussed in Propositions 1b and 1c, will also be intensified under a centralized coordination mechanism. Under centralization, maintaining control in complex networks would require much information to flow to and from the decision rights holder when compared to a decentralized environment where firms only have direct exchanges with their immediate suppliers or buyers. More importantly, these exchanges are limited to a set of highly defined communications.

A comparison between the two coordination structures is made possible with cross-case analysis due to the fact that the original study had two SNs (Honda Accord, and Acura CL/TL) that have a centralized structure, while the third (DCX) is decentralized. In the Honda and Acura SNs, which are centralized, the final assembler controls the list that the top-tier suppliers use to select their lower-tier suppliers, and sometimes even specifies the names of suppliers for specific parts before the launch of a new program. On the other hand, in the DCX network, Textron, the top-tier supplier, has the final say regarding who the second-tier suppliers will be. DCX, even though it may discuss second-tier suppliers with Textron, does not interfere with the decision, and takes a more hands-off, decentralized approach. Textron, in turn, lets its suppliers choose their suppliers, in continuation of this decentralized approach. In the dyadic relationships between the final assemblers and their top-tier suppliers, there is less need for coordinating information flow to DCX. This is in contrast with the greater need for Honda, since Honda must centrally control the network. There is tremendous pressure throughout the DCX network to cut costs—DCX puts pressure on Textron, which passes it on to Leon, and so forth up the chain. Thus the extent to which strategic information is shared between DCX and Textron is less than between Honda and CVT, or Acura and Intek, since the decentralized structure makes it a more traditional buyer and seller relationship in comparison with Honda and Acura’s relationships. Thus the strategic information sharing in a dyadic partnership is stronger in a centralized coordination structure, leading to Proposition 3a.

**Proposition 3a.** The association between a single-stage dyadic network configuration and strategic IIS is stronger in a centralized coordination structure than in a decentralized coordination structure.

5.2. Multi-channel and multi-stage networks

As the SN becomes more complex, moving from dyadic to single stage multi-channel or multi-stage, centralizing decision rights improves accessibility to network members both within a single stage and several stages down from the locus of control. Such an environment provides opportunities to discuss common concerns, jointly work on product design and process design improvements, and identify possible areas for cost reduction. While this necessitates the sharing of some strategic level information, the primary impact is likely to be an increase in the volume of operational information shared, given that information must be collected from a larger contingent in order to make an informed decision that takes the whole network into consideration. Although some firms in the network may resent the control by a central authority, the threat of being dropped from the network are sufficient to counteract any thoughts of resisting this type of governance.

With decentralized decision rights, as coordination science literature argues, local suppliers have autonomy and so can respond quickly to the needs of their immediate customers without having to wait for information to be processed through a central body (Bolton and Farrell, 1990). They are not as concerned about the implications for others outside of their immediate domain, and will act in their own self-interest, which may sometimes conflict with the goals of their partners. Where there is more than one supplier of the same product or product line, each firm will consider the other firms as rivals and therefore be unwilling to share information. In the absence of a central body to facilitate that level of interaction, the volume of information shared will be smaller than with a centrally coordinated structure. This is particularly important as the network becomes more complex.
For Honda, the stated benefits of a centralized arrangement are more authority and commitment from suppliers throughout the network, reduced cost from the ability to specify common parts, to account for the lack of expertise in the top-tier supplier in procuring parts, and to ensure consistent quality. One other benefit of centralization for Honda is the reduction in switching costs if the top-tier supplier were to end the relationship for some reason. Since the other suppliers are loyal to Honda, it would be relatively less catastrophic a change to find a new first-tier supplier. To maintain centralized control, however, increases the load on Honda in terms of information sharing requirements. As Choi and Hong (2002) report, the central control also increases the complexity at the second-tier level, generally requiring more suppliers at that level. This requires greater information flow between the second-tier and the first-tier suppliers. Both Honda and Acura centrally control several activities, as well as specify many of the second- and third-tier suppliers, necessitating greater operational collaboration. Thus centralized control provides the requisite environment for the sharing of greater volumes of information in a multi-channel or multi-stage SN, with the influence of the centralized authority extending way beyond just the top-tier supplier.

In contrast, the top-tier supplier at DCX has autonomy over the selection of the next tier of suppliers and is given responsibility for leading the design effort and coordinating the design activity with other suppliers in the decentralized structure. This reduces opportunities for interaction between DCX and the supplier for coordination purposes. In fact, apart from two situations where DCX selected the third-tier suppliers to gain the benefits of common parts and to maintain goodwill, the company has very little control over suppliers below the top tier. One of the disadvantages of decentralization is the high cost of switching top-tier suppliers, if the need arises. Since all second-tier suppliers are the responsibility of the top-tier supplier, losing the top-tier supplier can have a greater impact than in a centralized structure.

Choi and Hong (2002) observe that DCX wants their top-tier supplier to minimize the second-tier sourcing so that they can have better control over the network and reduce their existing communication problems. One reason for some of these communication problems could be the perception by suppliers that DCX is “squeezing down” on their profit margins. In fact one supplier indicated their company’s intention to withdraw from the market “if the profit margin gets reduced to a certain level”. Clearly this is not the kind of environment that is conducive to the sharing of strategic information. The information shared across the network is primarily operational. Overall, the volume of information shared is lower because it is essentially shared only with the immediate supplier, not gathered and disseminated by a central authority. The need for coordination is much lower than in a centralized structure.

Table 2
Summary of propositions

<table>
<thead>
<tr>
<th>Variables</th>
<th>Propositions regarding IIS types</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. SN configuration</strong></td>
<td></td>
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<tr>
<td>Number of channels</td>
<td></td>
</tr>
<tr>
<td>Dyadic</td>
<td>[1a] Strategic IIS (Types 3 and 4)</td>
</tr>
<tr>
<td>Multi-channel</td>
<td>[1b] High volume operational (Type 2)</td>
</tr>
<tr>
<td>Number of stages</td>
<td>[1c] Greater the number of stages, greater the volume of operational information shared (Type 2 IIS)</td>
</tr>
<tr>
<td>Location in the network</td>
<td>[1d] Downstream (close to consumer) firms more likely to engage in strategic IIS (Types 3 and 4). Upstream firms more likely to engage in operational IIS (Types 1 and 2)</td>
</tr>
<tr>
<td><strong>2. Partner characteristics</strong></td>
<td></td>
</tr>
<tr>
<td>Goal congruence</td>
<td>[2] Greater the congruence, greater the strategic nature of IIS (move towards type 4)</td>
</tr>
<tr>
<td><strong>3. Coordination structure</strong></td>
<td></td>
</tr>
<tr>
<td>(moderating variable)</td>
<td></td>
</tr>
<tr>
<td>[3a, 3b, 3c] Each of the relationships in the first three Propositions 1a, 1b, 1c is strengthened in a centralized coordination structure</td>
<td></td>
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</tbody>
</table>
This leads us to develop Propositions 3b and 3c regarding the effect of coordination structures on IIS in complex SNs.

**Proposition 3b.** The association between a single-stage multi-channel network configuration and high-volume operational IIS is stronger in a centralized coordination structure than in a decentralized coordination structure.

**Proposition 3c.** The association between the number of stages in a multi-stage network configuration and high-volume operational IIS is stronger in a centralized coordination structure than in a decentralized coordination structure.

In the last two sections we have examined the relationships between types of IIS that firms in a SN engage in and some of their antecedent variables—specifically, SN configuration and partner goal congruence, and the moderating effect of coordination structure. Table 2 summarizes our propositions regarding these relationships.

6. Discussion and conclusion

Earlier research has shown that effective IIS can enhance the performance of a supply network. Consequently, the idea of managing IIS effectively within a SN becomes appealing to managers. However, setting up a SN with the appropriate level of IIS remains a difficult task, since SNs tend to evolve over time, and are usually not the result of a master plan by any firm. Therefore, firms need guidance to effectively channel resources and deploy IIS capabilities as needed so that they can benefit from knowledge and information sharing. Since aspects of the design of a supply network, such as network configuration, determine the patterns of inter-organizational connections, and partner characteristics such as goal congruence determine the extent of commitment, these two factors emerge naturally as ones worthy of investigation. In this paper, we focused on network configuration and partner goal congruence and their potential influence on IIS.

As we discussed earlier in Section 2, IIS has in the past been conceived primarily in a one-dimensional way, either in terms of the volume of information shared, or in terms of the strategic consequences of information sharing. Since effective deployment of IIS would require managers to understand its physical needs in terms of the volume of information shared as well as its strategic consequences, we developed a typology of IIS that is informed by both these dimensions. We described four types of IIS: Type 1, representing low volume operational information; Type 2, representing high volume operational information; Type 3, representing low volume strategic information; and Type 4, representing high volume strategic information.

While this typology helps us understand the kinds of information sharing that can exist in terms of volume and strategic consequence, managing the IIS requires knowledge of the relationships between IIS and its antecedents, such as SN configuration and partner goal congruence. Based on our analysis, we posit that dyadic configurations are associated with strategic IIS (Types 3 and 4), while multi-channel and multi-stage supply network configurations are associated with high volume operational (Type 2) IIS. Each of these associations is moderated by the coordination structure that is in place. Here we argue that the relationship between the various network configurations and IIS is stronger in a centralized coordination structure. The coordination structure includes the concepts of decision rights and information structure. Further, location of the partner firms in the network and the degree of goal congruence are found to influence the nature of information sharing.

Analysis of published case studies from three automobile companies provides grounding for our propositions. This paper makes theoretical contributions to the current research on inter-organizational information sharing and design of supply networks, by identifying some key parameters of supply network design that can have an impact on IIS. The arguments presented in this paper also have practical significance for managers as they develop strategic plans for managing their supply networks. Essential to their success in this endeavor is the ability to capitalize on the benefits of IIS, which includes having a richer understand-
ing of how IIS is influenced by the design of the supply network that is in place to facilitate an effective flow of goods and information.

In the future, empirical studies need to be conducted to rigorously test and build on the propositions developed in this paper. By studying supply networks of different sizes and configurations and with varying levels of goal congruence directly, the propositions can be more thoroughly investigated. Survey research can be conducted that includes all the members of a SN (or at least a few from every stage) rather than a select few as in this study. Thus questions about information sharing across the network can be answered more comprehensively. Further, some factors that might affect IIS in a SN (like industry type, for instance) or may in turn be affected by the IIS type (such as profitability) were beyond the scope of this study. Some of the questions that suggest themselves for future study are listed below:

- Does industry type influence the type of IIS in a SN? Since the nature of competition may be different in different industries, the proclivity for sharing strategic information with partners is likely to be different. The model can be expanded to include the influence of product and process design characteristics. Investigation of SNs of different classes of products, from electronic parts to chemicals, can yield further insight into the workings of IIS in various industries.

- What is the role of information technology in the ability to setup complex supply networks? Information and communication technology that is available to a SN can be studied as a constraint for IIS.

- What is the impact of trust (or lack thereof) on IIS? This paper makes the assumption that IIS is inherently ‘good’, but lack of cooperation between partner firms can create gaming scenarios that can complicate the issue, and may negatively affect the performance of the firm that shares strategic information. In recent times, the mediating role of trust in interpersonal information sharing has been studied to some extent (Levin and Cross, 2004), and a gaming approach has been used to study collaboration among organizations (Samaddar and Kadiyala, in press). The issue of trust, which is implicitly assumed in this paper, deserves further investigation.

- What is the return on investment from setting up a SN and sharing information? Empirical studies can be conducted to see if size and complexity of the SNs, coordination mechanisms used, degree of trust between the firms, and the type of IIS that exists are related to the profitability and risk measures of the firm. Ultimately, the test of a successful SN may be the improved performance of the firms involved.

In conclusion, understanding the configurations of SNs and the nature of relationships with partners, along with other factors, is essential for effective management of IIS within SNs. As configurations evolve, so will the nature of IIS. Knowing the possibilities in this regard will assist managers in maintaining the flexibility needed to address the complexities in dealing with a dynamic network of inter-organizational relationships.

References


