AN EMPIRICAL EXAMINATION OF THE INFLUENCE OF

INFORMATION TECHNOLOGY AND TRUST ON

SUPPLY CHAIN DYAD RELATIONSHIPS

AND PERFORMANCE

by

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ABSTRACT

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Reacting to increased competition, companies are adopting inter-organizational information systems (IOS) that share information across the supply chain partners; this sharing requires trust. To better understand the phenomenon of trust between partners, we developed an integrated model of trust in supply chains with theoretical underpinnings from Transaction Cost Economics and also with environmental factors like Information Technology and Power. The framework also takes into consideration the association between trust and final outcome measures, such as performance and satisfaction, throughout the supply chain relationship. By assessing the interconnectivity of trust in inter-organizational information systems coupled with environmental factors, our research model will help researchers as well as practitioners develop a more comprehensive and holistic understanding of factors contributing to supply chain success.

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CHAPTER 1

INTRODUCTION

"We must all hang together or assuredly we will all hang separately."

- Benjamin Franklin

The global marketplace has seen a shift towards open supply chains where partners are expected to share both resources and information to optimize the entire supply chain. Research is replete with examples of supply chains being beneficial to both partners. Oliver (1990) identified necessity, asymmetry, reciprocity, efficiency, stability and legitimacy, as reasons organizations form inter-organizational relationships. Forging supply chain alliances to achieve efficiencies has become a necessary, if not sufficient, condition to gain competitive advantage. To manage these increasingly complex, merged systems, companies are investing in information systems for supply chain management (Talluri and Silberman, 2000). The potential uses of an inter-organizational systems (IOS) to combat competitive forces are: entry barriers, economies of scale, adding switching costs, product differentiation, increasing access to distribution channels, controlling market access, and improving cost effectiveness (Cash Jr. and Konsynski, 1985). Using IOS, organizations can enhance value-added partnerships (Johnston and Lawrence, 1988), reduce the bull whip effect (Lee, et al., 1997), decrease both safety stock and inventory (Yu and Pysarchik, 2002; Yu, et al., 2001), utilize human resources effectively, deliver products faster, improve customer service, speed new products to

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market faster, focus more strongly on core competencies, enhance public image, create greater trust and interdependence, increase improve shareholder value and competitive advantage over other supply chains, and increase the sharing of information, ideas, and technology, (Mentzer, et al., 2000). These improvements allow firms to be competitive in their industries. As an illustration, Bose Corporation has suppliers manage its inventory and feed production processes on a just-in-time basis. The benefits to Bose include: reduced inventory, lower transaction costs, faster response to problems, and decreased procurement costs. Supplier benefits include increased volume, lower production costs, and improved overall operations (Segars, et al., 2001).

1.1 Information Technology Alliances

Industry had traditionally conformed to the ideal of free market competition, where individual firms pursued their own goals (Etzioni, 1988). This was suppressed only in times of crisis, like war, where alliances became a necessity (Trice and Beyer, 1993). Ironically, today it is the same competitive environment that has compelled companies to form strategic alliances and inter-organizational systems. In a sense, these alliances are both cooperative and competitive weapons (Osborn and Hagedoorn, 1997). Information technology (IT) has empowered companies to paradoxically compete by allowing them new ways to cooperate (Konsynski and McFarlan, 1990). Many manufacturers are changing their relationships with component suppliers away from traditional arm's length relationships driven by competitive logic, towards collaboration (Bensaou, 1997). Supply chain channels are becoming so pervasive that competition is no longer between individual organizations but between competing supply chains (Christopher 1992).

1.2 Importance of Trust in Supply Chains

To be efficient, open supply chains require information sharing; however, sharing may require trust between the supply chain partners. Adam Smith claimed that if each individual pursued his profit in optimal fashion, the total profit of the community would be maximized. This concept was the de-facto standard until Nash (1950), with the help of Game Theory, re-conceptualized optimization. Game Theory basically suggests that sharing, instead of individual pursuits, would lead to optimization. Its applicability has been found to hold true in areas ranging from economics to solving international affairs,

1.3 Contribution

In this thesis, we have developed a theoretical framework for the role of trust as it relates to power, trust, and transaction cost in the context of inter-organizational information systems, with consequent effects on outcome measures of satisfaction and performance. The thorough, theoretical development of relationships between factors involved in the framework is relevant to both practitioners and academicians. Through a better understanding of the influencing factors in their supply chains, practitioners can use the framework as a basis for formulating tactics and strategies for improving their supply chain operations and relationships.

On the academic front, supply chains present a complex and rich phenomena to challenge researchers, who have attempted to understand and explain it with powerful theories such as Social Exchange Theory (Cook and Emerson, 1978; Ybarra-Young and Margarethe, 1999), Transaction Cost Theory (Bensaou, 1999; Haugland, 1999), and Game Theory (Van Witteloostuijn, 2003). We rise to this challenge by first including a

more complete set of elements including IT, trust, channel power, satisfaction and performance, so that the theoretical framework we developed would provide a comprehensive and realistic coverage of the phenomena that we attempt to understand. Secondly, we exploit the power of not one theory, but multiple theoretical lenses to seek a fuller and more global interpretation of the complex relationships involved in a supply chain. The resulting theoretical framework is integrated in the sense that it includes an extensive range of elements of the phenomena, as well as a more complete explanation of it from different but complementary theories for transaction cost and social exchange. The theoretical advances achieved should provide ample opportunities for further research in this area of inquiry, both theoretically and empirically.

1.4 Research Questions

While the industry is replete with examples of success stories, there are cases where open supply chains have led to disasters. Technology per se may not be a source of sustained competitive advantage. However, a successful IT system is socially complex, making it imperfectly imitable and hence a source of sustained competitive advantage (Barney, 1991). Theoretically, sharing and trust make sense. However, in practice industries are wary of sharing information across organizational boundaries. Apart from the obvious conflict between participants (Eisenhardt, 1989), non-technical issues such as quests for dominance, clash of personalities, incompatibility of organizational culture and values, inadequate communication, and betrayal can also underlie the demise of these alliances (Kanter, 1994; Mentzer, et al., 2000). According to Fisher (1997), the performance of many supply chains has never been worse; leading to rising costs due to

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competitive relations between supply chain partners. This illustrates why Moberg, Speh and Freese (2003) identified lack of trust as one of the barriers to good supply chain relationships.

Basically the bottom-line of open supply chains is: if we all truly trust each other, we all end up making a lot of money. One of the major challenges in supply chains is to develop trust. When companies forge supply chain alliances they commit to two objectives:

- maintain a certain level of optimization within the supply chain in order to compete with other supply chains.
- obtain maximum gain from the supply chain at the potential cost of other players within the supply chain-- i.e., global maximization rather than local optimization (Williamson, 1973).

These two objectives can sometimes be counterproductive (Eisenhardt, 1989) and conflicting. This set of conflicting objectives is considered as the major factor for the lack of success of the supply chain in industry. In fact, studies have shown that up to 70% of alliances are considered failures by at least one partner. Table 1.1 lists some benefits and drawbacks of inter-organizational information systems (Cash Jr. and Konsynski, 1985; Etzioni, 1988; Johnston and Lawrence, 1988; Kanter, 1994; Lee, et al., 1997; Mentzer, et al., 2000; Moberg, et al., 2003; Yu and Pysarchik, 2002).

To overcome this conflict organizations have invested in trust-building mechanisms. The type of trusting relationship supply chain partners may have depends on the impact of three key environmental factors:

- Information technology integration

- Process integration

- Organizational power in the channel

For example, due to high channel power, an organization may perceive low transaction costs and hence not find it necessary to invest in developing relationships with partners because the social embeddedness of transactions can reduce the cost of opportunism (Van der Meer-kooistra and Vosselman, 2000).

In this study, therefore, we will attempt to address these three research questions:

1. What are the influences on trust in the supply chain of these antecedents: IT integration, process integration and power?

2. What are the relationships among the three consequent constructs: Trust, Transaction Costs and Relationalism?

3. What is the influence of Relationalism on the outcome measures: Satisfaction and Performance?

Table 1.1 Benefits and Drawbacks of Inter-Organizational Information Systems

Benefits:
- entry barriers
- economies of scale
- switching cost cash
- product differentiation
- increase access to distribution channels
- control market access
- improve cost effectiveness
- enhance value added partnerships
- reduce the bull whip effect
- decrease the safety stock and utilize human resources effectively
- deliver products faster
- improve customer service
- speed new products to market faster
- intensify focus on core competencies
- enhance public image
- foster greater trust and interdependence
- increase sharing of information, ideas & technology
- improve shareholder value and competitive advantage over other supply chains

Impediments:
- lack of Trust
- goal conflict between participants
- quest for dominance
- clash of personalities
- incompatibile of organizational cultures and values
- inadequate communication and betrayal

CHAPTER 2

LITERATURE REVIEW

<u>2.1 Transaction Cost Economics</u>

The theory of Transaction Cost Economics (TCE) is most often used to explain why companies form alliances and describe the type of relationships among the supply chain partners (Rindfleisch and Heide, 1997). TCE looks at firms as avoiders of market costs by analyzing the relative efficiency of the market in comparison to internalization . This theory, pioneered by Coase (1937), predicted that "a firm will tend to expand until the costs of organizing an extra transaction within the firm become equal to the costs of carrying out the same transaction by means of exchange on the open market or the costs of organizing in another firm" (Conner, 1991). All transactions in a market are associated with production costs; in addition are other costs associated with incomplete contracts due to bounded rationality and the risk of opportunistic behavior.

Organizations have found a middle path between the two extremes by forming supply chain alliances. These have neither the characteristics of pure markets nor those of pure hierarchies (Grover, et al., 2002). While markets and hierarchies are two extreme forms of governance mechanisms in response to the transaction environment, long term cooperative relationships between firms lie on the continuum between markets and hierarchies. Also called relationalism, this type of mechanism extends TCE by considering the social context. These structures have the element of relationship as a

deterrent to opportunism. Adler (2001) extends the TCE framework by adding a third structure based on opportunity/trust in addition to market/price and hierarchy/authority. We shall discuss the two aspects of TCE: Asset Specificity and Imperfect Information and their connection to trust in the following sections.

2.1.1. Asset Specificity: a double-edged sword

One aspect of TCE: asset specificity, refers to the amount of dependence an asset has on the input, or producer, to which it is specific. Asset specificity can arise in one or a combination of the following three ways: 1. site specificity: a resource available at a certain location 2. physical asset specificity: a specialized system or tool designed for a unique purpose and 3. human asset specificity: specialized human skills that cannot readily used for other purposes.

Asset specificity puts the producer at higher risk because the assets are so specific, they cannot be easily transferred elsewhere. This can lead to a lesser number of suppliers and a potential for opportunistic behavior. A petroleum refinery with its high asset specificity is a pertinent example.

There is evidence of information technology infrastructure creating relationships across organizations, which in turn help reduce opportunism (Grover, et al., 2002; Stump and Sriram, 1997) . However, by making investments of people knowledge and IT that are specific to a partnership, asset specificity accumulates which makes the organization slip into a small-numbers bargaining position. Hence, by investing in a supply chain with a partner, an organization may compromise its strategic flexibility. According to some

studies, specific assets have been found to have a detrimental impact on the strategic flexibility of alliance relationships (Ybarra-Young and Margarethe, 1999).

2.1.2. Imperfect Information

Another facet of TCE, imperfect information, leaves open the risk of opportunistic behavior by suppliers. IT has the capability of reducing imperfect information and uncertainty by using transparent systems. IT can also be an asset specific to a partnership. In many cases, due to the small number of transactions, many partners are stuck with dealing with only one or few partners. There is evidence that transaction costs associated with asset specificity, small numbers bargaining, and imperfect information (Williamson, 1981) (Conner, 1991) can be reduced by trust (Wright, 1986); (New, 1996) (Butler and Carney, 1983).

2.2 Process Integration

Process integration deals with the policies and measures taken by the management to foster communication and processes between the two organizations. These measures take time and effort and are not easily replaceable. Using Game Theory as a basis to explain mutual entanglements, it can be hypothesized that, as the level of integration between two organizations increases, the investment in trust required increases because the two parties have more at stake.

A physical supply chain is the basic movement of products and at times this traditional approach is said to constrict innovation (Cavinato, 2004). Towill and Christopher (2002) espouse the importance of lean and agile techniques in supply chains

to gain competitive advantage. The level of integration is also defined by the degree of synchronization among partners.

An IOS can start at the level of just sharing information or sending emails and can reach the level of highly integrated systems where the boundaries between the two organizations become blurred. The level of integration depends upon on how many functions and activities are included within the supply chain management function (Wu, et al., 2004). Activities may include basic operational activities like transparency and information flow as well as cash flow to joint marketing research, promotion, sales and information collecting, common forecasting, sharing technical knowledge, research and development, and product design. The more the organizations integrate with each other, the more they resemble a single organization and hence the more investments in trust may be required. As this trust grows, information sharing between members will reduce uncertainty, enhance shipment performance and greatly improve the performance of the supply chain system (Srinivasan and Kekre, 1994).

Integration can happen on two fronts, the process integration front and the IT integration front. Process integration defines the formal relational structures which emerge from the policies made by the company to cooperate with the supply chain partner. IT integration, on the other hand, involves IT artifacts, shared applications, shared data and other elements that define the depth of IT interconnectedness between the partners.

The level of commitment to the relationship is largely personified in the policies of the partners regarding the relationship. In contrast to a pure contract-based approach, these policies give rise to formal structures which consequently give rise to relationships.

Some of these may involve policies to share research and development capabilities, train supplier staff, create a joint task force, invest time and resources towards the relationship, hold periodic meetings, and formulate policies to jointly forecast sales.

2.3 Information Technology Integration

While explaining antecedents to trust, it is impossible to ignore the extensive evidence of the role IT deployments play in buyer-supplier relationships. The IT artifact, with its rapid evolvement, is touching upon many aspects of business and personal life. The discussion of its role in the IS community will potentially shape the future direction of the discipline for years (Whinston and Geng, 2004).

We are increasingly becoming dependent on a multiplicity of pervasive and invasive technological artifacts (Orlikowski and Lacono, 2001). Using the Models of Change within organizations and industry (Meyer, et al., 1990), we can place IT as a revolution and open supply chains as an evolution. Today, the most important and powerful IT systems involve networks that transcend across organizations and the most successful examples of IT systems are ones that link a company to its suppliers, distributors and customers (Johnston and Vitale, 1988).

According to Bowersox and Daugherty (1995), the current level of information technology sophistication is capable of impacting organizational structural choice to a greater degree than ever before. They use examples in logistics to explain how both strategy and structure are directly influenced by IT. As Bensaou (1997) said, technological tools like ERP, EDI applications, and RFID may not directly create cooperation between partners, but they may exert an enabling effect.

To briefly summarize, there is extensive research on technological tools like bar codes, CAD and CAM which help create value-added partnerships (Johnston and Lawrence, 1988). In relationship management, intra- and inter-organizational IT deployment has different effects on relationship atmosphere (Ryssel, et al., 2004) (Stump and Sriram, 1997). IT deployments in supply chains lead to closer buyer-supplier relationships (Bakos and Brynjolfsson, 1993). Patterns of information technology use are significant determinants of relationship-specific investments (Subramani, 2004) and it has been argued that information systems, by keeping principals informed of agents' actions, can reduce agent opportunism (Eisenhardt, 1989). IT-induced organizational relationships has been a stream of research and the IT functionality plays an important role in defining inter-firm relationships (Zaheer and Venkatraman, 1994). Technologies with feedback mechanisms have been shown to be effective in trust building (Sulin and Paul, 2002) and it has been found that it is impossible to achieve an effective supply chain without IT (Gunasekaran and Ngai, 2004). Finally, one study (Mouritsen, et al., 2001) found that information overcomes absence and creates closeness and trust-based relations .

IT serves to create a less risky relationship between the parties either by promoting information exchange or by replacing investment in assets with a high degree of specificity with investments in IT/IS (Birnbirg, 1998). These information networks can function as a safeguard by reducing information asymmetries among the networking parties and by developing group norms (Gierl and Bambauer, 2002). We emphasize our point by using two supply chain specific current technologies; Vendor Managed Inventory (VMI), and Radio Frequency IDs (RFID).

Vendor-managed inventory (VMI) is emerging as a significant development in the recent trend towards collaboration and information sharing in supply chain management. Transfer of inventory monitoring and other overhead costs to manufacturers and continuous replenishment of retailer inventory are commonly cited as potential benefits that VMI offers to retailers (Mishra and Raghunathan, 2004); implementing VMI has cut costs by 30% (Swanekamp, 1995). Automatic replenishment programs (ARP) represent a type of inventory management designed to improve efficiency across the supply chain. ARP Programs such as Continuous Replenishment Planning, Efficient Consumer Response, Quick Response, and VMI can be defined as partnership initiatives based on information sharing among the members that attempts to match supply and demand as closely as possible (Angulo, et al., 2004). The benefits of VMI are well recognized by successful retail businesses such as Wal-Mart (Cetinkaya and Lee, 2000). Concepts like VMI requires technology; successful implementation of VMI often depends on computer platforms, communications technology, as well as product identification and tracking systems (Waller, et al., 1999). Daft and Lengel (1986) have asserted that information processing combined with the correct capabilities can help organizations manage uncertainty and improve performance.

Radio Frequency ID (RFID) is another technology that is currently in use and experimentation. RFID is a good illustration of IT in action. In a European study, managers were enthusiastic about the potential of RFID to give a return on investment. The benefits they identified most commonly were: potential to increase profits, speed and ease of use of the technology, and improvements in traceability (Davies, 2004). It is believed that the technology used does affect the type of relationship between partners

(Grover, et al., 2002). IT within a dyad can encourage a commitment to establishing relational behavior.

2.4 Channel Power

"You can go a long way with a smile. You can go a lot farther with a smile and a gun. "

-Al Capone

Finally, another factor that defines the relationship between two partners is the level of influence each has over the other. An organization on which other organizations are dependent may consequently gain power over them (Mizruchi and Yoo, 2002). Formally called channel power, it is the ability of the organization to influence the specific decisions and behavior of another channel member (Stern and El-Ansary, 1988). Powerful partners in the channel may force others in the supply chain to adhere to the norms of the more powerful without much investment in trust building mechanisms by these powerful partners. For example, Wal- Mart put heavy pressure on suppliers to keep their prices down. Its power provides Wal-Mart with a captive set of partners who can be held hostage. Knowledge and know-how can be shared without investments in trust-building mechanisms. Industry is replete with cases of alliances forged between channel partners with disproportionate power, although the relationship between them is often cold at best.

Illustrations from industry show cases where a relationship is not necessarily a requirement when one of the partners exerts a lot of influence over the other. An IOS may have been thrust on the weaker partner. For instance, Wal-Mart mandated its

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suppliers use EDI at a very early stage of the technology, and is currently repeating the process with RFID. Weaker partners accept the rules of the game due to their low bargaining power. On the other hand, a partner with high bargaining power can afford to share information without fear of partner opportunism.

Kumar (1996) classified power between two partners into four categories based on the combination of the level of the organization's dependence on the partnership and the level of a partner's dependence on the partnership. In many cases, the powerful partner may not choose to use the power it holds in the supply chain thereby leading to a more amicable and trustworthy environment. Companies like Ekornes tripled their sales in three years for one of their product lines by moving away from the traditional adversarial relationships to deeper more intense relationships (Kumar, 1996). Companies can do this freely or under duress. For example, Proctor & Gamble does not possess the same bargaining power it had before the advent of supermarkets (Kumar, 1996). Therefore, there is reason to believe that the level of power wielded by a partner in the supply chain is one of the factors that define the relationship between the partners.

<u>2.5 Relationalism</u>

For mutual benefit, partners are increasingly involved in relational exchange in which they form intensive interdependent relationships (Maloni and Benton, 1997). We draw on Relational Exchange Theory to explain the level of continuum from pure market-based transactions to vertical integration (Dwyer, et al., 1987). According to Barney (1990) and Saxton (1997), TCE does not fully explain the alliances formed. Grover et al. (2002) claim that the measure of relationship, called relationalism, stands

anywhere between pure contract-based relationship and a pure trust-based relationship. With a relational contract, suppliers and buyers can achieve some of the basic advantages of vertical integration without high financial costs or substantial loss of operating autonomy as dependence rises (Provan and Gassenheimer, 1994).

In terms of channel power, the requirement for relationship building mechanisms depends on the level of influence the player has with respect to the channel partner. Powerful players can coerce vulnerable partners to follow their lead without having to invest in relationship building. Kumar (1996) contrasts relationship of trust with relationship of power and discusses the limitations of both. With respect to TCE, trust is crucial when uncertainty and incomplete product information are present (Swan and Nolan, 1985). Integrative technologies like EDI are viewed as an opportunity to build and reinforce trust between firms (Hart and Saunders, 1997).

2.6 Level of Inter-organizational Trust

Trust is closely related to relationship. According to Social Exchange Theory, trust may be influential in understanding the relationship between partners. While a relationship can be positioned on a continuum between pure contract-based to a pure trust-based relationship, the level of trust can be considered as one of the aspects of relationship. Trust is particularly critical in the international context where individuals may not share the same underlying values and norms (Nicol, 1996).

Trust is defined by: (1) one party's confidence that the other party in the exchange relationship will not exploit its vulnerabilities (Dyer and Chu, 2000), (2) confidence in another's goodwill (Ring and van de Ven, 1992), (3) confidence or predictability in one's

expectations about another's behavior and confidence in another's goodwill (Zaheer, et al., 1998), (4) a common belief that another individual makes good-faith efforts to behave according to commitments is honest and does not take excessive advantage of another even when the opportunity is available (Cummings and Bromiley, 1996), and (5) a set of expectations shared by all those involved in an exchange (Zucker, 1986). At the inter-organizational level, trust can be defined as the extent of trust placed in the partner organization by the members of a focal organization (Zaheer, et al., 1998).

Although considerable research has been done in the area of inter-personal trust, the concept of inter-organizational trust is just beginning to be analyzed. We argue that trust is unique as a governance mechanism because it not only minimizes transaction costs, but also has a causal relationship with information sharing (Levin and Cross, 2004), which also creates value in the exchange relationship. Other governance mechanisms (e.g., contracts and financial hostages) are necessary costs incurred to prevent opportunistic behavior, but do not create value beyond transaction-cost minimization (Dyer and Chu, 2003).

On the flip side, one of the primary reasons for failure in supply chains is the lack of trust in partners (Moberg, et al., 2003). Researchers have attempted to develop a framework on trust development (Hart and Johnson, 1999) using some tools such as Game Theory (Das and Teng, 2001; Van Witteloostuijn, 2003). According to Williamson (1993), the three important source of trust are: 1. familiarity: based on repeated interactions 2. calculative-ness: based on evaluation of costs and benefits and 3. values: based on norms.

As academic research moves toward relationship-based and trust-based organizations (Sheppard and Tuchinsky, 1996), the need to understand both trust and relationship grows. With the advent of information sharing, supply chains and strategic partnerships, trust is increasingly being recognized as an important factor in inter-organizational research (Mishra, 1996; Tyler and Kramer, 1996; Webb, 1996).

2.7 Supply Chain Performance

With competitive advantage as the ultimate goal, our research will remain unfulfilled if an association between trust and final performance is not examined. Outcomes of cooperation between organizations need to be researched (Smith, et al., 1995). There is evidence of the value of intangible assets in inter-organizational relationships (Subramani and Venkatraman, 2003). According to Gattorna (2001) benefits occurring from synchronization between partners include increased delivery performance, inventory reduction, reduction in fulfillment cycle time, enhanced overall productivity, improved capacity, greater forecast accuracy, and lower supply chain cost.

Researchers have used subjective as well as objective measures to measure supply chain performance and found a strong correlation between the two (Min and Mentzer, 2004). Evidence has been provided for important positive correlations between trust, trustworthiness, reciprocity and performance (Mollering, 2003). However, the impact of supply chain relationship quality on supply chain performance has received less attention in the literature (Fynes, et al., 2005). Most papers have used operational metrics like average inventory levels, fill rates, cost calculations, order quantity and order-interarrival time to measure performance (Angulo, et al., 2004; Lin, et al., 2005). Some identified

characteristics required from effective performance metrics like inclusiveness, universality, measurability, and consistency (Beamon, 1999).

When using subjective criteria to measure supply chain performance, Min and Mentzer (2004) used five dimensions: availability, growth, timeliness, profitability, product and service offerings. We followed the paradigm adopted by Johnston et al. (2004) and Smith and Barclay (1999) by measuring the perception of performance.

2.8 Supply Chain Satisfaction

Satisfaction is defined as the feeling of equity with the relationship no matter what power imbalance exists (Benton and Maloni, 2005). While industry is replete with examples of success stories, there are cases where open supply chains have led to disasters and the question of partnership satisfaction has generally gone unanswered (Walton, 1996). In the end, supply chain partner satisfaction remains the overriding factor in determining the future of a supply chain partnership (Benton and Maloni, 2005).

CHAPTER 3

RESEARCH MODEL AND HYPOTHESES

3.1 Research Model

The previous chapter discussed pertinent concepts and key theories related to this thesis. However, to take these concepts and provide a useful model for practitioners and researchers requires us to develop a testable model. We do that in this section by leveraging the conceptual framework and adding the real-world implications of IT integration.
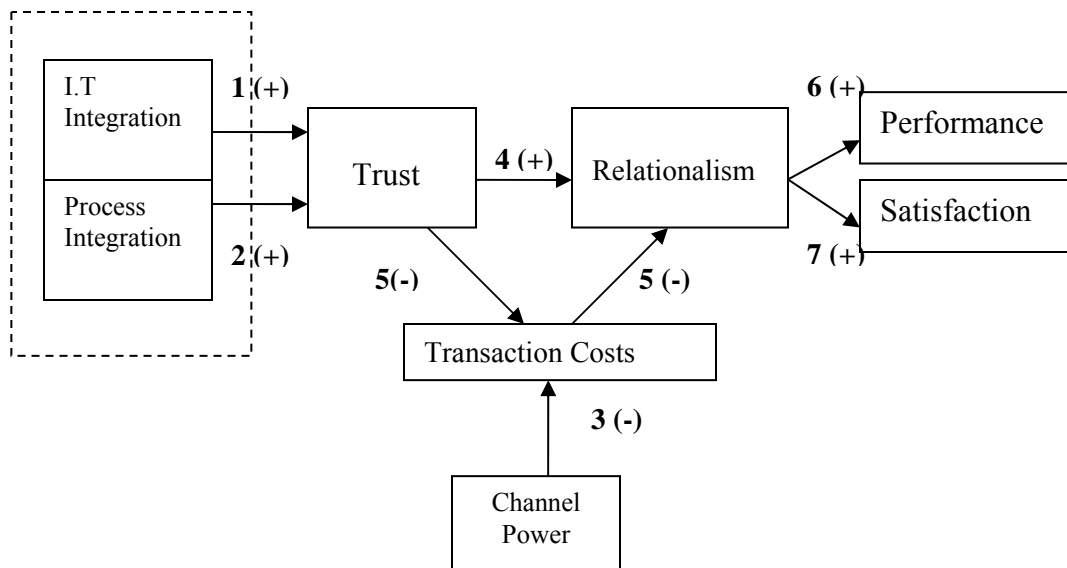
Figure 3.1 Research Model

The next stage is to develop empirically testable antecedents and scales for each of the concepts in the model and then test the model with a large number of business cases. Table 3.1 provides a list of concepts used in this study, their origin and their constructs.

Table 3.1 List of Variables

Concept	Origin / Validity	Constructs
Power	(Pfeffer, 1982)	Coercive Non-coercive
Transaction cost economics	Coase (1937) (Expanded by Williamson 1974)	Opportunism Asset specificity Uncertainty Reputation
IT integration	Multiple Origins	-
Process integration	Multiple Origins	-
Relationalism	(Heide and John, 1992) (Grover, et al., 2002)	(1) flexibility in the relationship, (2) voluntary exchange of useful information, (3) extent of shared problem solving, and (4) restraint in the use of power.
Trust	Multiple Origins (Cummings and Bromiley, 1996)	-

3.2 Unit of Analysis and Sample Frame

The unit of analysis is the supply chain dyad and the respondents will be buyers in the dyad. The research model is designed to capture perceptions framed as measurable research constructs from respondents who form the interface between the organization and its supply chain partners. These people typically are involved in making decisions or they are aware of decisions regarding policies concerning their suppliers.

3.3 Research Hypothesis

The hypotheses are developed using the research model shown in Figure 3.1. Our hypotheses are divided into three categories. The first category is comprised of relationships 1, 2 and 3; it involves the direct relationship of the antecedents of trust: IT integration, process integration and power. The second category consists of relationships 4, 5 and 6 which involve the relationship among each of the three consequent constructs: trust, transaction costs and relationalism. The third category contains the relationships 7 and 8 which relate the association of relationship with the outcome measures: satisfaction and performance. A summary of the hypotheses is shown in Table 3.9.

3.3.1. Influence of Information Technology Integration on Trust (1)

The presence of IT systems has the ability to create specific assets across partners; one such relational asset is trust. In this section we emphasize the underlying influence of IT systems on the level of relationship. The use of IT could be interpreted as a decision made in response to high transaction costs, since the deployment of IT systems reduce opportunistic potential and monitoring costs (Grover, et al., 2002). Also, IT has a direct impact on environmental constraints, opportunism, and market exchanges with a small number of participants through its effect on bounded rationality and its reduction in contracting and monitoring costs (Bakos and Treacy, 1986). The presence of IT systems can create a quasi power situation across partners. Also an IT system can help facilitate integration. A partner can get accustomed to using the same IT system for a long period. From the strategic viewpoint, IT has been used for different purposes. While American

companies have used IT to "automate" relationships, Japanese companies have used it as a tool to further their nurturing partnerships (Bensaou, 1999; Bensaou, 1997). Table 3.2 provides a list of empirical studies related to IT and trust.

Table 3.2 Selected Empirical Studies involving IT and Trust

Authors	Objective	Results
(Grover, et al., 2002)	To investigate role of IT in buyer-supplier relationships	Positive role of IT in the level of relationship
(Sulin and Paul, 2002)	Study effect of trust building technology	Appropriate feedback mechanisms in a system can generate trust.
(Stump and Sriram, 1997)	To study IT in buyer supplier relationship	Positive impact of IT use and an overall closeness of buyerseller relationships.

Bensaou and Anderson (1999) found a significant relationship between the level of architectural interdependency and the buyer's level of investments specific to the buyer. IT technology has been shown to influence trust in other areas like e-commerce (Sulin and Paul, 2002) and we believe it holds true for supply chains too as IT processes across two organizations has a tendency to develop trust. Therefore we propose:

H1: In a supply-chain dyad, Information Technology integration is positively associated with Trust.

3.3.2. Influence of Process Integration on Trust (2)

Mutual trust is strongly influenced by the level of communications within the dyad (Anderson and Weitz, 1989). Also it was found that information sharing reduces the level of behavioral uncertainty (Kwon and Suh, 2004). Haugland (1999) found significant support for the hypothesis that ongoing relationships will be characterized by higher

levels of relational investments than terminated relationships. Table 3.3 provides a list of empirical studies related to Process Integration and Trust.

Table 3.3 Selected Empirical Studies involving Process Integration and Trust

Authors	Objective	Results
(Grover, et al., 2002)	To investigate role of IT in buyer-supplier relationships	Positive role of IT in partially offsetting the negative relationship between transaction cost and Relationalism.
(Anderson and Weitz, 1989)	To study determinants of Continuity in dyads	Trust is enhanced by the degree of two-way communication in the dyad
(Ybarra-Young and Margarethe, 1999)	Strategic flexibility in IT alliances	Communication significantly related to trust

Some examples of measures taken to improve coordination between partners are: frequent meetings, collaborative forecasting and participation in strategy. We believe that the policies made by the management regarding the level of communication between the partners will affect the level of trust between the partners. Therefore, we propose:

> **H2: In a supply-chain dyad Process Integration is positively associated with Trust**

3.3.3. Influence of Channel Power on Transaction Cost (3)

It can be argued that the higher the power an organization has over its partners, the lower the transaction costs and therefore the relationship between power and transaction costs needs to examined (Erdem, 1994). With an increase in power, the safeguarding of buyer-specific assets is substantially reinforced, thereby leading to lower transaction costs (Buvik and Reve, 2002). Power is a critical factor in the use of EDI (Hart and Saunders, 1997). In a related study Maloni and Benton (2000) found out that

power plays a significant role in the supply chain, and the different sources of power have contrasting effects upon inter-firm relationships in the chain. Some studies have found a direct relationship between power and trust. For example, Simpson and Mayo (1997) found that, independent of relationship structure, a supplier's use of non-coercive strategies is associated with increased distribution commitment, trust, and satisfaction, while coercive strategies are associated with reduced levels of commitment and trust. According to Hart and Saunders (1997) power, either coercive or persuasive, may have an impact on trust between channel partners. Table 3.4 provides a list of empirical studies related to Power and Transaction Cost

Table 3.4 Selected Empirical Studies involving channel Power and Transaction Cost

Authors	Objective	Results
(Buvik and Reve, 2002)	To combine resource dependence theory and transaction cost	As the buyer's relative bargaining power increases, the safeguarding of buyer-specific assets is substantially reinforced.
(Berthon, et al., 2003)	To study norms and power in marketing relationships	Power has strong influence over decision control

Coercive power may be inversely related to trust while persuasive power may be directly related to trust between partners. In our case, we consider the inherent power rather than the "use of power" to explain the change in transaction costs. Therefore we propose:

H3: In a supply-chain dyad higher buyer power in the dyad is associated with low transaction costs.

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3.3.4. Influence of Trust on Relationalism (4)

Trust is a good predictor of a lasting relationship and plays a crucial role in long term relationships (Sahay, 2003). Borrowing from Social Exchange Theory (Emerson, 1976), trust can be treated as social currency available for exchange for developing relationship between partners. Table 3.5 provides a list of empirical studies related to Trust and Relationalism.

Table 3.5 Selected Empirical Studies involving Trust and Relationalism

Authors	Objective	Results
(Ryssel, et al., 2004)	Study the impact of IT on trust and value creation	Two important input factors for a successful relationship are trust and commitment.
(Anderson and Weitz, 1989)	To study determinants of Continuity in dyads	Relationships which are expected to continue characterized by high level of trust.

While relationships can be placed on a continuum between a pure contract-based to pure trust-based relationship, the level of trust can be considered as one of the aspects leading to a relationship. Therefore we propose:

H4: In a supply-chain dyad Trust is positively related to Relationalism

3.3.5. Mediation of Transaction Cost (5)

Trust finally becomes a relationship only if the transaction costs are low. According to Williamson (1993), trust has the ability to mitigate the influence of transaction costs. Trust will reduce transaction costs as the cost or remaining in a relationship will reduce due to the reduction in cost of evaluating and selecting the partner (Bharadwaj and Matsuno, 2006). Also, research reveals that one of the primary

reasons for the failure of supply chains has been the lack of trust (Moberg, et al., 2003).

In other words, partners are willing to forego costs if there is trust. On the other hand,

lack of trust causes an increase in the costs of monitoring and maintaining a relationship

thereby increasing transaction costs. According to Ganesan (1994), dependence and trust

are both related to environmental uncertainty, transaction-specific investments, reputation

and satisfaction in a buyer/seller relationships. Table 3.6 provides a list of empirical

studies related to mediation of transaction cost between trust and relationalism.

Table 3.6 Selected Empirical Studies involving mediation of Transaction Cost

Authors	Objective	Results
(Grover, et al., 2002)	To investigate role of IT in buyer-supplier relationships	strong negative relationship between perceived Transaction Costs and Relationalism
(Pilling, et al., 1994)	Relational bonds in industrial exchange	guarding against opportunism may lead to diminished relationalism
(Bharadwaj and Matsuno, 2006)	Investigating the antecedents and outcomes of customer firm transaction cost savings in a supply chain relationship	trust in the supplier is positively related to the customer firm's transaction cost advantage

In a study, Pilling et al. (1994) found effort to be positively related to relationship

focus, opportunism to be negatively related, but monitoring showed no effect. The above

discussion emphasizes the interplay between trust, transaction cost and relationship.

Therefore we propose:

> **H5: In a supply-chain dyad the association between the level of trust**
> **and relationalism is mediated by transaction costs**

3.3.6. Influence of Relationalism on Performance (6)

One factor related to the success of the supply chain is its performance. Although, research is replete with papers researching the measurement of supply chain performance there are few papers tying relationship to performance. The premise of social capital theory is that social networks have the capability of creating value (Putnam, 2000). We believe supply chain relationships too, have the capability to contribute to the performance of the supply chain.

A stronger buyer-supplier relationship will enhance performance throughout the chain (Maloni and Benton, 2000). According to Benton and Maloni (2005) power-affected buyer-supplier relationships have a significant positive effect on performance. According to Min and Mentzer (2004), to have a successful supply chain managers must build and develop cultural elements of relations like trust, commitment and cooperative norms with its supply chain partners. Mallering (2003) provided evidence on important positive correlations between trust, trustworthiness, reciprocity and performance. A study by Noordewier et al. (1990) indicates the positive effect of relational elements on performance outcomes. The effect of ordinary technical exchanges on supplier performance improvement does not vary with relationship duration. The effect of higher-level technology transfer, however, grows more positive as relationship duration increases (Kotabe, et al., 2003). Table 3.7 provides a list of empirical studies related to Relationalism and Performance.

Table 3.7 Selected Empirical Studies involving Relationalism and Performance

Authors	Objective	Results
(Fynes and De Barca, 2005)	To study impact of supply chain relationship on performance	Mixed support for the impact of relationship on various indicators of performance.
(Lin, et al., 2005)	Effects of Trust Mechanisms on Supply-Chain Performance	Benevolence, trust and integrity reduce improve certain indicators of performance.
(Olson and Adya, 2003)	The Effect of Collaborative Forecasting on Supply Chain Performance.	collaborative forecasting seems to perform better in instances when lead times are short.

Using simulation, Lin et al. (2005) provided evidence that software agents embedded with trust mechanisms can improve supply-chain performance. In a study by Langerak (2001), it was observed that the customer's and the supplier's perception of trust positively influences the manufacturer's financial performance. Siguaw et al. (1998), found a significant positive relationship between a distributor's trust in the supplier and its satisfaction with its financial performance. Therefore we propose:

H6: In a supply-chain dyad Relationalism is positively related to Performance

3.3.7. Influence of Relationalisn on Satisfaction (7)

Another factor related to the success of the supply chain is perceived satisfaction. At this point, it is necessary to discuss the reason to make a distinction between performance and satisfaction. Satisfaction and Performance are two distinct measures related to the success of the supply chain. Performance is related to more tangible measurements like improvement in coordination, inventory turnover etc. Performance

measurements are relative measures, either in relation to past or in relation to the industry. Satisfaction, on the other hand is micro factor related to only the supply chain in question. In a study involving buyer-seller relationships, Benton and Maloni (2005) found the paths between performance and satisfaction to be non- significant. Table 3.8 provides a list of empirical studies related to Relationalism and Satisfaction.

Table 3.8 Selected Empirical Studies involving Relationalism and Satisfaction

Authors	Objective	Results
(Walton, 1996)	To measure current and expected levels of satisfaction in supply chain dyad	EDI significantly contributes to *partnership satisfaction*,
(Benton and Maloni, 2005)	The influence of power driven supply chain relationship on satisfaction	Buyer supplier relationship has significant positive impact on Supply chain satisfaction

While topics in partnership related to understanding the dyadic perspective of partnering, managing the partnership, partnering negotiations, and even supply chain performance is emphasized in research, little attention is paid on the issue of supply chain satisfaction (Walton, 1996). Satisfaction with the supply chain is a crucial indicator of continuance of the partnership (Benton and Maloni, 2005) and hence satisfaction and its relationship with its antecedent factor: relationalism, make good candidates for the study.

H7: In a supply-chain dyad Relationalism is positively related to Satisfaction.

Table 3.9 Table of Hypotheses

H1: In a supply-chain dyad, Information Technology integration is positively associated with Trust.

H2: In a supply-chain dyad Process Integration is positively associated with Trust.

H3: In a supply-chain dyad higher buyer power in the dyad is associated with low transaction costs.

H4: In a supply-chain dyad Trust is positively related to relationalism.

H5: In a supply-chain dyad the association between the level of trust and relationalism is mediated by transaction costs.

H6: In a supply-chain dyad Relationalism is positively related to Performance.

H7: In a supply-chain dyad Relationalism is positively related to Satisfaction.

CHAPTER 4

INSTRUMENT DEVELOPMENT

The research model is broadly divided into three categories of variables. The first category involves the explanatory environmental variables: Information Technology Integration, Process Integration and Power in the Dyad. The second category involves the first level of influence; these are Trust, Transaction costs and Relationalism. Finally, the third category involves the outcome variables, Performance and Satisfaction, which are the ultimate objective of a supply chain. The following sections deal with the source and validity of items for each the constructs.

4.1 Measures of Information Technology Integration

The questions on Information technology integration in Table 4.1 are based on the items were used by to measure the extent of EDI use.

Table 4.1 Measures of Information Technology Integration

#	Item
(IT1)	Shipping, receiving and Ordering raw materials or components
(IT2)	Inventory control for raw material or components
(IT3)	Exchanging information on finished goods inventory
(IT4)	Exchanging information on production schedules
(IT5)	Exchanging information on anticipated demand
(IT6)	Monitoring and coordinating performance and activities
(IT7)	Sharing databases, applications and files

4.2 Measures of Process Integration

The questions on process integration have been adopted from a study by Stank et al. (2001) to investigate the relationship between logistics integration and performance. The following items in Table 4.2 used by Stank et al. (2001) showed an item to total correlation of > 0.30. In order to cater to the specific requirements of our study, we added three more items from research done by Berthon et al. (2003) involving relational norms and governance mechanisms in marketing dyads.

Table 4.2 Measures of Process Integration

#	Item	Source	Validity
(PI1)	My firm shares technical resources with Supplier S to facilitate operations.	Adopted from (Stank, et al., 2001)	Item to total correlation > 0.30
(PI2)	My firm is committed to sharing responsibility with Supplier S in new product/service development and commercialization.	Adopted from (Stank, et al., 2001)	Item to total correlation > 0.30
(PI3)	My firm has active programs to positively impact our Supplier S.	Adopted from (Stank, et al., 2001)	Item to total correlation > 0.30
(PI4)	My firm has been allowing Supplier S to participate in strategic decisions.	Adopted from (Stank, et al., 2001)	Item to total correlation > 0.30
(PI5)	My firm collaborates in forecasting and planning with Supplier S.	Adopted from (Stank, et al., 2001)	Item to total correlation > 0.30
(PI6)	My firm has made investments in specific procedures, routines, and equipment dedicated to our relationship with Supplier S.	Adopted from (Ganesan, 1994)	
(PI7)	We have routines tailored to meet Supplier S' requirements.	Adapted from (Heide, 1994)	
(PI8)	We have committed time and money to train and qualify Supplier S.	Adapted from (Ganesan, 1994)	

4.3 Measures of Channel Power

Questions regarding Channel Power in Table 4.3 were developed using items from a study by Ganesan (1994) involving the antecedents of long term orientation among supply chain partners. To make the questionnaire more comprehensive we added an item from a study by (Heide, 1994) on "governance in marketing channels".

Table 4.3 Measures of Channel Power

#	**Item:** Adopted from (Ganesan, 1994) and (Heide, 1994)
(Pow1)	If our relationship with Supplier S was discontinued, we would have difficulty in making up the sales volume in our trading area. *(Negatively worded)*
(Pow2)	This Supplier S is crucial to our future performance. *(Negatively worded)*
(Pow3)	It would be difficult for us to replace Supplier S. *(Negatively worded)*
(Pow4)	If our relationship was discontinued, we would have difficulty replacing Supplier S**.** *(Negatively worded)*
(Pow5)	If we stopped buying from Supplier S, they could easily replace our volume with sales to some other buyers. *(Negatively worded)*

4.4 Measures of Trust

In a comprehensive study by Cummings and Bromiley (1996) involving conceptual, empirical development and validation of organizational trust, the following items in Table 4.4 were found to have an item-to-factor correlation of more than 0.85.

Table 4.4 Measures of Trust

#	**Item:** adapted from (Cummings and Bromiley, 1996)	**Item to factor correlation**
(Trust1)	We think that Supplier S is dependable.	0.85
(Trust2)	We think that Supplier S meets its negotiated obligations to us.	0.90
(Trust3)	In our opinion Supplier S is reliable.	0.90
(Trust4)	We think that the people in Supplier S keep their promises.	0.90
(Trust5)	We think Supplier S keeps the spirit of an agreement.	0.87
(Trust6)	We think that people in Supplier S will honor the commitments made in our dealings	0.85

4.5. Measures of Transaction Costs

The measurements items for Transaction Costs in Table 4.5 were adopted exclusively from Grover et al. (2002). In their survey, all second order constructs of transaction costs were found to have good convergent validity (> 0.70).

Table 4.5 Measures of Transaction Costs

#	**Item:** Adopted from Grover, et al (2002)	**Validity**
	In developing an association with Supplier S	0.79
MD1	Significant effort was required to gather the information necessary to outline the working relationship with Supplier S.	0.56
MD2	There were many unspecified terms which had to be worked out as the relationship with Supplier S developed.	0.74
MD3	It required significant effort to determine roles to be performed by our firm and Supplier S.	0.73
	In Monitoring the performance of Supplier S:	0.80
MM4	It is easy to tell if we were receiving fair treatment from Supplier S. *(Negatively worded)*	0.55
MM5	It takes significant effort to detect whether or not Supplier S conforms to specifications and quality standards.	0.56
MM6	Accurately evaluating Supplier S requires a lot of effort.	0.73
MM7	It is costly, in time and effort, to clearly monitor the performance of Supplier S.	0.61

Table 4.5 Continued

	In addressing problems that might arise in the relationship with Supplier S:	0.79
MA8	The approach to solving problems in our relationship with Supplier S is clear-cut. *(Negatively worded)*	0.51
MA9	There are standard solutions or approaches to problems that might occur with Supplier S. *(Negatively worded)*	0.43
ML10	Problem-solving is often challenging, due to the nature of components handled by Supplier S.	0.55
ML11	Although solutions to problems with Supplier S, can be achieved, they often need to be highly customized	0.64
	Concerning the likelihood of Supplier S taking advantage of its relationship with our firm:	0.80
ML12	It is easy for Supplier S to alter the facts in order to get what they wanted.	0.63
ML13	There is a strong temptation for Supplier S to withhold or distort information for their benefit.	0.62
ML14	Supplier S has the opportunity to take advantage of unspecified or unenforceable contract terms	0.70

4.6 Measures of Relationalism

Four dimensions of relationalism: flexibility in the relationship, voluntary exchange of useful information, shared problem solving and restraint in the use of power were measured by them using validated instruments from Heide and Miner (1992). The measurements items for Relationalism in Table 4.6 were adopted exclusively from Grover et al. (2002). In their survey, all second order constructs of Relationalism were found to have good convergent validity (> 0.70).

Table 4.6 Measures of Relationalism

#	**Item** Adapted from	**Validity**
	Flexibility:	Rel. = 0.68
RF1	Our relationship with Supplier S permits flexibility in response to requests for changes.	0.42
RF2	The parties will be open to modifying their agreements if unexpected events occur.	0.60
RF3	If considered necessary, we may change previously agreed prices.	0.47
	Information exchange:	Rel. = 0.80
RI4	In our relationship with Supplier S, it is expected that any information that might help the other party will be provided to them.	0.64
RI5	Exchange of information in our relationship with Supplier S takes place frequently and informally and not only according to a pre-specified agreement.	0.56
RI6	It is expected that the parties will provide proprietary information if it can help the other party.	0.60
RI7	It is expected that the parties keep each other informed about events or Changes that may affect the other party.	0.64
	Shared problem solving:	Rel.= 0.79
RS8	In general, we and Supplier S, are jointly responsible for getting things done	0.59
RS9	Problems that arise are treated by both parties as joint rather than individual responsibilities.	0.68
RS10	In our relationship with Supplier S, we do not mind owing each other favors.	0.47
RS11	In working with Supplier S, the responsibility for making sure that the relationship works for both parties, is shared jointly.	0.64
	Restraint in the use of power:	Rel.= 0.68
RR2	The parties feel it is important not to use any proprietary information to the other party's disadvantage.	0.65
RR13	In our relationship with Supplier S, neither party is expected to make demands that might be damaging to the other.	0.57
RR14	Between us and Supplier S, whoever has more power, is expected to refrain from using this power in attempting to get its way.	0.30

<u>4.7 Measures of Performance</u>

Benton and Maloni (2005) found the summary statistics of performance measures to be strongly favorable. Also, their study revealed an association between relationalism and performance as perceived by the supply chain partners. Table 4.7 provides a selected list of items selected from Benton and Maloni (2005) and Premkumar and Ramamurthy (1995).

Table 4.7 Measures of Performance

#	Item	Source
(Per1)	Supply operations for Component C, has improved due to our relationship with Supplier S.	Adapted from (Benton and Maloni, 2005)
(Per2)	Without Supplier S the supply operation for Component C would not perform as well.	Adapted from (Benton and Maloni, 2005)
(Per3)	• Compared to your industry's average, how would you rate your supply chain?	Adopted from (Premkumar and Ramamurthy, 1995)
(Per4)	• This relationship has improved inventory turnover.	Adopted from (Premkumar and Ramamurthy, 1995)
(Per5)	• This relationship has improved coordination with the suppliers.	Adopted from (Premkumar and Ramamurthy, 1995)

<u>4.8 Measures of Satisfaction</u>

In an instrument developed by Benton and Maloni (2005) to measure the effect of relational elements and performance on satisfaction, the following items in Table 4.8 were found to be significant at $\alpha = 0.01$

Table 4.8 Measures of Satisfaction

#	**Item** adapted from Benton and Maloni (2005)
(Sat1)	Dealing with Supplier S benefits our company.
(Sat2)	We are satisfied with dealings with Supplier S.
(Sat3)	We would discontinue dealing with Supplier S if we could. *(Negatively worded)*
(Sat4)	Supplier S is a good company to do business with.

4.9 First and Second Order Constructs

Table 4.9 provides a list of first and second order constructs in our model. The

questionnaires were developed from previously validated instruments.

Table 4.9 First and Second Order Constructs

Construct	Source	Validity
Process Integration	(Stank, et al., 2001)	Cronbach Alpha 0.83
	(Berthon, et al., 2003)	Cronbach Alpha 0.75
Information Technology Integration	(Stank, et al., 2001)	Cronbach Alpha 0.86
Transaction Costs	(Pilling, et al., 1994)	
Trust	(Cummings and Bromiley, 1996)	Cronbach Alpha 0.95
Power	(Ganesan, 1994), (Heide, 1994)	
Relationalism	(Heide and John, 1992) (Grover, et al., 2002)	
Performance	(Benton and Maloni, 2005)	Cronbach Alpha 0.85
Satisfaction	(Benton and Maloni, 2005)	Cronbach Alpha 0.80

4.10 Summary

In this chapter, we discussed the constructs related to the model. Instruments from related studies were adopted or adapted to suit the unique requirements of the situation specific to this study. Demographic questions as well as the format of the introductory page on the website were in line with past studies.

CHAPTER 5

DATA COLLECTION AND ANALYSIS

5.1 Survey Technique

The research survey instrument (Appendix A) was developed from a combination of a compilation of instruments successfully tested in the past and adapted to fit our specific needs without distorting the purpose it was meant to serve. The survey was conducted online. The online survey provides us with a flexible and low cost approach. The URL containing the survey was sent to respondents via email along with the introductory letter. Non-respondents were identified and an email reminder was sent to them. Efforts were made to ensure the privacy of the respondents. In terms of testing the effectiveness of online surveys, research has shown online surveys to be equal to and in certain situations better than postal surveys (Bachmann, et al., 1996). In a study comparing web based surveys to telephone and postal survey; Coderre (2004) found that the quality of qualitative data obtained through a web-based survey was comparable to that of information obtained through telephone or postal surveys for two of the three target firms. According to Ilieva (2002) one major advantage of using postal surveys is that everyone has a physical address and not everyone has an email address. We believe that almost all the respondents in medium and large scale buyers will at least possess a working email address. Some of the advantages of using an online survey are reduction in cost, time and effort.

5.2 Pretest

Before starting the survey, a pretest of the survey to check for face validity of the instrument was done. The survey instrument was tested and discussed face-to-face with nine volunteer respondents who fit the respondent profile. These volunteer were typically purchasing managers with more than three years experience in dealing with their suppliers. Using their feedback, the instrument was tweaked with modifications to some items. The survey was further tested on line with five more respondents. These respondents too were volunteers who fit the respondent profile. A text box at the end of the survey required the respondents to specify any discrepancies they found with the survey or any suggestions they had for the survey.

5.3 Data Collection

The respondents are: purchase and supply chain managers. The survey was done online by emailing the respondents and requesting they visit the survey website. The respondents were either from an email list of supply chain professionals or members of supply chain forums. The email list of supply chain professionals was obtained from the US Small Business Administration. The two main supply chain forums were APICS (The Association for Operations Management) and APS (The American Purchasing Society). Both APS and APICS partnered with us in surveys targeting their respective members. Separate links were created for both with their logos along with the University Logo on the survey website. This may have provided more legitimacy to our survey in the eyes of the members of both organizations and they may have felt more secure in doing the survey. The remaining were online communities/ forums in the area of supply chain management, distribution of logistics, operations management and global operations etc.

For members of these supply chain communities/forums, the editors / presidents of the forums were contacted to have our survey link available to members who fit the respondent profile. They then forwarded our survey website to their members or provided our website link in their publication.

The respondents from the email list obtained from US Small Business Administration were directly emailed. The responses gathered in a file in the server were then downloaded. After checking for outliers and missing values and data cleaning, a total of 220 good responses were identified. 29 good responses from APICS and APS, 167 good responses from the email list and 24 responses from other supply-chain forums, were received. The response rate in the case of APICS, APS and other supply chain forums can only be estimated as we did not directly email the respondents. The editors of these forums forwarded our request to their members.

In the case of the email list, a total of 7000 emails were sent. Of the 7000 emails, 1000 emails were bounced back. One reason could be the respondents left the company. 500 were returned with messages against anti spamming and a request to be removed from the mailing list. At least 1000 respondents returned an automated "out of office" reply and may not have checked their emails during the required survey period. A possible reason for the low response rate could be automatic spam guards and intelligent agents embedded in computers which put the survey mail into either bulk or spam. In the case of the email list, we estimate a response rate of 3.7 % (167/4500)

5.4 Statistical Analysis Technique

We use descriptive statistics to tabulate and summarize all constructs in the next section. Also factor loadings of each construct will be tested. The responses in the survey will be analyzed using techniques including descriptive statistics, t-tests, analysis of variance (ANOVA), and structural equation modeling.

The primary statistical technique used here is Partial Least Squares Regression (PLS) (Gefen, et al., 2000). PLSGraph Ver 3 *(courtesy Dr. Wynne W. Chin - University of Houston)* was used to analyze the data. PLS, a Structural Equation Modeling (SEM) technique is a second generation data analysis technique. SEM techniques not only assess the structural model but also assess the measurement model thereby enabling us to simultaneously do factor analysis with hypotheses testing (Marcoulides and Saunders, 2006). SEM techniques help do a simple, systematic and comprehensive analysis among multiple constructs simultaneously. LISREL does not map formative observed variables whereas PLS supports both formative as well as reflective measures. In our model, IT integration and Process integration are formative variables and the rest are reflective variables. PLS is more flexible than other traditional multivariate methods, especially in terms of sample size.

5.5 Sample Size Requirement

After data cleaning our total final usable sample size is 220. Suggested sample size requirements for PLS vary and are often conflicting. While there are cases where PLS is considered a good technique for small sample size, others suggest practicing caution with small sample size (Goodhue, et al., 2006; Hair, et al., 2005; Marcoulides and Saunders, 2006). According to studies done by Curran (2002), there is evidence of bias in

both mean and variance in smaller samples when using SEM and sample sizes of more than 200 is needed to prevent bias. Another requirement is the sample should be at least ten times the number of predictors from the indicators on the most complex formative construct or the largest number of antecedent constructs leading to an endogenous construct whichever is greater (Chin and Newsted, 1999). By the above rule the sample size should be at least 140 (14*10). The sample size in this thesis is 220, which adequately satisfies the requirements.

<u>5.6 Data Preparation</u>

5.6.1. Outliers

We searched for outliers from both univariate and multivariate perspectives. Univariate outliers are cases that have abnormal values for a single variable. Multivariate outliers are cases that have abnormal combination of values for a number of variables. In the case of univariate data, we looked at values with a standardized score of three or more, as suggested by Hair et al. (2005) in case of more than 80 observations. We also used Mahalanobis Distance to identify multidimensional outliers. Five cases were found to be outliers. After looking at the cases individually, we found no "abnormality" in the data. We believed there was no reason to drop them from the data set and therefore retained all the cases.

5.6.2. Missing Values

Forcing the respondents to answer each question was not done. This was due to two reasons. The first was that we felt that respondents would feel dissuaded from completing the survey. Secondly, according to Institutional Review Board (IRB)

requirements we could not force respondents to answer questions. They had to be given a choice of not answering. Cases with more than eight (out of 65) missing values were dropped. The remaining raw data showed some missing values, which then were imputed using Expectation Maximization (EM) method. While EM method is much better method with least bias (Hair, et al., 2005), methods including list-wise deletion, pair-wise deletion and means substitution either reduce the sample size or bias the results.

5.6.3. Key informant bias

One of the suggestions to overcome key informant bias is to assess informant competency (Straub, et al., 2004). One of our questions is related to the job title of the respondent. Typical responses were Purchase coordinator, Purchasing Manager, Senior Buyer, Senior Logistics Planner, VP of Operations etc. (Appendix A). The median of years of experience was eight years. With relevant job titles and experience we believe the respondents were good representatives of the organizations they represented.

5.6.4. Checking for Non- response bias

Literature on non-response suggests three methods of estimating non-response bias: comparison with known values for the population, subjective estimates and extrapolation methods (Armstrong and Overton, 1977).

Due to the inability to access known values of the population or subjective estimates, we use extrapolation. The extrapolation method treats late respondents as non-respondents and therefore testing for differences between early and late respondents can be considered as a test between respondents and non-respondents. We also compared the demographics of the respondents from the e-mail list with remaining respondents from the APICS, APS and other sources.

First, we tested for response bias by comparing the proportion of genders between different sources (Chi square test) and comparing item responses of late and early respondents. Table 5.1 provides the details of the Chi square test for Gender

Table 5.1 Chi square test: Gender

Gender	APICS and APS	Email List	Total
Male	39	121	160
Female	13	44	57
TOTAL	52	165	217
chi-squared Stat			0.0567
Df			1
p-value			0.8118
chi-squared Critical			3.8415

Because the "other" category had values less than five we combined it with APICS and APS. Also, the values for some experience categories (16 to 25) and (25 and above) were less than 5 so they were combined with the other categories. The distribution of genders across the two lists were not significantly different.

In the second test, Table 5.2 provides a t-test comparing responses for four items between 52 early and 115 late respondents from the email group. The test for all items showed no significant difference between early and late respondents. In the third test, we compared years of experience data between early and late respondents (Table 5.3). No significant difference was found. Finally, a comparison between the age of early and late respondents (Table 5.2) was done and no significant difference was found.

Table 5.2 T test- Difference between early and late respondents

Item: (Trust 1) We think that Supplier S is dependable.						
Sample	N	Range	Mean	Variance	T stat	T- Test Results
EARLY	115	1-7	5.5478	1.5130	0.2326	Not significantly different
LATE	52	1-7	5.5961	1.6180		
Item: (Satis2) We are satisfied with dealings with Supplier S.						
Sample	N	Range	Mean	Variance	T stat	T- Test Results
EARLY	115	1-7	5.617	1.308	- 1.30	Not significantly different
LATE	52	1-7	5.3465	2.113		
Item: (Pow2) This Supplier S is crucial to our future performance.						
Sample	N	Range	Mean	Variance	T stat	T- Test Results
EARLY	115	1-7	4.4608	3.163	0.6435	Not significantly different
LATE	52	1-7	4.6538	3.250		
Item:(Rel8) In general, we and Supplier S, are jointly responsible for getting things done						
Sample	N	Range	Mean	Variance	T stat	T- Test Results
EARLY	115	1-7	4.9739	2.1459	0.7295	Not significantly different
LATE	52	1-7	5.1730	2.9028		

Table 5.3 Chi Square to test years of experience early and late respondents

	Early	Late	Total
1 to 4	13	26	39
5 to 10	11	21	32
11 to 15	9	22	31
16 to 25	11	30	41
More than 25	6	11	17
TOTAL	50	110	160
chi-square Stat			0.7976
Df			4
p-value			0.9388
chi-square Critical			9.4877
Result : Not significantly different			

Table 5.4 Chi Square to test age of early and late respondents

	Late	Early	Total
20 to 39	10	16	26
40 to 49	15	39	54
50 to 59	18	46	64
60 and above	9	13	22
TOTAL	52	114	166
chi-square Stat			2.1754
Df			3
p-value			0.5368
chi-square Critical			7.8147
Result : Not significantly different			

5.7 Sample Respondent characteristics

Of the 220 respondents, 167 were from the email list, 29 from APICS and APS and 24 from others (Table 5.5). Also, there were 160 (73%) males, 57 (26%) females and three non-responses. The median age was between 40 and 49. The median number of years worked in the organization was ten. Table 5.5 also shows industry wise break up of respondents. More than half of the respondents were from either manufacturing or retail and wholesale.

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Table 5.5 Respondent Characteristics

Sources of Response	Responses	Percentage
APICS and APS	29	0.132
Email List	167	0.759
Others	24	0.109
Gender	**Frequency**	**Percentage**
Male	160	0.727
Female	57	0.259
No Response	3	0.014
Age	**Frequency**	**Percentage**
Less than 20	3	0.013
20 to 29	26	0.118
30 to 39	29	0.131
40 to 49	65	0.295
50 to 59	74	0.336
60 and above	23	0.104
Years Worked	**Frequency**	**Percentage**
1 to 4	67	0.305
5 to 10	52	0.236
11 to 15	36	0.164
16 to 25	43	0.195
More than 25	19	0.086
Non-responses	3	0.014
Primary Business	**Frequency**	**Percentage**
Consultant/Professional	9	0.04
Educational	3	0.01
Financial	4	0.02
Hospitality	1	0.00
InformationTechnology	8	0.04
Legal	1	0.00
Manufacturing	100	0.45
Media/Marketing/Advertisement	11	0.05
Medical	5	0.02
Retail/Wholesale	25	0.11
Service Provider	14	0.06
Telecommunications	3	0.01
Transportation	6	0.03
Utility	2	0.01
Others	28	0.13

5.8 Data analysis

Guidelines were taken from the study done by (Baron and Kenny, 1986) on requirements in contemporary IS research. In IS research, the mandatory validities to consider, as suggested by Baron and Kenny (1986) are discriminant, convergent, factorial, reliability and manipulation validity. In this thesis, the measurement model was used to access the reliability and validity of the instrument and the structural model was used to test the hypothesized relationships.

5.8.1 Measurement (Outer) Model

The relationship between constructs and their indicators is often referred to as the measurement model. Appendix D shows the loadings of indicators with their respective constructs. Item Pow5 had a low loading of 0.127 and was dropped. MM4 also had a low loading of -0.2718 on the first order construct (maintaining relationship) and also was removed from the model. In retrospective, the items were not clear enough and too verbose and should have been made simpler to understand. After this, all items related to first order reflective constructs showed a loading of more than 0.67.

5.8.2 Higher Order Constructs

Transaction cost is conceptualized as a higher order construct formed by; 1. developing, 2. monitoring, 3. addressing and 4. gauging opportunism in a relationship. Relationalism, too, is conceptualized as a higher order construct formed by: 1. flexibility 2. shared problem solving, 3. voluntary information exchange and 4. restraint in the use of power. The paths coefficients from lower to the related higher order constructs are shown in Figure 5.1
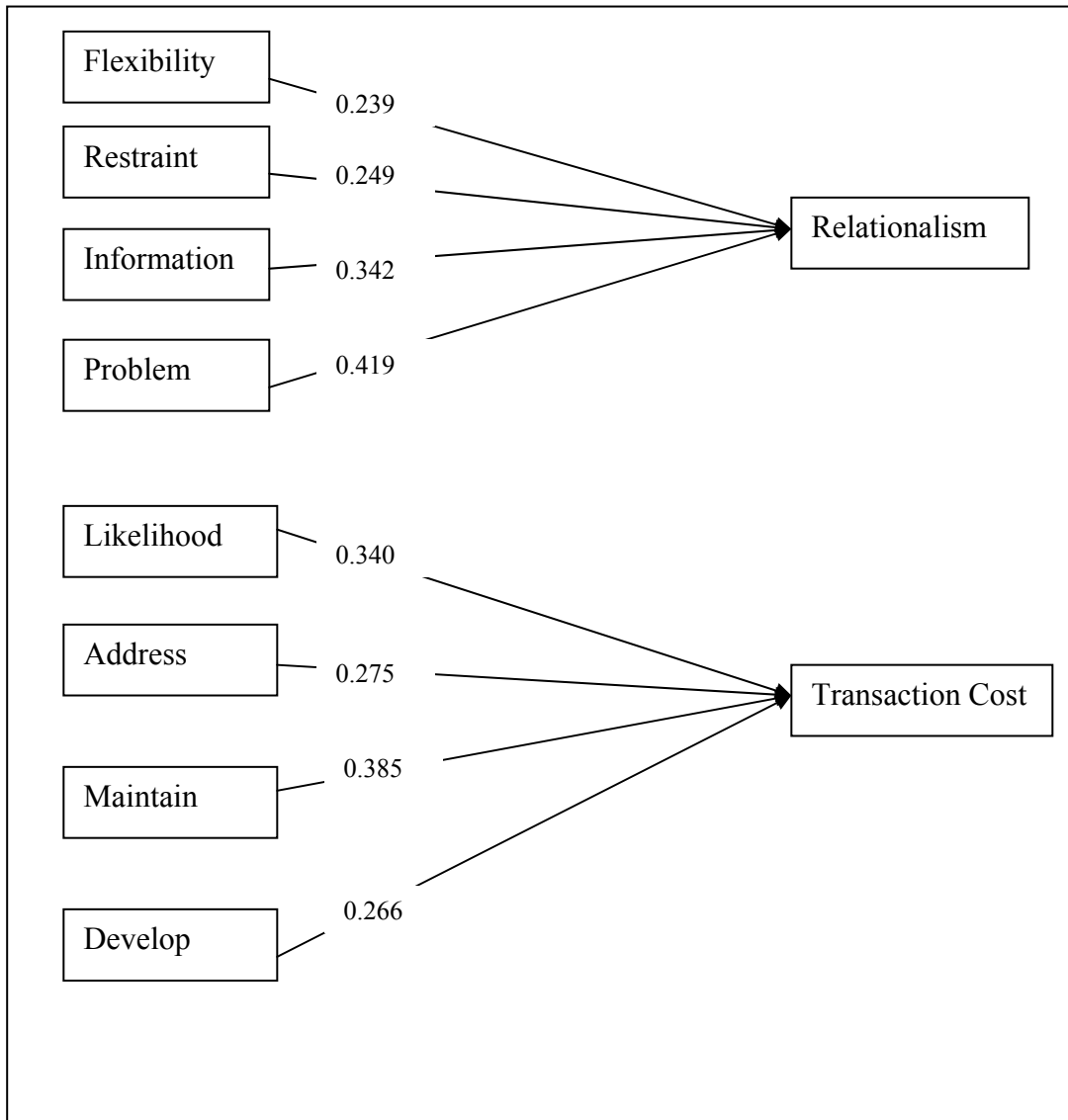
Figure 5.1 Higher Order Constructs

5.8.3 Reliability and Validity

Before testing the various hypotheses, the reliability and validity of the scales were examined. All constructs in this model are either formative or reflective. The statistical requirements to check for reliability of the formative constructs differ from that of reflective constructs.

In a formative measure, the indicators form or cause the creation of the latent variable (Chin, 1998). The formative indicators can be considered as causing rather than being caused by the latent variable (Hair, et al., 2005; MacCallum and Browne, 1993). The indicators need not be correlated and the construct is not expected to have high internal consistency (Bollen, 1984). In this model, IT integration and process integration, are formative constructs.

In reflective measures, the direction of causality flows from the construct to the measures and all the indicators of a single construct have to relate to each other and therefore reflective measures are expected to have high reliability (Hair, et al., 2005). In this model trust, transaction cost and relationship, performance and satisfaction are reflective constructs.

For internal consistency, in the case of reflective measures, the construct's average variance extracted (AVE) should not be below 0.50 (Fornell and Larcker, 1981) and the Cronbach's alpha should not be less than 0.70 (Hair, et al., 2005). Being formative constructs, IT integration and Process integration are exempt from the above requirement.

The AVE is the variance in indicator items captured by a construct as a proportion of captured plus error variance. Factors loadings in Appendix D showed loadings of more than 0.67. Nunnally (1967) recommends a loading threshold of at least 0.70. In the case of early stages of the research Nunnally (1967) considers reliability coefficients between 0.5 and 0.6 as adequate. All reflective constructs showed a composite reliability(R) of 0.80 or more (Table 5.6). As the constructs were either adapted or adopted from past studies, high reliability was expected.

Tests for convergent and discriminant validities were done simultaneously. In order to have convergent and discriminant validity, the square root of the AVE should be larger than the correlation of the construct with other constructs (Chin, 1998; Fornell and Larcker, 1981; Gefen, et al., 2000) All items related to reflective items correlated more with the construct than any other construct (Appendix E).

The above tests validate the suitability of the data collection mechanism along with the reliability of the constructs.

Table 5.6 Correlations, CR and AVE Values (N = 220)

Construct	CR	AVE	Correlations							
			1	2	3	4	5	6	7	8
Process (F)	0.58	0.18	**0.42**							
Trust (R)	0.98	0.87	0.39	**0.93**						
IT Integ. (F)	0.33	0.09	0.29	0.28	**0.30**					
Relationship (R)	0.91	0.42	0.38	0.66	0.23	**0.65**				
Transaction (R)	0.90	0.41	-0.20	-0.65	-0.33	-0.47	**0.64**			
Power (R)	0.95	0.83	-0.37	-0.22	-0.25	-0.14	0.10	**0.91**		
Satisfaction (R)	0.90	0.70	0.29	0.74	0.22	0.73	-0.53	-0.23	**0.84**	
Performance (R)	0.90	0.59	0.33	0.60	0.28	0.65	-0.30	-0.29	0.72	**0.77**

Note: CR: Composite Reliability; AVE: Average Variance Extracted ; Boldface numbers on the diagonal are the square roots of the AVE values
F: Formative Construct, R: Reflective Construct

5.8.4 Hypothesis testing

Finally, we test the model by testing the significance of the paths purported in the model. The results of the hypothesis are given in Table 5.8. The standard errors were calculated by bootstrapping the sample data. Bootstrapping is a method, which involves drawing repeated samples (with replacement) from the data and then building a distribution for a statistic by calculating a value of the statistic for each sample (Wasserman and Bockenholt, 1989). The path coefficients and R^2 are shown in Figure 5.2.
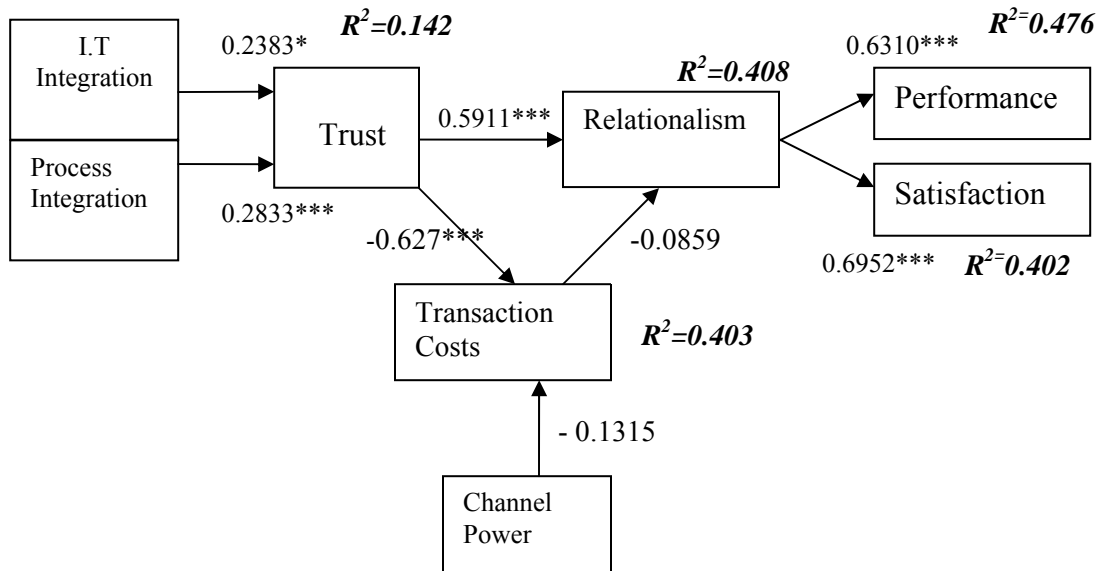

Figure 5.2 Structural Model

Note: ***: significant at 0.01 level
      ** : significant at 0.05 level
      * : significant at 0.1 level

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Hypothesis 1: In a supply-chain dyad, Information Technology integration is positively associated with Trust. (b = 0.2383, t = 1.6358, p < 0.1). Support for this hypothesis implies that the more the level of IT technology used in supply chain dyad, the more the trust between partners in a supply chain dyad.

Hypothesis 2: In a supply-chain dyad Process Integration is positively associated with Trust. (b = 0.2833, t = 2.7674, p < 0.01). Support for this hypothesis implies that the more the level of Process Integration in a supply chain dyad, the more the trust between partners in a supply chain dyad.

Hypothesis 3: In a supply-chain dyad higher buyer power in the dyad is associated with low transaction costs. (b = -0.1315, t = 1.6847, p < 0.1). Support for this hypothesis implies that the more the Power an organization wields over its partner, the more the lower the transaction costs associated with dealing with the partner.

Hypothesis 4: In a supply-chain dyad Trust is positively related to relationalism. (b = 0.5911, t = 7.1860, p < 0.01). Support for this hypothesis implies that more trust among partners leads to a better relationship between the participants of a supply chain dyad.

Hypothesis 5 (mediation): In a supply-chain dyad the association between the level of trust and relationalism is mediated by transaction costs.

According to the three rules of mediation (Baron and Kenny, 1986), in order for transaction cost to mediate between trust and relationship, the following three conditions should hold true: the path between Trust (IV) and Relationship (DV) should be significant, the path between Trust (IV) and Transaction Costs (M) should be significant, the path between Transaction Costs (M) and Relationship (DV) should be significant

after controlling for Trust (IV) and the path between Trust (IV) and Relationship (DV) should become insignificant after controlling for Transaction Costs (M).

To test the each of the three rules, the constructs involved were isolated. Then the path coefficients between the constructs were tested for significance. Table 5.7 provides the results of the test of mediation.

Table 5.7 Mediation of Transaction Cost

Step	Model	I. V	D.V	Coeff.	t-Stat	Significant
1	Direct	Trust	Relationship	0.6420	12.555***	Yes
2	Direct	Trust	Trans. Cost	-0.5920	-14.250***	Yes
3	After controlling for Trust	Trans. Cost	Relationship	-0.111	-1.4113	No
4	After controlling for Trans. Costs	Trust	Relationship	0.575	6.9704***	Yes

From Table 5.7 it was concluded that there is not enough evidence in order to support this hypothesis regarding the mediation of transaction cost between trust and relationship.

Hypothesis 6: In a supply-chain dyad Relationalism is positively related to Performance. (b = 0.6310, t = 11.4979, p < 0.01). Support for this hypothesis implies that relationships among the participants of a supply chain dyad have an influence on the performance of the supply chain as perceived by the buyers.

Hypothesis 7: In a supply-chain dyad Relationalism is positively related to Satisfaction. (b = 0.6952, t = 13.8962, p < 0.01). Support for this hypothesis implies that relationships among the participants of a supply chain dyad have an influence on the satisfaction perceived by the buyers.

Table 5.8 Strengths of Paths and T statistics

		Dir	Coeff.	Standard Error	t-stat	Result
H1	IT → Trust	+	0.2383	0.1479	1.6358*	Supported
H2	Process Integration → Trust	+	0.2833	0.0846	2.7674***	Supported
H3	Power → Transaction Cost	_	- 0.1315	0.0985	1.6847*	Supported
H4	Trust → Relationalism	+	0.5911	0.0810	7.1860***	Supported
H5(a)	Trust → Transaction Costs	_	-0.6276	0.0469	13.4055***	Supported
H5(b)	Transaction Costs → Relationalism	_	-0.0859	0.0931	0.8804	Not supported
H6	Relationalism → Performance	+	0.6310	0.0541	11.4979***	Supported
H7	Relationalism → Satisfaction	+	0.6952	0.0496	13.8962***	Supported

*** significant at 0.01 level
** significant at 0.05 level
* significant at 0.1 level

5.9 Summary

As researchers of factors surrounding the IT artifact, the connection between IT and trust emphasizes the role of IT in influencing perception and behavior. As shown from the correlations, the role of IT is just as important as management efforts to induce cooperation. Practitioners' intent on building trust can depend on a mutual entanglement of IT systems between the supply chain partners in addition to traditional managerial techniques to improve relationship and improve performance and satisfaction.

There is significant evidence of the role of Power in reducing transaction costs. A powerful organization, it appears, neither has the need to maintain a relationship with its

partner nor has the need to guard against opportunism. Overall, it seems that an organization may either have power or have trust in order to reduce transaction cost.

The mediating role of transaction costs was not found to be significant as trust seems to be very closely and directly related to relationship. Transaction Costs seem to be a final outcome measure like performance and satisfaction rather than an influencing factor.

CHAPTER 6

DISCUSSION AND CONCLUSION

6.1 Discussion

The goal of this thesis is twofold. The first is to provide a general framework of the relationship between antecedents to trust and consequences of trust between supply chain partners. The second is to expand that framework into a model that can empirically test the key relationships between trust and its interplay with environmental variables in supply chain dyads. Although research has been done on topics related to supply chain relationships, little had been done to directly ascertain the environmental factors affecting the level of trust between partners. Finally, we also measure the relationship between resultant relational structure with performance and satisfaction, variables more relevant to practitioners.

Although, not all hypotheses were found to be significant, the directions of the relationships (positive or negative) agreed with the suggested model. The successful agreement of most of the hypotheses brings out the usefulness of the model. It also contributes to strengthening the underlying theories used in the framework.

Support for hypotheses 1 reveals the importance of the role of IT in influencing trust. "IT has been used by companies to 'automate' relationships; a tool to further nurturing partnerships" (Bensaou, 1997). As researchers of the IT artifact, to us the

significance of the above statement stands out as the most relevant as it defines the role of IT in the overall scheme of things in an organization. This also negates beliefs about IT being an inert phenomenon without the capability to influence perceptions at the organizational levels.

Trust is influenced by the level of communication within the dyad (Anderson and Weitz, 1989) and significance of hypotheses 2 involving the role of process integration and trust confirms the role of management processes in influencing trust. In a study by Zaheer and Venkatraman (1994), trust was found to be an antecedent to electronic integration. In a reversal of roles, our study has found a significant role of electronic integration in creating trust between partners. While trust may influence implementation of IT systems in future, an established IT system may start influencing trust between partners.

In testing hypothesis 3, we did not find evidence of the significance of the role of power in influencing transaction costs. According to a study by Maloni and Benton (2000), power plays a significant role in supply chain relationships. In testing the same, the hypothesized relationship in our study, although not significant, goes in the direction as hypothesized and test statistic is also close to the critical value. Part of the reason is our use of "power" instead of the "use of power" which, we believe, in retrospective, could have made the relationship significant.

The association between Trust and quality of relationship in hypothesis 4 was found to be significant. Trust generates lasting relationships (Sahay, 2003). We believe trust plays a pivotal role in the organization and shows the ubiquitous effect of trust in

relationship building across entities, whether it be across individuals or across organizations.

In testing hypothesis 5 regarding the mediating role of transaction cost in the relationship between trust and relationalism, trust was shown to be negatively associated with transaction costs. This confirms claims by Williamson (1993) about the role of trust in mitigating Transaction Cost. Interestingly, despite technological advances we still must depend on the time-tested phenomenon called trust to ensure supply chain success. This also complements conclusions from research in e-commerce area where IT has been instrumental in developing trust between parties (Sulin and Paul, 2002).

The mediating role of Transaction Costs was not found to be significant. Perhaps the reason was the differences in the basic principles underlying the two constructs. Relationalism, which is defined as the quality of the relationship, is a richer multidimensional construct involving perceptions and cognition linked to social interchange between two supply chain partners. Transaction cost on the other hand is a much more simplistic pure economic aspect more closely related to market influences.

The above model is incomplete without the measurement of final outcome measures related to success of the supply chain. Success finally rests in the minds of the users. Two ways to conceptualize success is through measuring perceived performance and satisfaction. In Hypothesis 6 and 7, we see positive relationship between relationalism and the measures of success, performance and satisfaction. Although, research is replete with papers researching the measurement of supply chain performance there are few papers tying relationship to performance. The significance of the test strengthens past studies connecting buyer-supplier relationship with performance (Maloni

and Benton, 2000). Satisfaction with the supply chain is a crucial indicator of continuance and hence the success of the partnership (Benton and Maloni, 2005). Satisfaction too was significantly related to relationship.

6.2 Contribution

Once completed, this model can be used by researchers and practitioners alike. On one hand, researchers will have a model that can be applied to different research problems; for example, the potential for studying the opposing effects of specific assets also exists. On the other hand, practitioners have a scale that they can use to assess their own supply chain relationships.

The model first emphasizes IT as a trust building factor. The significance of the relationship between IT and Trust negates claims about IT being an inert phenomenon. As evidenced by this model, IT displays dynamic nature capable of influencing perceptions like trust.

Second, the model brings out the importance of trust as a relationship builder and also its indirect relationship with outcome measures, performance and satisfaction. Social interchange phenomenon like trust still hold ground in influencing perceptions despite the advent of new management processes and cutting edge technology.

The third unique contribution of this model is its extension into outcome measures. The model convincingly demonstrates the importance of relationship in improving the performance of the supply chain.

The following sections deal with benefits specific to practitioners and researchers.

6.2.1 Contribution to Research

On the academic front, supply chains present a complex and rich phenomena to challenge researchers, who have attempted to understand and explain it with powerful theories such as Social Exchange Theory, Transaction Cost Theory, and Game Theory. The supply chain phenomenon encompasses technical, behavioral and economic aspects. Owing to this, the supply chain has become fertile ground for researchers from different disciplines. While there is extensive research done on supply chains by researchers, each researcher only studies the supply chain from the view point of his/her own discipline.

We rise to this challenge by first including a more complete set of elements including IT, trust, channel power, satisfaction and performance, so that the theoretical framework we developed would provide a comprehensive and realistic coverage of the phenomena we attempt to understand. Secondly, we exploit the power of not one theory, but multiple theoretical lenses to seek a fuller and more global interpretation of the complex relationships involved in a supply chain. The resulting theoretical framework is integrated in the sense that it includes an extensive range of the elements of the phenomena, as well as a more complete explanation of it from different but complementary theories of transaction cost and social exchange.

The use of Transaction Cost Theory in the interplay between various factors in the model brings out the legitimacy of transaction costs as an economic phenomenon worth consideration. Transaction costs are defined as a set of costs given as a reason for the boundaries of the company. Organizations form alliances to reduce transaction costs and form supply chains with their partners. Hence reduction in transaction costs forms the basis of the formation of supply chains. Both, power and trust are shown to reduce

transaction costs. This brings out the complimentary nature of power and trust. It also brings out the influence non-technical factors have over an economic aspect like transaction cost economics.

The theoretical advances achieved should provide ample opportunities for further advances in this area of inquiry, both theoretically and empirically.

6.2.2 Contribution to Practitioners

Our study brings out the following suggestions to practitioners:

- Practitioner's utmost concern is the performance of the supply chain dyad.

- This outcome depends on the type of the relationship with the buyer.

- Relationships are built on trust.

- Inter-tangling of processes, policies and IT systems across the dyads creates trust .

- Power is important and is substitutable by trust. Both, power and trust complement each other.

This thesis not only provides rich information to academics, but also acts as guidance to practitioners interested in the supply chain. Using this framework, practitioners can understand the intermingling of technological aspects of the supply chain (e.g. information systems) and its influence on behavioral aspects of the supply chain (e.g. trust) culminating in pertinent outcome measures of supply chain success. This framework brings out the importance of IT as a catalyst of trust. As, expected, the role of trust as the soul of the supply chain reiterates age old wisdom about the importance of trust in business relationships. Having said that, we believe the role of power, although not as strong as trust, is still important in defining the relationship.

Power may act as a complement to trust in defining the relationships and eventually supply chain success.

The above study would have been incomplete if we had not connected this framework with outcomes measures related to benefits. The later part of the model emphasizes the dependence of performance and satisfaction on the quality of the relationship. Here again, we confirm the contention that IT per se may be inert but combination of processes well aligned with the IT artifact can lead to better performance and hence sustainable competitive advantage.

A technically efficient IT system may not be enough in ensuring the success of the dyad. Management processes involving the partner also play a crucial role. IT integration and management processes play complementary role in defining the success of the dyad.

Although forces like power are largely uncontrollable, these change over time, which directly affect the relationships. For instance, large retail stores possess more power in the channel than they did earlier. Practitioners need to be aware of such shifts in power and adjust their power-trust combination with their partners accordingly. Companies today share information and integrate with partners, something not possible some years ago.

More controllable factors like management policies and IT integration can be manipulated in various extents to reach a certain position in response to opportunism. In many cases companies have been known to impose specific assets on partners to mitigate opportunism. Others use trust and cooperation to mitigate opportunism. Companies also

need to be aware of the advantages and perils of relational assets specific to the partnership.

This framework will provide a guideline to understanding the relationships of organizations with their partners. Through a better understanding of the influencing factors in its supply chain, practitioners can use the framework as a basis for formulating tactics and strategies for improving their supply chains operations and relationships.

6.3 Limitations

One limitation of this study is the cross-sectional nature of the data. With data collected at one point in time, it becomes a challenge to infer causality and therefore we suggest caution when interpreting the results. Nevertheless, we consider this a necessary but acceptable risk to infer associations between the various constructs.

Another limitation of the study is the low response rate, however, this may not be a serious limitation as we have done adequate tests to test for response rate bias. Additionally we also compared the demographics of our respondents with those from other studies with similar target respondents and found no significant difference.

In retrospective, the significance of power in reducing transaction costs was not found to be significant perhaps because we measured power instead of the "use of power" in a supply chain relationship. Power, per se, is static phenomenon in comparison to "use of power" which is more dynamic and more capable of influencing the transaction costs.

Lastly, most of our respondents belonged to either small or medium-sized companies. Here again, since the percentage of large companies among all organizations

is small and therefore, should not be considered a threat to the conclusions from the study.

6.4 Future Studies

No research can be considered as completely isolated. In this thesis, while we focused on only certain aspects of supply chain to contain the model, we left open many promising avenues for future research.

In order to keep the responses from being susceptible to externalities, we queried respondents regarding their role as buyers and asked them questions with respect to their supplier. A complementary study treating respondents as sellers and asking questions with respect to buyers can be conducted. As explained in limitations, we may have missed very large companies as respondents. A study comparing models in large and small companies can also be attempted.

In order to study the factors in the model in isolation, this study focused on dyadic relationships. We believe this approach has brought out a much more granular level of analysis and helps us analyze the factors in isolation. Future research can extend this study to include multiple partners in the supply chain.

While well into the development of this study, we also identified institutionalization and psychic distance theory as possible factors governing trust in a supply chain which can be used to further research in this area.

Institutional theory attends to deeper and more resilient aspects of social structure. DiMaggio and Powell, (1991; 1983) classify isomorphic institutional influences as coercive, normative, and mimetic to respectively emphasize the role of pressures exerted by government agencies, professions, and social expectations. Institutional theory

conceptualizes social reality as a human construction created through interaction which could explain, for example, the differences in perceived trust.

Psychic distance theory posits that perceptions and eventually behavior between two entities is a factor of cultural, language and political distance between the two (Johanson and Vahlne, 1990) . This too, could explain the differences in perceived trust and relationship between partners.

6.5 Conclusion

Supply chains are becoming a de-facto standard for organizations keen on remaining competitive. Competition is no longer between individual organizations, but between competing supply chains (Christopher 1992). With obvious benefits, the supply chain also comes with its own set of challenges. A need is felt, therefore, by both practitioners and academicians to better understand the supply chain and factors influencing its success.

We have developed a theoretical framework of the relationship of power, trust, transaction cost in the context of inter-organizational information systems, with consequent effects on outcome measures of satisfaction and performance. The thorough theoretical development of relationships between factors involved in the framework is relevant to both practitioners and academicians. This study brings out the interplay between technical, cognitive and economic factors in a supply chain. It caters to academic curiosity and rigor without sacrificing practical relevance. Age old solutions like trust and relationship contribute equally, if not more than new-age techniques like IT and management processes in defining a successful supply chain.

By assessing the interconnectedness of trust in inter-organizational information systems with environmental factors, our research model will help researchers as well as practitioners develop a more comprehensive and holistic understanding of factors contributing to supply chain success.

APPENDIX A

QUESTIONNAIRE

Please select one of your important suppliers, referred to as **"Supplier S",** in answering all questions.

The following statements pertain to the relationship between your firm and Supplier S.

Please indicate the extent of your agreement to each of the following statements using the following scale:
1=Strongly Disagree;   4=Neutral;   7=Strongly Agree

	1 Strongly-Disagree	2	3	4 Neutral	5	6	7 Strongly-Agree
If our relationship with Supplier S was discontinued, we would have difficulty in making up the sales volume in our trading area.	▢	▢	▢	▢	▢	▢	▢
This Supplier S is crucial to our future performance.	▢	▢	▢	▢	▢	▢	▢
It would be difficult for us to replace Supplier S.	▢	▢	▢	▢	▢	▢	▢
If our relationship was discontinued, we would have difficulty replacing Supplier S**.**	▢	▢	▢	▢	▢	▢	▢
If we stopped buying from Supplier S, they could easily replace our volume with sales to some other buyers.	▢	▢	▢	▢	▢	▢	▢

	1	2	3	4	5	6	7
	Strongly-Disagree			**Neutral**			**Strongly-Agree**
My firm shares technical resources with Supplier S to facilitate operations.	☐	☐	☐	☐	☐	☐	☐
My firm is committed to sharing responsibility with Supplier S in new product/service development and commercialization.	☐	☐	☐	☐	☐	☐	☐
My firm has active programs to positively impact our Supplier S.	☐	☐	☐	☐	☐	☐	☐
My firm has been allowing Supplier S to participate in strategic decisions.	☐	☐	☐	☐	☐	☐	☐
My firm collaborates in forecasting and planning with Supplier S.	☐	☐	☐	☐	☐	☐	☐
My firm has made investments in specific procedures, routines, and equipment dedicated to our relationship with Supplier S.	☐	☐	☐	☐	☐	☐	☐
We have routines tailored to meet Supplier S' requirements.	☐	☐	☐	☐	☐	☐	☐
We have committed time and money to train and qualify Supplier S.	☐	☐	☐	☐	☐	☐	☐

Please indicate the extent of use of **Information Technology (IT)** for each of the following activities with respect to your **Supplier S.**	1	2	3	4	5	6	7
	Minimal use of IT			**Neutral**	**Maximum use of IT**		
Shipping, receiving and Ordering raw materials or components	▢	▢	▢	▢	▢	▢	▢
Inventory control for raw material or components	▢	▢	▢	▢	▢	▢	▢
Exchanging information on finished goods inventory	▢	▢	▢	▢	▢	▢	▢
Exchanging information on production schedules	▢	▢	▢	▢	▢	▢	▢
Exchanging information on anticipated demand	▢	▢	▢	▢	▢	▢	▢
Monitoring and coordinating performance and activities	▢	▢	▢	▢	▢	▢	▢
Sharing databases, applications and files	▢	▢	▢	▢	▢	▢	▢

The following statements pertain to the relationship between your firm and Supplier S.	1	2	3	4	5	6	7
	Strongly-Disagree			Neutral			Strongly-Agree
Significant effort was required to gather the information necessary to outline the working relationship with Supplier S.	☐	☐	☐	☐	☐	☐	☐
There were many unspecified terms which had to be worked out as the relationship with Supplier S developed.	☐	☐	☐	☐	☐	☐	☐
It required significant effort to determine roles to be performed by our firm and Supplier S.	☐	☐	☐	☐	☐	☐	☐
It is easy to tell if we were receiving fair treatment from Supplier S.	☐	☐	☐	☐	☐	☐	☐
It takes significant effort to detect whether or not Supplier S conforms to specifications and quality standards.	☐	☐	☐	☐	☐	☐	☐
Accurately evaluating Supplier S requires a lot of effort.	☐	☐	☐	☐	☐	☐	☐
It is costly, in time and effort, to clearly monitor the performance of Supplier S.	☐	☐	☐	☐	☐	☐	☐

	1	2	3	4	5	6	7
	Strongly-Disagree			**Neutral**			**Strongly-Agree**
The approach to solving problems in our relationship with Supplier S is clear-cut.	☐	☐	☐	☐	☐	☐	☐
There are standard solutions or approaches to problems that might occur with Supplier S.	☐	☐	☐	☐	☐	☐	☐
Problem-solving is often challenging, due to the nature of components handled by Supplier S.	☐	☐	☐	☐	☐	☐	☐
Although solutions to problems with Supplier S, can be achieved, they often need to be highly customized.	☐	☐	☐	☐	☐	☐	☐
It is easy for Supplier S to alter the facts in order to get what they wanted.	☐	☐	☐	☐	☐	☐	☐
There is a strong temptation for Supplier S to withhold or distort information for their benefit.	☐	☐	☐	☐	☐	☐	☐
Supplier S has the opportunity to take advantage of unspecified or unenforceable contract terms.	☐	☐	☐	☐	☐	☐	☐

	1	2	3	4	5	6	7
	Strongly-Disagree			**Neutral**			**Strongly-Agree**
Our relationship with Supplier S permits flexibility in response to requests for changes.	☐	☐	☐	☐	☐	☐	☐
The parties will be open to modifying their agreements if unexpected events occur.	☐	☐	☐	☐	☐	☐	☐
If considered necessary, we may change previously agreed prices.	☐	☐	☐	☐	☐	☐	☐
In our relationship with Supplier S, it is expected that any information that might help the other party will be provided to them.	☐	☐	☐	☐	☐	☐	☐
Exchange of information in our relationship with Supplier S takes place frequently and informally and not only according to a pre-specified agreement.	☐	☐	☐	☐	☐	☐	☐
It is expected that the parties will provide proprietary information if it can help the other party.	☐	☐	☐	☐	☐	☐	☐
It is expected that the parties keep each other informed about events or changes that may affect the other party.	☐	☐	☐	☐	☐	☐	☐

	1	2	3	4	5	6	7
	Strongly-Disagree			**Neutral**			**Strongly-Agree**
In general, we and Supplier S, are jointly responsible for getting things done	☐	☐	☐	☐	☐	☐	☐
Problems that arise are treated by both parties as joint rather than individual responsibilities.	☐	☐	☐	☐	☐	☐	☐
In our relationship with Supplier S, we do not mind owing each other favors.	☐	☐	☐	☐	☐	☐	☐
In working with Supplier S, the responsibility for making sure that the relationship works for both parties, is shared jointly.	☐	☐	☐	☐	☐	☐	☐
The parties feel it is important not to use any proprietary information to the other party's disadvantage.	☐	☐	☐	☐	☐	☐	☐
In our relationship with Supplier S, neither party is expected to make demands that might be damaging to the other.	☐	☐	☐	☐	☐	☐	☐
Between us and Supplier S, whoever has more power, is expected to refrain from using this power in attempting to get its way.	☐	☐	☐	☐	☐	☐	☐

Component C refers to the collection of material supplied by Supplier S

	1 Strongly-Disagree	2	3	4 Neutral	5	6	7 Strongly-Agree
Supply operations for Component C, has improved due to our relationship with Supplier S.	☐	☐	☐	☐	☐	☐	☐
Without Supplier S the supply operation for Component C would not perform as well.	☐	☐	☐	☐	☐	☐	☐
Inventory turnover of Component C has improved due to our relationship with Supplier S.	☐	☐	☐	☐	☐	☐	☐
Our relationship with Supplier S has improved the coordination activities related to Components C.	☐	☐	☐	☐	☐	☐	☐
Our relationship with Supplier S helped us get better prices on Component C	☐	☐	☐	☐	☐	☐	☐
Dealing with Supplier S benefits our company.	☐	☐	☐	☐	☐	☐	☐
We are satisfied with dealings with Supplier S.	☐	☐	☐	☐	☐	☐	☐
We would discontinue dealing with Supplier S if we could.	☐	☐	☐	☐	☐	☐	☐
Supplier S is a good company to do business with.	☐	☐	☐	☐	☐	☐	☐
Compared to your other supply operations, the performance of supply operation for Component C is excellent.	☐	☐	☐	☐	☐	☐	☐

	1	2	3	4	5	6	7
	Strongly-Disagree			Neutral			Strongly-Agree
We think that Supplier S is dependable.	☐	☐	☐	☐	☐	☐	☐
We think that Supplier S meets its negotiated obligations to us.	☐	☐	☐	☐	☐	☐	☐
In our opinion Supplier S is reliable.	☐	☐	☐	☐	☐	☐	☐
We think that the people in Supplier S keep their promises.	☐	☐	☐	☐	☐	☐	☐
We think Supplier S keeps the spirit of an agreement.	☐	☐	☐	☐	☐	☐	☐
We think that people in Supplier S will honor the commitments made in our dealings	☐	☐	☐	☐	☐	☐	☐

1. I am working in an area which relates to dealing with my company's vendors

☐ Yes ☐ No

2. Gender ☐ Male ☐ Female

3. Age [Less than 20 ▼]

4. How many years have you worked in your organization? [1 ▼] years.

5. Your Job title ? [   ]

6. My firm places employees at a business facility of supplier S to facilitate coordination.

☐ Yes ☐ No

7. Estimate the percentage of your total supplies (in dollars) handled by Supplier S ? [   ] %.

8. The following describes my organization's primary business at my location? (select one)

☐ Consultant/ProfessionalService   ☐ Educational

☐ Financial   ☐ Hospitality

☐ InformationTechnology   ☐ Legal

☐ Manufacturing   ☐ Media/Marketing/Advertisement

☐ Medical   ☐ Retail/Wholesale

☐ Service Provider   ☐ Telecommunications

☐ Transportation   ☐ Utility

☐ Others [   ]

9. In this box, you may briefly describe actions (or approaches) undertaken by you or Supplier S that have improved the relationship.

[   ]

	Highly Standardized-----	---	----Highly Customized
10. My dealings with Supplier S are? (Choose between customized and standardized)	☐ ☐ ☐ ☐	☐	☐ ☐

APPENDIX B

SURVEY LETTER

Dear Sir/Madam:

In the past few days you received an email regarding completing our survey to win one of five IPoD shuffles.

This is a gentle reminder to complete the survey as the due date to complete the survey is Sept 16th

Your input is vital and will be deeply appreciated!

If you complete the survey by Sept 16th, you will be entered into a drawing to win one of five iPod Shuffles. If you are not permitted to win such gratuities, a donation on your behalf for an equal value will be made to The American Red Cross.

The survey will take about 20 minutes to complete. The responses will be strictly confidential and will in no way be linked to any individual respondent. If you would be willing to participate, please go to the survey

http://www2.uta.edu/infosys/survey/as/page01.asp

Thank You very much!

James Teng, Ph.D. , West Distinguished Professor
Anil Singh, Research Associate
Department of information and Operations Management, College of Business,
University of Texas at Arlington

APPENDIX C

SURVEY FRONTPAGE

Thank you for participating in this survey. Your knowledge and opinions are highly valued.

To be entered in the drawing for one of the **five iPod Shuffles**, you must complete the entire survey   by Sept 16th.

http://www.apple.com/ipodshuffle/specs.html

All responses will be kept completely confidential. Responses will be saved in a manner where there will be no way to link responses to specific individuals (You may contact Office of Research Compliance 817-272-3723 at University of Texas- Arlington regarding confidentiality). If you have any questions please contact Anil Singh by calling 817-272-3531 or e-mailing asingh@uta.edu

To participate in the survey, kindly click on the button below.

APPENDIX D

OUTER MODEL

Variable	Weight	Loading	ResidVar	Communal	Redundan
PROCESS INTEGRATION					
Pi1	-0.44	0.11	0.99	0.01	0.00
Pi2	0.51	0.55	0.69	0.31	0.00
Pi3	0.63	0.68	0.53	0.47	0.00
Pi4	0.19	0.45	0.80	0.20	0.00
Pi5	0.12	0.44	0.81	0.19	0.00
Pi6	-0.89	0.01	1.00	0.00	0.00
Pi7	0.34	0.39	0.85	0.15	0.00
Pi8	0.20	0.35	0.87	0.13	0.00
TRUST					
trust1	0.18	0.93	0.14	0.86	0.12
trust2	0.18	0.92	0.15	0.85	0.12
trust3	0.19	0.96	0.09	0.91	0.13
trust4	0.17	0.94	0.12	0.88	0.13
trust5	0.18	0.92	0.15	0.85	0.12
trust6	0.17	0.92	0.15	0.85	0.12
INFORMATION TECHNOLOGY					
it1	0.08	0.15	0.98	0.02	0.00
it2	0.08	0.26	0.93	0.07	0.00
it3	0.31	0.19	0.96	0.04	0.00
it4	0.17	0.16	0.97	0.03	0.00
it5	0.43	0.34	0.88	0.12	0.00
it6	0.12	0.06	1.00	0.00	0.00
it7	-1.22	-0.59	0.65	0.35	0.00
RELATIONSHIP					
rf1	0.10	0.59	0.65	0.35	0.35
rf2	0.10	0.60	0.63	0.37	0.37
rf3	0.07	0.49	0.76	0.24	0.24
ri4	0.12	0.69	0.52	0.48	0.48
ri5	0.11	0.68	0.54	0.46	0.46
ri6	0.09	0.53	0.72	0.28	0.28
ri7	0.11	0.66	0.57	0.43	0.43
rs8	0.12	0.73	0.47	0.53	0.53
rs9	0.13	0.75	0.44	0.56	0.56

Variable	Weight	Loading	ResidVar	Communal	Redundan
rs10	0.10	0.65	0.58	0.42	0.42
rs11	0.14	0.80	0.36	0.64	0.64
rr12	0.11	0.60	0.64	0.36	0.36
rr13	0.12	0.68	0.54	0.46	0.46
rr14	0.09	0.55	0.70	0.30	0.30
TRANSACTION COSTS					
md1	0.06	0.41	0.83	0.17	0.17
md2	0.08	0.54	0.71	0.29	0.29
md3	0.09	0.60	0.64	0.36	0.36
mm4	0.04	0.19	0.96	0.04	0.04
mm5	0.13	0.75	0.44	0.56	0.56
mm6	0.14	0.81	0.35	0.65	0.65
mm7	0.15	0.83	0.31	0.69	0.69
ma8	0.09	0.43	0.81	0.19	0.19
ma9	0.08	0.38	0.86	0.14	0.14
ma10	0.11	0.63	0.60	0.40	0.40
ma11	0.12	0.71	0.49	0.51	0.51
ml12	0.13	0.73	0.47	0.53	0.53
ml13	0.14	0.77	0.41	0.59	0.59
ml14	0.14	0.74	0.45	0.55	0.55
POWER					
Pow1	0.23	0.86	0.26	0.74	0.00
Pow2	0.16	0.88	0.23	0.77	0.00
Pow3	0.27	0.95	0.10	0.90	0.00
Pow4	0.43	0.96	0.08	0.92	0.00
SATISFACTION					
sat1	0.32	0.84	0.30	0.70	0.33
sat2	0.34	0.93	0.13	0.87	0.41
sat3	0.24	0.69	0.52	0.48	0.22
sat4	0.29	0.87	0.24	0.76	0.36
PERFORMANCE					
per1	0.27	0.86	0.26	0.74	0.30
per2	0.16	0.68	0.53	0.47	0.19
per3	0.23	0.67	0.55	0.45	0.18
per4	0.19	0.78	0.38	0.62	0.25

Variable	Weight	Loading	ResidVar	Communal	Redundan
per5	0.23	0.84	0.29	0.71	0.28
per6	0.21	0.74	0.45	0.55	0.22
FLEXIBILITY (under Relationship)					
rf1	0.43	0.85	0.28	0.72	0.00
rf2	0.44	0.88	0.22	0.78	0.00
rf3	0.36	0.71	0.50	0.50	0.00
INFORMATION SHARING (under Relationship)					
ri4	0.35	0.84	0.29	0.71	0.00
ri5	0.34	0.81	0.34	0.66	0.00
ri6	0.27	0.68	0.54	0.46	0.00
ri7	0.33	0.78	0.40	0.60	0.00
SHARED PROBLEM SOLVING (under Relationship)					
rs8	0.30	0.86	0.26	0.74	0.00
rs9	0.30	0.88	0.22	0.78	0.00
rs10	0.26	0.74	0.45	0.55	0.00
rs11	0.33	0.87	0.25	0.75	0.00
RESTRAIN (under relationship)					
rr12	0.40	0.79	0.38	0.62	0.00
rr13	0.46	0.88	0.22	0.78	0.00
rr14	0.37	0.76	0.43	0.57	0.00
DEVELOPMENT (under transaction costs)					
md1	0.30	0.86	0.26	0.74	0.00
md2	0.39	0.89	0.21	0.79	0.00
md3	0.44	0.91	0.17	0.83	0.00
MAINTAINING (under transaction costs)					
mm5	0.34	0.89	0.21	0.79	0.00
mm6	0.36	0.92	0.16	0.84	0.00
mm7	0.37	0.93	0.14	0.86	0.00
ADDRESS (under transaction costs)					

Variable	Weight	Loading	ResidVar	Communal	Redundan
ma8	0.27	0.56	0.68	0.32	0.00
ma9	0.24	0.60	0.64	0.36	0.00
ma10	0.40	0.81	0.34	0.66	0.00
ma11	0.45	0.84	0.29	0.71	0.00
LIKLIHOOD (under transaction costs)					
ml12	0.37	0.86	0.27	0.73	0.00
ml13	0.39	0.92	0.15	0.85	0.00
ml14	0.37	0.88	0.23	0.77	0.00

APPENDIX E

DISCRIMINANT ANALYSIS

Discriminant Analysis

	Process	Trust	IT Integration	Power	Satisfaction	Performance
pi1	**0.11**	0.03	0.13	0.37	0.05	0.24
pi2	**0.55**	0.15	0.09	0.39	0.21	0.35
pi3	**0.68**	0.18	0.15	0.35	0.23	0.34
pi4	**0.45**	0.12	0.05	0.29	0.12	0.25
pi5	**0.44**	0.11	0.20	0.29	0.12	0.30
pi6	**0.01**	0.00	0.02	0.28	0.15	0.31
pi7	**0.39**	0.10	-0.08	0.29	0.15	0.28
pi8	**0.35**	0.09	-0.02	0.17	0.12	0.29
trust1	0.23	**0.93**	0.31	0.21	0.76	0.60
trust2	0.25	**0.92**	0.28	0.18	0.76	0.61
trust3	0.24	**0.96**	0.31	0.14	0.77	0.60
trust4	0.26	**0.94**	0.23	0.11	0.72	0.60
trust5	0.25	**0.92**	0.25	0.07	0.71	0.55
trust6	0.24	**0.92**	0.22	0.09	0.70	0.54
it1	0.12	0.04	**0.15**	0.07	0.05	0.22
it2	0.19	0.08	**0.26**	0.15	0.17	0.31
it3	0.22	0.06	**0.19**	0.09	0.15	0.34
it4	0.22	0.05	**0.16**	0.05	0.16	0.28
it5	0.22	0.10	**0.34**	0.05	0.19	0.32
it6	0.23	0.02	**0.06**	-0.02	0.13	0.26
it7	0.15	-0.17	**-0.59**	-0.12	-0.02	0.12
rf1	0.22	0.41	0.20	0.07	0.41	0.34
rf2	0.21	0.46	0.09	-0.02	0.43	0.29
rf3	0.21	0.21	0.04	-0.05	0.23	0.25
ri4	0.20	0.51	0.12	0.05	0.54	0.48
ri5	0.12	0.41	0.06	0.03	0.45	0.40
ri6	0.14	0.22	-0.05	-0.01	0.31	0.32
ri7	0.21	0.44	0.09	0.09	0.43	0.39
rs8	0.29	0.39	0.06	0.16	0.42	0.47
rs9	0.26	0.41	0.03	0.14	0.50	0.52
rs10	0.09	0.35	0.20	0.13	0.39	0.33
rs11	0.26	0.57	0.08	0.10	0.63	0.54
rr12	0.19	0.44	0.14	0.18	0.44	0.41
rr13	0.17	0.48	0.15	0.12	0.53	0.50
rr14	0.17	0.29	0.13	0.11	0.37	0.37
md1	0.24	0.06	0.12	0.31	0.15	0.27

	Process	Trust	IT Integration	Power	Satisfaction	Performance
md2	0.14	-0.06	0.04	0.24	-0.01	0.14
md3	0.20	-0.13	0.06	0.22	-0.06	0.10
mm4	0.05	0.28	0.18	0.26	0.38	0.37
mm5	-0.01	-0.35	-0.21	0.03	-0.31	-0.16
mm6	0.04	-0.38	-0.22	0.03	-0.34	-0.21
mm7	-0.03	-0.49	-0.24	0.04	-0.40	-0.26
ma8	0.09	0.43	0.32	-0.03	0.44	0.37
ma9	0.06	0.36	0.22	-0.06	0.39	0.28
ma10	0.16	-0.20	-0.12	0.21	-0.15	0.01
ma11	0.15	-0.26	-0.16	0.22	-0.22	-0.02
ml12	0.07	-0.45	-0.23	0.06	-0.36	-0.17
ml13	-0.07	-0.52	-0.20	0.09	-0.42	-0.25
ml14	-0.04	-0.47	-0.21	0.11	-0.41	-0.22
Pow1	0.17	0.16	0.28	**0.86**	0.13	0.27
Pow2	0.26	0.19	0.21	**0.88**	0.20	0.31
Pow3	0.24	0.11	0.16	**0.95**	0.11	0.17
Pow4	0.20	0.11	0.20	**0.96**	0.13	0.18
sat1	0.19	0.62	0.16	0.29	**0.84**	0.74
sat2	0.15	0.74	0.16	0.05	**0.93**	0.69
sat3	-0.22	-0.60	-0.24	-0.09	**-0.69**	-0.39
sat4	0.17	0.70	0.19	0.05	**0.87**	0.62
per1	0.23	0.56	0.28	0.20	**0.64**	**0.86**
per2	0.16	0.35	0.19	0.41	0.41	**0.68**
per3	0.13	0.59	0.14	0.02	0.72	**0.67**
per4	0.18	0.39	0.10	0.21	0.45	**0.78**
per5	0.25	0.43	0.18	0.20	0.54	**0.84**
per6	0.17	0.52	0.11	0.11	0.60	**0.74**
rf1	0.22	0.41	0.20	0.07	0.41	0.34
rf2	0.21	0.46	0.09	-0.02	0.43	0.29
rf3	0.21	0.21	0.04	-0.05	0.23	0.25
ri4	0.20	0.51	0.12	0.05	0.54	0.48
ri5	0.12	0.41	0.06	0.03	0.45	0.40
ri6	0.14	0.22	-0.05	-0.01	0.31	0.32
ri7	0.21	0.44	0.09	0.09	0.43	0.39
rs8	0.29	0.39	0.06	0.16	0.42	0.47
rs9	0.26	0.41	0.03	0.14	0.50	0.52
rs10	0.09	0.35	0.20	0.13	0.39	0.33
rs11	0.26	0.57	0.08	0.10	0.63	0.54
rr12	0.19	0.44	0.14	0.18	0.44	0.41
rr13	0.17	0.48	0.15	0.12	0.53	0.50
rr14	0.17	0.29	0.13	0.11	0.37	0.37

	Process	Trust	IT Integration	Power	Satisfaction	Performance
pi1	**0.11**	0.03	0.13	0.37	0.05	0.24
pi2	**0.55**	0.15	0.09	0.39	0.21	0.35
pi3	**0.68**	0.18	0.15	0.35	0.23	0.34
pi4	**0.45**	0.12	0.05	0.29	0.12	0.25
pi5	**0.44**	0.11	0.20	0.29	0.12	0.30
pi6	**0.01**	0.00	0.02	0.28	0.15	0.31
pi7	**0.39**	0.10	-0.08	0.29	0.15	0.28
pi8	**0.35**	0.09	-0.02	0.17	0.12	0.29
trust1	0.23	**0.93**	0.31	0.21	0.76	0.60
trust2	0.25	**0.92**	0.28	0.18	0.76	0.61
trust3	0.24	**0.96**	0.31	0.14	0.77	0.60
trust4	0.26	**0.94**	0.23	0.11	0.72	0.60
trust5	0.25	**0.92**	0.25	0.07	0.71	0.55
trust6	0.24	**0.92**	0.22	0.09	0.70	0.54
it1	0.12	0.04	**0.15**	0.07	0.05	0.22
it2	0.19	0.08	**0.26**	0.15	0.17	0.31
it3	0.22	0.06	**0.19**	0.09	0.15	0.34
it4	0.22	0.05	**0.16**	0.05	0.16	0.28
it5	0.22	0.10	**0.34**	0.05	0.19	0.32
it6	0.23	0.02	**0.06**	-0.02	0.13	0.26
it7	0.15	-0.17	**-0.59**	-0.12	-0.02	0.12
rf1	0.22	0.41	0.20	0.07	0.41	0.34
rf2	0.21	0.46	0.09	-0.02	0.43	0.29
rf3	0.21	0.21	0.04	-0.05	0.23	0.25
ri4	0.20	0.51	0.12	0.05	0.54	0.48
ri5	0.12	0.41	0.06	0.03	0.45	0.40
ri6	0.14	0.22	-0.05	-0.01	0.31	0.32
ri7	0.21	0.44	0.09	0.09	0.43	0.39
rs8	0.29	0.39	0.06	0.16	0.42	0.47
rs9	0.26	0.41	0.03	0.14	0.50	0.52
rs10	0.09	0.35	0.20	0.13	0.39	0.33
rs11	0.26	0.57	0.08	0.10	0.63	0.54
rr12	0.19	0.44	0.14	0.18	0.44	0.41
rr13	0.17	0.48	0.15	0.12	0.53	0.50
rr14	0.17	0.29	0.13	0.11	0.37	0.37
md1	0.24	0.06	0.12	0.31	0.15	0.27
md2	0.14	-0.06	0.04	0.24	-0.01	0.14
md3	0.20	-0.13	0.06	0.22	-0.06	0.10

	Process	Trust	IT Integration	Power	Satisfaction	Performance
mm4	0.05	0.28	0.18	0.26	0.38	0.37
mm5	-0.01	-0.35	-0.21	0.03	-0.31	-0.16
mm6	0.04	-0.38	-0.22	0.03	-0.34	-0.21
mm7	-0.03	-0.49	-0.24	0.04	-0.40	-0.26
ma8	0.09	0.43	0.32	-0.03	0.44	0.37
ma9	0.06	0.36	0.22	-0.06	0.39	0.28
ma10	0.16	-0.20	-0.12	0.21	-0.15	0.01
ma11	0.15	-0.26	-0.16	0.22	-0.22	-0.02
ml12	0.07	-0.45	-0.23	0.06	-0.36	-0.17
ml13	-0.07	-0.52	-0.20	0.09	-0.42	-0.25
ml14	-0.04	-0.47	-0.21	0.11	-0.41	-0.22
Pow1	0.17	0.16	0.28	**0.86**	0.13	0.27
Pow2	0.26	0.19	0.21	**0.88**	0.20	0.31
Pow3	0.24	0.11	0.16	**0.95**	0.11	0.17
Pow4	0.20	0.11	0.20	**0.96**	0.13	0.18
sat1	0.19	0.62	0.16	0.29	**0.84**	0.74
sat2	0.15	0.74	0.16	0.05	**0.93**	0.69
sat3	-0.22	-0.60	-0.24	-0.09	**-0.69**	-0.39
sat4	0.17	0.70	0.19	0.05	**0.87**	0.62
per1	0.23	0.56	0.28	0.20	0.64	**0.86**
per2	0.16	0.35	0.19	0.41	0.41	**0.68**
per3	0.13	0.59	0.14	0.02	0.72	**0.67**
per4	0.18	0.39	0.10	0.21	0.45	**0.78**
per5	0.25	0.43	0.18	0.20	0.54	**0.84**
per6	0.17	0.52	0.11	0.11	0.60	**0.74**
rf1	0.22	0.41	0.20	0.07	0.41	0.34
rf2	0.21	0.46	0.09	-0.02	0.43	0.29
rf3	0.21	0.21	0.04	-0.05	0.23	0.25
ri4	0.20	0.51	0.12	0.05	0.54	0.48
ri5	0.12	0.41	0.06	0.03	0.45	0.40
ri6	0.14	0.22	-0.05	-0.01	0.31	0.32
ri7	0.21	0.44	0.09	0.09	0.43	0.39
rs8	0.29	0.39	0.06	0.16	0.42	0.47
rs9	0.26	0.41	0.03	0.14	0.50	0.52
rs10	0.09	0.35	0.20	0.13	0.39	0.33
rs11	0.26	0.57	0.08	0.10	0.63	0.54
rr12	0.19	0.44	0.14	0.18	0.44	0.41
rr13	0.17	0.48	0.15	0.12	0.53	0.50
rr14	0.17	0.29	0.13	0.11	0.37	0.37

	Flexibility	Informat	Share	Restrain	Develop	Maintain	Likeliho	Address
pi1	0.06	0.17	0.24	0.08	0.42	0.07	0.12	0.21
pi2	0.15	0.22	0.36	0.21	0.45	0.10	0.14	0.23
pi3	0.31	0.32	0.33	0.27	0.35	0.01	0.05	0.11
pi4	0.12	0.13	0.33	0.11	0.27	0.07	0.07	0.10
pi5	0.15	0.22	0.31	0.24	0.34	0.09	0.03	0.15
pi6	0.13	0.22	0.32	0.22	0.38	0.12	0.16	0.15
pi7	0.14	0.19	0.30	0.25	0.36	0.05	0.12	0.17
pi8	0.16	0.30	0.33	0.15	0.37	0.15	0.08	0.17
trust1	0.44	0.49	0.47	0.47	-0.03	-0.44	-0.50	-0.37
trust2	0.47	0.50	0.46	0.47	-0.03	-0.49	-0.50	-0.39
trust3	0.45	0.48	0.48	0.49	-0.06	-0.44	-0.51	-0.41
trust4	0.41	0.45	0.49	0.46	-0.07	-0.41	-0.50	-0.36
trust5	0.37	0.49	0.50	0.47	-0.07	-0.41	-0.53	-0.38
trust6	0.37	0.48	0.48	0.47	-0.09	-0.38	-0.51	-0.32
it1	0.13	0.12	0.15	0.06	0.29	0.16	0.07	0.09
it2	0.11	0.19	0.25	0.20	0.21	0.01	0.00	0.05
it3	0.13	0.25	0.26	0.10	0.43	0.04	-0.01	0.08
it4	0.11	0.27	0.26	0.11	0.39	0.04	-0.04	0.15
it5	0.14	0.30	0.25	0.14	0.32	0.03	-0.08	0.05
it6	0.15	0.22	0.26	0.15	0.31	0.07	0.01	0.12
it7	0.01	0.19	0.15	-0.02	0.27	0.25	0.16	0.29
rf1	**0.85**	0.42	0.39	0.36	0.10	-0.20	-0.29	-0.21
rf2	**0.88**	0.45	0.38	0.36	0.04	-0.20	-0.35	-0.28
rf3	**0.71**	0.33	0.37	0.29	0.09	-0.05	-0.15	-0.16
ri4	0.42	**0.84**	0.48	0.41	0.08	-0.27	-0.36	-0.23
ri5	0.40	**0.81**	0.53	0.34	0.13	-0.23	-0.24	-0.13
ri6	0.31	**0.68**	0.43	0.20	0.21	-0.04	-0.08	0.02
ri7	0.38	**0.78**	0.43	0.47	0.11	-0.22	-0.27	-0.09
rs8	0.38	0.50	**0.86**	0.44	0.36	-0.07	-0.15	0.05
rs9	0.38	0.51	**0.88**	0.44	0.29	-0.10	-0.16	-0.01
rs10	0.38	0.44	**0.74**	0.40	0.21	-0.10	-0.07	-0.06
rs11	0.41	0.55	**0.87**	0.59	0.15	-0.27	-0.40	-0.18
rr12	0.34	0.39	0.42	**0.79**	0.04	-0.17	-0.24	-0.07
rr13	0.36	0.43	0.50	**0.88**	0.08	-0.19	-0.29	-0.22
rr14	0.29	0.30	0.44	**0.76**	0.15	-0.07	-0.16	-0.09
md1	0.17	0.25	0.34	0.17	**0.86**	0.25	0.18	0.28
md2	0.08	0.12	0.22	0.13	**0.89**	0.37	0.31	0.37
md3	0.03	0.10	0.24	0.02	**0.91**	0.41	0.38	0.41
mm5	-0.16	-0.17	-0.10	-0.13	0.36	**0.89**	0.53	0.45
mm6	-0.15	-0.22	-0.13	-0.13	0.39	**0.92**	0.59	0.52
mm7	-0.18	-0.24	-0.16	-0.15	0.41	**0.93**	0.63	0.52
ma8	0.40	0.32	0.35	0.32	0.04	-0.36	-0.33	**-0.56**

	Flexibility	Informat	Share	Restrain	Develop	Maintain	Likeliho	Address
ma9	0.35	0.23	0.24	0.29	-0.02	-0.24	-0.25	**-0.60**
ma10	-0.11	0.01	0.12	0.00	0.45	0.45	0.39	**0.81**
ma11	-0.08	-0.02	0.09	-0.01	0.51	0.47	0.53	**0.84**
ml12	-0.26	-0.21	-0.18	-0.24	0.34	0.53	**0.86**	0.49
ml13	-0.28	-0.31	-0.27	-0.26	0.29	0.60	**0.92**	0.47
ml14	-0.34	-0.30	-0.19	-0.26	0.29	0.57	**0.88**	0.47
Pow1	0.00	0.07	0.20	0.20	0.28	-0.02	0.06	0.14
Pow2	0.07	0.07	0.19	0.19	0.26	-0.05	0.02	0.13
Pow3	-0.02	0.02	0.11	0.10	0.22	-0.01	0.08	0.20
Pow4	-0.01	0.05	0.13	0.15	0.28	0.07	0.15	0.23
sat1	0.36	0.53	0.49	0.52	0.12	-0.31	-0.27	-0.20
sat2	0.38	0.55	0.56	0.52	-0.03	-0.38	-0.44	-0.37
sat3	-0.39	-0.32	-0.40	-0.36	0.01	0.35	0.39	0.29
sat4	0.36	0.44	0.48	0.46	-0.04	-0.34	-0.41	-0.39
per1	0.38	0.47	0.55	0.47	0.20	-0.24	-0.24	-0.15
per2	0.13	0.27	0.33	0.37	0.19	-0.09	0.00	0.04
per3	0.34	0.44	0.43	0.35	0.00	-0.27	-0.38	-0.43
per4	0.18	0.32	0.40	0.39	0.16	-0.12	-0.10	0.02
per5	0.23	0.41	0.44	0.45	0.20	-0.16	-0.07	0.02
per6	0.32	0.40	0.38	0.39	0.07	-0.26	-0.26	-0.22
rf1	**0.85**	0.42	0.39	0.36	0.10	-0.20	-0.29	-0.21
rf2	**0.88**	0.45	0.38	0.36	0.04	-0.20	-0.35	-0.28
rf3	**0.71**	0.33	0.37	0.29	0.09	-0.05	-0.15	-0.16
ri4	0.42	**0.84**	0.48	0.41	0.08	-0.27	-0.36	-0.23
ri5	0.40	**0.81**	0.53	0.34	0.13	-0.23	-0.24	-0.13
ri6	0.31	**0.68**	0.43	0.20	0.21	-0.04	-0.08	0.02
ri7	0.38	**0.78**	0.43	0.47	0.11	-0.22	-0.27	-0.09
rs8	0.38	0.50	**0.86**	0.44	0.36	-0.07	-0.15	0.05
rs9	0.38	0.51	**0.88**	0.44	0.29	-0.10	-0.16	-0.01
rs10	0.38	0.44	**0.74**	0.40	0.21	-0.10	-0.07	-0.06
rs11	0.41	0.55	**0.87**	0.59	0.15	-0.27	-0.40	-0.18
rr12	0.34	0.39	0.42	**0.79**	0.04	-0.17	-0.24	-0.07
rr13	0.36	0.43	0.50	**0.88**	0.08	-0.19	-0.29	-0.22
rr14	0.29	0.30	0.44	**0.76**	0.15	-0.07	-0.16	-0.09

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