COORDINATION AND CONTROL OF RETAILER-SUPPLIER TRANSACTIONS: FACTORS INFLUENCING ORGANIZATIONAL ADOPTION AND USE OF ELECTRONIC INFORMATION NETWORKS

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ABSTRACT

COORDINATION AND CONTROL OF RETAILER-SUPPLIER TRANSACTIONS: FACTORS INFLUENCING ORGANIZATIONAL ADOPTION AND USE OF ELECTRONIC INFORMATION NETWORKS

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This dissertation research investigates the factors influencing organizational adoption and use of electronic information networks. It focuses specifically on retailer-supplier transactions associated with product acquisitions. Derived from transaction cost analysis, several factors antecedent to electronic network adoption and use are proposed; they include uncertainty, asset specificity and complexity of product description. In addition, three social relational predictor variables are tested, namely interpersonal relationships, mutual commitment and trust. One of the dependent variables is an information technology cluster, which measures the adoption of six information technologies that enable electronic exchange of information. The other major criterion variable deals with the perceived importance of electronic network use to supporting transactions associated with product acquisitions.

Empirical observations were obtained from a telephone survey of 143 U.S. grocery retailers. Interviews focused on the way in which product buyers acquired key products from their major suppliers. One main finding is that significant predictors of technological adoption and network use are different. In particular, adoption is more likely when technology is viewed as a functional substitute for two social relational modalities of coordination and control: interpersonal relationships with and trust in the

supplier. Trust and the importance of electronic network use also appear to be substitutable in managing transactions that involve routine, straightforward communication of price and order information. Furthermore, in executing these same types of transactions, using an electronic interconnection with a supplier appears to be a tangible indication of mutual commitment between the trading parties. When the transactions involve higher complexity, ambiguity or need for recursive interactions with the supplier (e.g., negotiations, monitoring and problem solving), a different group of factors are found to be correlated with electronic network use. First, electronic network use is perceived as complementary to interpersonal relationships as a coordination and control mechanism. In addition, electronic network use is strongly associated with high levels of complexity of product description: by offering sophisticated capabilities for representing and transmitting information, technologies facilitate the communication of a product's critical features, which are otherwise difficult to describe. All analyses controlled for the impact of organizational size and retailer-supplier integration.

In conclusion, this research shows that social relational factors influence organizational adoption and use of electronic networks in ways that are not explained by transaction cost variables. Future research efforts devoted to the refinement of the conceptualizations and measurement proposed in this study can further test the relative utility of transaction cost and social relational analyses. At a practical level, findings in this research suggest that retailers should not be concerned with technological implementation costs alone. Decisions to adopt and use electronic networks need to factor in the varying complementary and substituting relationships technologies have with the pre-existing social relational conditions characterizing trade with suppliers.

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Chapter 1

INTRODUCTION

Why Do (Should) Organizations Use Information Technology?

The question of why organizations ought to use information technology is not a new area of inquiry. Researchers spanning across several decades have been intrigued with what the antecedents are to the successful diffusion and adoption of innovations (e.g., Burns & Stalker, 1961; Rogers, 1962, 1986, 1995). Contemporary literature suggests that organizations use information technology to achieve greater efficiencies in their internal operations and transactions with external suppliers and customers. This desire to be more efficient can be traced to two major sources of motivations: (i) attaining a strategic necessity, e.g., following the technological "norm" in the industry or matching the actions of competitors; and (ii) pursuing competitive advantage, e.g., attempting to out-perform industrial rivals or gain a larger market share (Bradley, 1993; Porter & Millar, 1985; Sabherwal & Vijayasarathy, 1994; Venkatraman & Zaheer, 1994).[1]

Different theories adopted to study organizations carry different assumptions about how firm requirements are met (e.g., managing differentiated but interdependent units and tasks).[2] In turn, predictions and explanations for organizational adoption and

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[1] See other contributions to the volumes edited by Bradley, Hausman and Nolan (1993) and Allen & Scott Morton (1994) on reasons for implementing different types of information technology, networks and systems, and their relationships with intra- and inter-organizational structure, processes and other issues.

[2] For instance, "organic" (as opposed to "mechanistic") approaches that recognize organizations as open systems call attention to the impact of external contingencies,

use of information technology vary according to the theoretical angle used. For instance, economic theory is useful in helping to shed light on the impact of costs, such as how the reduction in the costs of coordination can motivate technology use. Social relational approaches can help to explain other variables affecting technological use that are less directly related to costs, such as, how an electronic information network is perceived to fit the established network of communication and social relationships. What can be observed is that these different perspectives complement each other in identifying conditions driving organizational technology adoption and use.

As the introduction to this dissertation, this chapter presents the research question addressed and how it is derived. Presented first is a brief review of how information technology supports communication for the purposes of coordination and control, especially in the inter-organizational context. Integrated in the discussion is an introduction to how transaction cost and social relational factors help to explain the way these communication objectives can be facilitated by electronic information networks. Following this review, the research question is stated, and the rationale and significance of the study presented. This chapter closes with an overview of the dissertation.

Information Technology: Communication for Coordination and Control

Many organizations, especially large ones, tend to be highly complex and differentiated, with many inter-related functional subunits performing tasks and activities

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(*continued from previous page*)

such as environmental uncertainty, on managerial decision making. See Morgan (1986) for a comparative review of "classical" theories of organizations.

(Lawrence & Lorsch, 1967). As organizations become more complex and differentiated, rules, programs and other mechanisms are needed to integrate and coordinate these interdependent tasks and subunits (Lawrence and Lorsch, 1967; March & Simon, 1958, 1993; Tushman & Nadler, 1978). It is through coordination that otherwise disparate activities or events are brought into a relationship, and diversified functional units integrated into the overall organizational structure (Allen & Hauptman, 1990; Frances, Levacic, Mitchell, & Thompson, 1991). The more effective organization is one that has a greater capacity to exchange information among subunits, thereby allowing for higher coordination of tasks (Hart & Estrin, 1991).

Tushman and Nadler (1978) submitted that coordination is achieved when there is a match between information processing capacities and requirements within the organization. Information processing requirements are created by such factors as task ambiguity and uncertainty. If these requirements could not be reduced, the organization facing them must be able to increase its information processing capacities. The key is that there must be a fit between information processing requirements and capacities. Because information technology effectively expands a firm's information processing capacities, coordination is enhanced. Therefore, facilitating the critical function of coordinating interdependent tasks among organizational subunits becomes a driving force for information technology use (Galbraith, 1973; Thompson, 1967).

The role played by communication and information networks in coordination is also articulated in the conceptualization of organizations as "communication networks in which actors or subunits recurrently process resources and information" (Dow, 1988, pg.

56). Based on this conceptualization, technology defines the channels and range of information available to an organization. In addition, the significance of communication in coordination is explicitly stated in the definition of coordination structure as "a pattern of decision-making and communication among a set of actors who perform tasks" (Malone, 1987, pg. 1319).

In order for there to be successful coordination among and integration of highly differentiated organizational units, appropriate control mechanisms are necessitated (Beniger, 1986, 1990; Galbraith, 1973; Thompson, 1967). According to Beniger's characterization (1990), as control technologies, formal organizations exist "to control large numbers of elements, excessive scope or complexity of interactions and contingencies, or an otherwise unmanageable volume of processing" (pg. 34). He also argued that information constitutes the basis of control, and that every task performed by information technology is directed towards control. Extending this argument, Nass and Mason (1990) contended that "*all* forms of control are based on information-processing and feedback" (pg. 57).

The Inter-organizational Context

In many ways, communication is more important to coordination and control when dealing with external suppliers or customers than internal organizational subunits (Rockart & Short, 1989). One major reason stems from the need to reduce information asymmetries that often exist in a trading situation. For instance, in order to know if a potential supplier's offer is attractive, the buyer needs information on the fair market

price. Another reason can be traced to the general lack of direct control on an external trading constituent, relative to an internal department or a division of the company of which there are ownership ties between the parties doing business with each other.

From a structural perspective, many organizational forms in existence to-date are not strict hierarchies, operating solely on bureaucratic administrative rules, nor are they pure markets, in which contracting relies on price competition (see contributions in Thompson, Frances, Levacic & Mitchell, 1991). Furthermore, few organizations are self-sufficient, but rather must depend on and interact with external constituents (e.g., suppliers of needed raw materials) to meet various resource requirements (Pfeffer & Salancik, 1978). These observations again point to the fact that managing inter-organizational relationships and interdependence necessitates coordination and control. Therefore, it should not be surprising to find communication and information exchanges to be central to the maintenance of inter-organizational relational networks (Flanagin, Monge & Fulk, 1997).

Furthermore, as much as communication and interactions within the boundaries of an organization are supported, electronic networks can facilitate the same functions of information exchange and processing in the inter-organizational context. At an intuitive level, electronic networks may be more important to inter-firm coordination and control, as opportunities for face-to-face interactions are often fewer when working with external constituents. In fact, inter-organizational networks, most notably electronic data interchange (EDI) systems, have been recognized for helping to ease the burden of interacting with suppliers, customers and other groups, and play a key role as a linking

element of business relationships (Davidow and Malone, 1992; Rockart & Benjamin, 1991). Well known cases of success include Baxter International's (previously known as American Hospital Supply Corporation) ASAP system and McKesson's Economost system. These electronic supplier-customer networks have helped to boost overall sales for these two supplier firms and improve their positions in the respective markets of hospital supplies and drugs (Clemons, 1993). In addition, inter-firm data networks have been found to enable full-scale coordination in form of customer-supplier partnerships, bringing both parties benefits beyond cost-savings associated with reducing inventory levels (Konsynski & McFarlan, 1990; Malone, Yates & Benjamin, 1989). Overall operations associated with production, delivery and processing of ordering and billing for both the buying and selling firms are trimmed substantially.

Transaction Cost Analysis

Over the last ten years, much of the discussion on how electronic information networks facilitate intra- and inter-organizational coordination and control has focused on economic variables, adopting the transaction cost analytical framework (Malone et. al., 1987).[3] Electronic networks are evaluated in the context of how they relate to changes in production and transaction costs that are associated with different coordination structures

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[3] In the article, Malone et. al. (1987) focused more explicitly on the benefits associated with coordination, i.e., the reduction in transaction costs, than the issue of control. How electronic networks can serve the control function is more implicit, as embedded in the framework of hierarchical governance and market coordination in transaction cost theory advanced by Williamson (1975).

governing any given set of economic activities (e.g., acquiring a key raw material for the production of a product).

Coordination places intense requirements on communication and information processing associated with such factors as uncertainty, asset specificity and complexity of product description faced by an organization (Malone et. al., 1987). Uncertainty relates to the unpredictability of such business environmental conditions as that associated with the availability a key asset (e.g., a product). Asset specificity deals with the extent to which a needed asset is specific to an organization. Complexity of product description concerns the difficulty in describing the critical attributes of a product that affects buying decisions. High levels of uncertainty, asset specificity and complexity of product description all serve to drive up the costs of coordination.[4] Therefore, by facilitating communication and information processing associated with these factors, electronic networks can help to lower coordination costs (Malone, et. al., 1987, 1989). (Conceptualization and operationalization of these variables will be discussed more in detail in Chapters 2 and 3, respectively.)

Adopting this applied transaction cost theoretical approach, it would appear that a key motivation for using electronic networks would be the reduction of coordination costs. As coordination costs are driven by the levels of uncertainty, asset specificity and complexity of product description, it is hypothesized that these three transaction cost analytic factors will likely affect electronic networks use for coordinating transactions.

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[4] Malone et. al. (1987, 1989) used "transaction costs" to distinguish between external coordination costs, i.e., those incurred in the market place, and internal coordination costs, or what Williamson (1975) called "governance costs."

Social Relational Analysis

Many social theorists posit that economic exchanges are embedded in particular social structural environments (e.g., Bradach and Eccles, 1991; Granovetter, 1985). Purposive actions, including those associated with the diffusion of innovations, are shaped and constrained by the established social structures in an organization (Burt, 1982; Valente, 1995). Therefore, merely focusing on cost considerations would lead to overlooking the impact of social relations on whether and how information networks are used for communication, coordination and control. In support of this position, Contractor and Eisenberg (1990) argued that in order to understand technology, one must first understand social relationships.

Furthermore, Nohria & Eccles (1992) observed that there has been converging use of the label "networks" to convey both the connotation of organizational structure and the technological sense of the term.[5] Childs (1987) called this phenomenon the "mutuality" between organizational and information technology design. These observations are suggestive of the possibility that the established social relational structure and norms of communication serve as the underlying commonality defining both the organizational structure of coordination and control, as well as the web of electronic links for supporting information processing and exchange.

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[5] They cautioned that such converging use of the term is often misguided, and that the structure of a technological network is not necessarily equivalent to the communication network characterizing the organizational structure. Not to misrepresent what these researchers wrote, the significance of pointing out this converging use of the term "network" is in highlighting the fact that the configuration of an electronic network is likely related to and affected by organizational structure.

Based on this empirically testable connection between the social relational norms and information networks, a likely set of key antecedents to adopting and using electronic linkages would be factors characterizing established relationships. These relationships can be among divisions of an organization (internal) or trading firms (external). Some important social relational variables to be considered include interpersonal relationships, trust and mutual commitment that exist between the buyer and seller firms. If electronic network use is indeed to be consistent with the pre-existing norms of interactions and patterns of relationships, these social relational variables ought to have impact on how electronic networks are used to support these relational norms and patterns. (These variables and their hypothesized relationships with network adoption and use will be discussed further in the next chapter.)

Research Question

The above introduction provides the conceptual background to why information technologies and networks are needed in organizations, and what are likely some key conditions influencing adoption and usage. Specifically, it is proposed that there are transaction cost and social relational factors in communication and information exchanges within and between organizations for coordinating and controlling important tasks. The present research integrates theoretical insights from these two bodies of literature in the study of electronic information network adoption and use in supporting important buyer-seller transactions. In particular, the research is aimed at addressing the following research question:

What are the factors influencing organizational adoption and use of electronic information networks in retailer-supplier transactions associated with product acquisitions?

General reports by the trade press have continually suggested that electronic networks, such as EDI systems, are increasingly perceived to be a significant mechanism for industrial buyer-seller transactions and interactions. This is especially true in the retail sector, where electronic supplier-customer interconnections can help the ordering and stocking of products become more efficient and less costly. Anecdotal observations aside, existing research has also been mainly conceptual and case-based with limited generalizability. It would appear that there is a lack of empirical, generalizable insights into the conditions favoring the adoption and use of electronic communication links to support commercial transactions. The current research aims at filling this void, subjecting to empirical scrutiny the hype concerning the importance of electronic information networks to retailer-supplier transactions.

Based on this rationale, the empirical study of the above stated question entails a survey of 143 grocery buyers in the United States. It is focused on the importance of computer-based information networks to the acquisition of key products from major suppliers. In turn, the significance of the research undertaken lies in contributing to the currently limited generalizable, empirical knowledge about the importance of electronic interconnections to supporting retailer-supplier transactions. Key factors antecedent to network use and adoption that are identified and tested in the current study can aid

managerial decisions concerning technologies. In addition, the findings obtained can serve to guide future research aimed at continuing the study of electronic interconnections in retail trade. This includes other industries that share similar characteristics as grocery retailing (e.g., apparel).

Overview of this Dissertation

In the next chapter (Chapter 2), the theoretical and empirical literature on transaction cost economics and social relations is examined in more depth, introducing the key concepts studied and the associated hypotheses tested.

Chapter 3 discusses the methods and procedures used in this project, i.e., measurement and data collection. Included in the chapter are the descriptions of how variables have been operationalized, as well as the rationale for and procedures used in the telephone survey of grocery retailers.

Data processing and statistical procedures employed to prepare and analyze the collected data are presented in Chapter 4. Also reported in this chapter are the overall results, which reveal varying patterns of relationships between the two sets of independent variables and the different operational measures of electronic network adoption and use. Factors that are strongly associated with technological adoption do not appear to have significant impact on the perceived importance of retailer-supplier electronic linkages. Furthermore, significant predictors of the importance of electronic network use to carrying out product acquisition activities of varying nature are different; these activities differ in their demands on interactive communication between a retailer

and its supplier. Theoretical and methodological explanations for these observed findings are discussed in Chapter 5.

Finally, Chapter 6 closes the presentation of this dissertation research with concluding observations. In addition to a summary of findings, discussion in the chapter covers the limitations stemming from conceptual caveats and drawbacks associated with the measurement and research design adopted in the current study. Theoretical and practical implications are also presented.

Chapter 2

REVIEW OF THEORETICAL AND EMPIRICAL LITERATURE

Introduced briefly in the last chapter is the central proposition of this dissertation research, that the adoption and use of electronic information networks in organizations is affected by organizational conditions and requirements, some of which are transaction cost variables and others are social relational factors. The common underlying link connecting the utility of economic and social theories in the current inquiry is the role electronic communication and information networks play in coordination and control.

Economic theory deals mainly with "objective" conditions in that actions are aimed at responding to contingencies and constraints imposed by the environment. Following this perspective, technology adoption and use for the purposes of coordination and control is driven largely by objective needs, as created by the industrial and market environment in which a firm carries out its business activities and transactions.

What is also recognized is that, rather than involving completely autonomous, atomized units in the market place, many economic transactions are often conducted among the same trading partners with a history of interacting with each other. Given the existence of recurring transactions, relationship-based factors will likely play a crucial role in whether and how networks are used to help coordinate and control these exchanges.

As can be readily inferred, it would appear that theoretical insights grounded in economic and social literature offer thoughts in complementary domains concerning what

are some key factors driving the adoption and use of information technology to support transactions. This chapter presents a review of the transaction cost and social relational literature that helps to shed light on different antecedents to electronic information network adoption and use in organizations.

Transaction Cost Factors

To date, transaction cost analysis, as advanced by Williamson (1975), is a popular theoretical approach used to study electronic network use and its relationship to structures of coordinating economic activities, namely, "markets" and "hierarchies" (e.g., Benjamin & Wigand, 1995; Gurbaxani & Whang, 1991; Kraut, Steinfield, Plummer, Butler & Hoag, 1997; Steinfield, Caby, Jaeger & Kraut, 1997). Initiation of this research "trend" is credited to the seminal précis on "electronic markets" and "electronic hierarchies" by Malone, Yates and Benjamin (1987). This section traces the roots and key propositions of this approach, leading to the derivation of the first three hypotheses tested in this study.

Transaction Cost Theory

Grounded in the neoclassical economic paradigm, the theory of the firm posits that hierarchies in the form of organizations emerge to internalize coordination of economic activities as a consequence of market failure (Coase, 1937). Market failure refers to the inability of price mechanisms to bring together efficiently sellers and buyers in the open market place. One of the chief reasons for prices failing to match supply with demand is the presence of imperfect information, thereby violating a key assumption of

perfect markets. What this means is that, without incurring high costs of search and negotiations, a procurer of a needed good or service cannot know what the best offer might be in the market (Hennart, 1986). In this scenario, inefficient coordination by price mechanisms is replaced by decision making by managerial fiat in hierarchies.

Building on this assumption that firms exist because markets fail, institutional economist, Oliver Williamson (1975) advanced transaction cost theory to elaborate on how various conditions associated with an imperfect market affect the costs of coordination and control. Rational economic actors must choose between the two alternative structures of hierarchies or markets for coordinating the performance of economic activities, whichever minimizes costs. Relative to markets, hierarchies generally incur higher production and internal governance costs associated with all processes necessary to produce or distribute a product or service. However, when it is difficult to anticipate all possible contingencies of transacting with an external supplier, negotiations will likely become cumbersome and complicated. In addition, the costs of detailing a complete contract to deal with these contingencies will be high. In effect, the costs of transacting with this party will increase, perhaps to the point of exceeding the costs of having the needed product made or service performed by a unit owned (fully or partially) by the organization. When this is the case, incentives exist to internalize production to minimize costs, thereby substituting complex, costly negotiations of transacting in the market with internal governance.

According to transaction cost theory, whether it is more costly to practice hierarchical governance or conduct market transactions depends on the amount of

uncertainty associated with the key economic activities to be performed (Williamson, 1975; 1979). For instance, if it is highly uncertain as to how often, from whom and/or how much of a key asset can be obtained when needed, it may be very difficult and costly to detail adequately in a contract all possible contingencies that may arise.

The desire to reduce such uncertainty will lead to internal production of the asset, rather than relying on external suppliers. Again, a key motivation is to minimize transaction costs incurred in searching for, negotiating with, monitoring and settling with an external supplier. Another important underlying motivation for internalization is to maximize control. Typically, management can exert considerably more control over an internal division or a corporate subsidiary than an outside trading partner or contractor.

A number of organizational researchers have dealt with this notion that managers face a high level of difficulty making rational decisions when there is high uncertainty (e.g., March & Simon, 1958, 1993; Lawrence & Lorsch, 1967; Pfeffer & Salancik, 1978). Nohria and Eccles (1992) argued that successful interactions depend on how well uncertainty in all exchanges are resolved. In this regard, internalization allows for much external uncertainty to be absorbed, resulting in savings on communication costs and permitting the activation of incentive, monitoring and control processes (Hennart, 1986; Klein, Frazier & Roth, 1990). As a case in point, Anderson (1985) concluded that an advantage for employing an internal sales force, as opposed to contracting external, independent agents, is the substitution of surveillance for commission as a control mechanism.

In addition to uncertainty, production and transaction costs are affected by the characteristics inherent in what a firm needs in order to perform its business functions, for example, the distribution of a product. These needs are generally manifested in such factors as raw materials, equipment and human knowledge necessary to perform the core activities of an organization. The extent to which these needs are specific to any given organization has been termed asset specificity (Williamson, 1975). An example of a highly specific asset is a button that carries the crest or design of a particular apparel manufacturer, which is useless to other clothes-makers. Exclusive knowledge of idiosyncratic business philosophies or practices of a client firm to an advertising agency is another case in point.

When the specificity of a needed asset is high, an organization is vulnerable to being taken advantage of by opportunistic suppliers, who are in the position to capitalize on the buyer's dependence (Williamson, 1975, 1979). Furthermore, this vulnerability is exacerbated when the *ex-ante* number of suppliers is small. Knowing that the buyer has few alternatives, an opportunistic supplier can, for instance, charge a higher than fair market price. In order to avoid being placed in a vulnerable position or being forced into small-numbers bargaining, the firm will have incentive to internalize the production/supply of this specific asset, since with ownership comes control. Alternatively, some means of locking in one of the few providers must be devised to control the likelihood of opportunistic behavior. As an example, due to reasons such as the time it takes for someone's learning curve to run its course and the desire to preserve trade secrets, an organization will likely opt to hire a software engineer internally to

develop its proprietary computer-aided manufacturing system than to outsource this job to an external contractor who has few incentives to be loyal to the firm. Empirical observations have generally lent support to this hypothesized relationship between asset specificity and coordination structure (e.g., Klein et. al., 1990; Kraut et. al., 1997; Steinfield et. al., 1997).

Electronic Markets and Electronic Hierarchies

What has precipitated from these transaction cost considerations are some areas in which electronic communication networks can facilitate the coordination and control of transactions and business activities. The main effect is in the reduction of all types of coordination costs, including those associated with search, conveying product information and quality monitoring (Bakos, 1991; Gurbaxani & Whang, 1991). Bakos & Treacy (1986) also proposed that electronic networks can reduce the costs of contracting (with external trading constituents) and monitoring, thus aiding in overcoming managerial bounded rationality and vulnerability to opportunism.

Although cost savings apply to both hierarchical production activities and market transactions, Malone et. al. (1987, 1989) argued that external coordination costs will be reduced more relative to internal governance costs. As a result, electronic interconnections will favor the evolution of what they called "electronic markets" over "electronic hierarchies." Benjamin and Wigand (1995) concurred with this proposition, contending that network use has the potential to drive transaction costs down to fairly close to non-existence.

Malone et. al. (1987) suggested three broad types of cost savings associated with electronic network use. First, there is the electronic communication effect, which deals with the fundamental improvement in overall communication and information exchanges. In addition, electronic linkages enhance the tighter coupling of production and distribution activities; this is the electronic integration effect. An example of this improved integration is the practice of just-in-time product ordering and delivery in the retail sector being enhanced by EDI systems. A third type of cost savings is the electronic brokerage effect, which entails the idea of electronic information networks serving the functions of a broker in bringing together buyers and sellers. By connecting buyers with suppliers in a central database, needs and offerings can be matched more efficiently and cost-effectively.

Due to savings in the costs of communication and information processing, electronic networks can help with coordination and control by reducing uncertainty. When the uncertainty faced by an organization is high, sound decision making necessitates a greater amount of information to be gathered, interpreted and synthesized (Galbraith, 1973; Tushman & Nadler, 1978). In order to control this situation, there must be either a reduction in the amount of information to be processed or an increase in the capacity to process information. Electronic information networks effectively increase the technological capacity available to an organization for meeting the heightened information processing demands, and, as a result, place the firm in a better position to cope with uncertainty. In support of this observation, Sabherwal & Vijayasarathy (1994)

found empirical evidence that organizations rely on telecommunication links with suppliers in the face of high environmental uncertainty.

Since this study is focused on electronic network use in supporting retailer-supplier interactions related to product acquisitions, the most relevant form of uncertainty would be that related to the contingencies surrounding those transactions. This is in contrast to examining uncertainty arising within the retailer firm, such as that associated with staffing requirements. Therefore, in this study, *uncertainty is conceptually defined as the predictability of the conditions in which a transaction takes place.*

Based on the discussion thus far, electronic network adoption and use would be motivated by the need to reduce high uncertainty, and thus the following relationship is hypothesized:

H1: Uncertainty is positively associated with electronic network adoption and use.

Furthermore, Malone et. al. (1987) argued that electronic information networks can diminish the constraints on the market coordination of economic activities stemming from asset specificity. As defined earlier, *asset specificity deals with the extent to which a needed asset is specific to any given organization* (Williamson, 1975). (In the current study, the asset needed is the product bought and sold.) With electronic interconnections, producers become more aware of similar product needs faced by multiple buyers, which may have been previously deemed as highly asset-specific. Having this information concerning a larger market than previously known, more firms will be willing to get

tooled up for production, effectively increasing the number of suppliers in the market. A potential benefit is in electronically gathering and linking up information about suppliers who may be geographically spread out, thereby reducing the difficulty and costs of search. These effects serve to attenuate the threat of small-numbers bargaining and fear of opportunism, affording procurers of needed assets more choices in the marketplace. In turn, firms are rendered less vulnerable to being taken advantage of by few powerful suppliers or customers in the market. As such, it would appear that a rational motivation to adopt and use networks is to overcome the disadvantages associated with high asset specificity.[1]

Similar logic applies to the effect of network use in reducing the impact of the complexity of product description. Product description deals with the information a buyer needs to have in order to evaluate the features of an offering that ultimately affects the purchasing decision (Porter & Millar, 1985). *Complexity of product description*, then, *refers to the difficulty in describing these critical product attributes.*

In the context of coordinating supplier-customer transactions, it is important that the information about products be usable to the buyer (Malone & Crowston, 1994). Electronic networks, especially sophisticated systems offering multimedia features, can help to convey complex information. Moreover, by allowing buyers to have information about the offerings of alternative trading partners of whom these buyers may have not

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[1] Of course, the above arguments are based on the assumption that all eligible firms are equally well-represented on the networks being used, and that information about possible trading partners is available electronically, at least in the sense of being useful to an organization for deciding among alternatives.

been aware previously, the relative imbalance of power, dependence and bargaining positions can be potentially eliminated (Johnston & Vitale, 1988).

Most business and economic researchers using transaction cost analysis have treated coordination structures as a dependent variable; electronic network use, if studied, has been modeled as an independent variable or a moderator of the relationship between asset specificity and coordination structure. Kraut et. al. (1997) found that, aside from predicting the level of internalization of production activities, various types of asset specificity and the complexity of product description have meaningful associations with whether networks have been used and regarded as important. These findings are particularly true for the cases in which networks have been used for coordinating internal activities (as opposed to enhancing transactions with outside contractors and suppliers). This 250-case empirical study of four American industries extends transaction cost analysis to a large-scale study of electronic network use within and between organizations. Similar results were also found in a replication of the study in France (Steinfield et. al., 1997), suggesting that the utility of the transaction cost analytical framework applies to another country that has markedly different characteristics in terms of market conditions and network infrastructure and use.

Derived from the above review are the following hypotheses regarding how asset specificity[2] and complexity of product description relate to electronic network adoption and use:

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[2] Following explication in the literature, three types of asset specificity are measured in this study, namely, product specificity, time specificity and knowledge specificity. These measures are discussed in the methods chapter (Chapter 3).

H2: Asset specificity is positively associated with electronic network adoption and use.

H3: Complexity of product description is positively associated with electronic network adoption and use.

The above hypothesis concerning the complexity of product description is based on the finding reported by Kraut et. al. (1997), which represents the only empirical test of the construct to date. Contrary to the original conceptualization by Malone et. al. (1987), Kraut et. al. (1997) found that the less difficult it is to describe a product, the more likely electronic interconnections are viewed to be important in producer-supplier transactions. One possible explanation for the contradiction could be the difference in network capabilities. When the construct of complexity of product description was first introduced a decade ago, the state of technology did not include multimedia features, which are supported by today's systems and networks, such as the Worldwide Web. Visual images provide an effective and "easy" way to represent product description that might be difficult to express in other media forms or modalities (e.g., a text-based data network). The current study takes into consideration the increased sophistication of information technology today as compared to what was available during the original inception of the construct of complexity of product description. Hypothesis 3 stated above is an empirical test of this consideration.

Social Relational Factors

Critics of neoclassical and institutional economics call attention to the fact that these paradigms carry biases and limiting conditions, which must be recognized when applied to the study of organizational phenomena. Most importantly, limitations exist in the key assumptions of these economic perspectives in viewing social relations in transactions as a source of "friction" (Biggart & Hamilton, 1992). Social relations are arguably seen as conflict to the presumed preferences of economic actors: the pursuit of self-interests through arms-length transactions in open markets consisting of atomized buyers and sellers. These perhaps flawed assumptions about the pursuit of self-interests, frequently at the expense of another party (as often modeled in game theory), belie the concerns for vulnerability and opportunism (Parkhe, 1993). Even if these assumptions were accurate reflections of reality, as observed by Granovetter (1985), it is unclear how strategies like internalization can guarantee elimination of opportunism.

There are a host of coordination and control mechanisms, such as trust and mutuality of interests, that are typically not present in spot-market transactions, but rather operate on a relational basis (Bradach & Eccles, 1991). In addition, negotiations often take place in the context of a relationship rather than ephemeral matching of buyers and sellers (Sheppard & Tuchinsky, 1996). This section reviews existing literature on social relations that can help lend some insights into why electronic networks are used to support transactions.

Networks of Social and Interpersonal Relationships

Empirical observations to date do not support the proposition that networks tend to favor the coordination structural outcome of electronic markets, which are characterized by fleeting associations between buyers and sellers. The closest set of findings to the Malone et. al. (1987) proposition is the study by Brynjolfsson, Malone, Gurbaxani & Kambil (1994). Over a two-year period, there is a decrease in firm size, suggestive of information technology use leading to more outsourcing of previously internalized activities. Hess & Kemerer (1994) did not find support for the electronic markets hypothesis in their research on computerized loan systems in the home mortgage market, even though these electronic data systems have been used in the industry for more than a decade.

Other research has found that network use has been associated more with furthering pre-existing trading relationships, or that, at the minimum, organizations with electronic interconnections are likely to have already been doing business with one another (Steinfield, Kraut & Plummer, 1995). These observed results lead to the question of whether established relationships between organizations necessarily serve as a pre-condition for electronic networks to be implemented and used.

Furthermore, many researchers have called attention to the importance of social relationships to coordination and control efforts, particularly in the inter-organizational context. One reason is that many buyer-supplier relationships do not fit the traditional market-hierarchy dichotomy (Sheppard & Tuchinsky, 1996). Furthermore, it has been argued that inter-firm communication systems increase the range of possible relationships

between organizations beyond the traditional structures of hierarchies and markets (Nohria and Eccles, 1992). This proposition is consistent with proponents of the network approach in viewing organizational structure and processes (e.g., Johanson & Mattson, 1987). Coordination in this network context involves exchange relationships that take time and efforts to establish and develop. Consequently, these relationships are more stable than market contracts (although organizations are free to choose business counterparts), but are more flexible than traditional hierarchies.

While markets and hierarchies rely on prices and routines, respectively, for coordination and control, "hybrid" inter-organizational arrangements depend on relationships, mutual interests and reputation to manage exchanges that tend to be more social than mundane or bureaucratic (Powell, 1990).[3] As observed by Eisenberg, Farace, Monge, Bettinghaus, Kurchner-Hawkins, Miller and Rothman (1985), information is usually exchanged at the personal level. In practice, organizations are indeed represented by individual members, for example, sales force or upper management. Besides, coordination success and other perceptual assessments in inter-organizational systems are often largely determined by personal linkages (Eisenberg et. al., 1985).

In discussing the strengths and limitations of electronic media use in interpersonal negotiations and interactions, Nohria & Eccles (1992) argued that it is a fallacy to conceive electronic networks as substitutes for the face-to-face communication modality. According to these researchers, electronic networks are good for mobilizing action but

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[3] Some examples of hybrid forms include different types of information partnerships, value-added partnerships, the network organization and relational contracting (Johnston & Lawrence, 1988; Konsynski & McFarlan, 1990; Powell, 1990).

face-to-face interactions are required to take actions themselves. One of the main reasons is that electronic networks are simply not robust enough for these actions. Finding empirical evidence consistent with this argument, Kraut et. al. (1997) concluded that electronic networks have not been regarded as substitutes for interpersonal links between firms; instead network linkages have been viewed predominantly as complements to personal relationships, contacts and interactions.

Based on the above review, *interpersonal relationships are conceptualized as interactions, contact and knowledge at the personal level* (between members of trading relationships). In addition, adopting the testable view that interpersonal relationships and electronic information networks complement each other in supporting the execution of inter-firm transactions, the following hypothesis is derived:

H4: (Importance of) interpersonal relationships is positively associated with electronic network adoption and use.

Mutuality and Trust

Examination of existing research shows that there is general recognition on the part of firms in a trading relationship that, rather than remaining separate and autonomous, their interests and welfare are interdependent and their fate intertwined with one another (Hart & Estrin, 1991; Johanson & Mattsson, 1987; Johnston & Lawrence, 1988; Powell, 1990). For instance, perspectives such as the resource dependency view (Pfeffer & Salancik, 1978) points to the fact that few organizations are fully self-sufficient with respect to their critical resources (or assets, in transaction cost terms).

This reality means that many firms will likely need external constituents to fulfill their resource needs, and, in turn, a resource-based dependency is created.

Recognizing the presence of resource control and dependence, Johanson & Mattson (1987) argued that "an interfirm relationship is a mutual orientation of two firms toward each other" (pg. 37). Adopting a social exchange theoretical angle, they posited that an inter-organizational relationship evolves through a process of members learning about and influencing each other. Powell (1990) defines mutual orientation as "knowledge which the parties assume each has about the other and upon which they draw in communication and problem solving" (pg. 272). These perspectives posit that the key to the social exchanges is mutuality, that is, demonstration of respect for each other's needs. Overtime, interactions help to develop a mutual orientation between members of the relationship, showing increased interests and knowledge about, as well as adaptations and commitment to one another.

This sort of mutuality of interests and commitment faced by organizations in the above sketch bears resemblance to the central tenet of coorientation theory (Newcomb, 1953). When the two individuals in a dyadic relationship like one another, their attitudes towards an object, person or event would likely be congruent with each other, thereby demonstrating mutual orientation. Should dissonance exist in their views toward the common object, person or event—especially when it is highly important to one party or has joint relevance to both parties—the two individuals engage in communication to restore cognitive balance and consistency in their coorientation. Willingness to work toward eliminating dissonance, instead of severing relational ties, implies the existence of

commitment to the relationship. Although coorientation theory mainly deals with interpersonal dyads, rather than business associations, individual actors are central to inter-firm relationships, as discussed earlier. Consistent with this perspective, Johanson & Mattson (1987) argued that mutuality among organizations is primarily the orientation and actions of individuals members.

The notion of mutuality as manifested in mutual commitment to a relationship is increasingly evident in what has been called information partnerships, which are characterized by organizations sharing crucial information resources and costs in their relationships (Konsynski & McFarlan, 1990). Computerized databases and other information technologies are among the critical, but expensive, resources that motivate these types of partnerships. This is why electronic networks are less likely to be associated with spot-market than relationship-based transactions. In many cases, the promise of a large amount of recurring business and transactions overtime is required to justify and recover the large sunk costs. Without the guarantee of a long-term business relationship over which to spread the substantial initial technological costs, firms will be reluctant to invest in electronic networks. This is especially true in cases where the electronic link is proprietary to the parties connected. Having invested in an electronic interconnection raises the costs of switching to a different partner, and effectively binds the trading firms to the business relationship.[4] This effect can be positive, as a lock-in

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[4] For instance, in a series of in-depth interviews with a few large magazine publishing firms, one reason for hesitating to establish an electronic connection with an external supplier is that the network cannot be "moved" if the publisher wishes to terminate the relationship and work with a different supplier. The network referenced here, again, is proprietary in nature, since the interviewee was not referring to an

situation tends to raise the likelihood of the trading partners being committed to a quality relationship (Dwyer, Schurr & Oh, 1987).

Given the above discussion, it appears logical to expect electronic network adoption and use to be an indication of, and favored by, the existence of mutual commitment in a pair of trading firms. With *mutual commitment* (toward the business relationship) *conceptually defined as pledge to each other's business needs and the success of the relationship*, the following hypothesis is derived:

H5: Mutual commitment is positively associated with electronic network adoption and use.

Cooperation in a committed business relationship necessarily places firms in a vulnerable position (Powell, 1996). Vulnerability develops, in part, because of reliance on one other (such as resource-based dependency) as the relationship grows. In order to off-set the unsettling feelings of vulnerability and interdependence associated with cooperation, the governance structures regulating a trading relationship must allow for constant monitoring and consultation.

It has been proposed that constant monitoring and consultation can be substituted by the presence of trust. For instance, Bradach and Eccles (1991) suggested the view of trust as a general control mechanism when the nature of inter-firm associations extends

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(*continued from previous page*)
interconnection built on "public" infrastructure or backbone, such as the Internet. (These interviews were conducted during the summer of 1995 and supported by an NSF grant, IRI-9408271.)

beyond ephemeral transactions, and when specialized control mechanisms like price and authority are insufficient. Ouchi (1991) proposed the notion of "clans" as a form of governance structure that depends on trust as a means of coordination and control. According to this view, trust is embedded in the networks of social relationships. Rather than relying on explicit auditing and monitoring for coordination and control, task performance is evaluated through more subtle reading of signals among members of the clan; these signals cannot easily be translated into explicit, verifiable measures of performance.

Moreover, recall from earlier arguments that it is highly unlikely that direct control of an external trading partner can be enforced. Therefore, when two organizations are bound to an interdependent trading relationship, there are few alternatives to managing the business liaison than trusting each other. This perspective is precisely what Kipnis (1996) argued, that out of increased reliance arises the need for partners to trust each other. Developing trust would be a necessary strategy to control the relationship, if dependence cannot be reduced. This is because trust conveys the acknowledgement—and, more importantly, expectations—of each other's ability to manage resources valued by the parties involved.

Owing to the fact that trust is not a state with which human actors feel naturally comfortable, the intended effects of trust often rely on the use of explicit procedures (Kipnis, 1996). Consistent with this logic, Granovetter (1985) argued that institutional arrangements can be devised to discourage malfeasance. An example of an institutional arrangement to guard against the breach of trust is a contract detailing terms of an

agreement. Besides punishing deviating actions by formal, legal sanctions, other more subtle safeguards entail covert threats to such valued considerations as organizational reputation. Capturing the notions described above, Creed and Miles (1996) proposed that trust deals with expectations of equitable treatment and reputational concerns.

Based on the discussion thus far about vulnerability, interdependence and the need for trust, it would appear that a network connection between two trading partners would be more likely when there is already some measure of trust between them. The underlying reasoning begins with the observation that inter-organizational electronic linkages have the effect of shifting the nature of interdependence among organizations (Hart and Estrin, 1991). It is argued that "new" costs and vulnerability are created as the firms come to depend on the electronic interconnections in their transactions with one another. Therefore, it would be reasonable to expect that before two organizations are willing to open up themselves to such new risks, there needs to be a certain level of confidence and assurance that they would not take advantage of each other's vulnerability and dependence on the relationship.

In addition, recall from Chapter 1 that information forms the basis of control, and that information technology serves as a control mechanism (Beniger, 1986, 1990; Nass and Mason, 1990). According to this perspective, electronic interconnections serve to provide an infrastructure for two trading companies to monitor and manage task interdependence. Linking this observation to the role of trust as a means of managing trading a relationship, it is possible (and empirically falsifiable) that electronic

information networks and trust complement each other in supporting business transactions.

Conceptualizing trust as the belief that one's trading partner will refrain from malfeasance, the extent to which this belief affects the likelihood of electronic network use and adoption is hypothesized as follows:

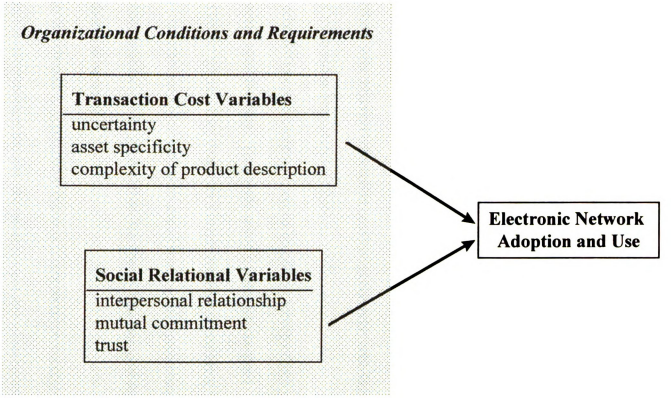
H6: Trust is positively associated with electronic network adoption and use.

Chapter Summary

This chapter presented a review of the transaction cost and social relational literature, guiding the formation of the hypothesized relationships presented above. Figure 1 illustrates a diagrammatic representation of these relationships. Restated below are the propositions driving the hypotheses in this study.

1. Transaction cost hypotheses (H1-H3). High levels of uncertainty, asset specificity and complexity of product description drive up the costs of coordination. Adoption and use of electronic information networks are motivated by the desire to reduce these costs.
2. Social relational hypotheses (H4-H6). Electronic retailer-supplier linkages adopted and used for the purposes of coordination and control are affected by the existing characteristics of a business relationship. In particular, network adoption and use complements interpersonal relationships, and indicates the existence of mutual commitment and trust.

Figure 1. Factors Influencing Organizational Electronic Network Adoption and Use



Chapter 3

METHODS AND PROCEDURES

Having stated the research question and hypotheses to be tested (in Chapters 1 and 2, respectively), the current chapter reports the research design used in this dissertation project, including measurement, population selection, sampling and data collection. To recapitulate the research task at hand, it is to identify and test some of the key antecedent factors to organizational adoption and use of electronic information networks in retailer-supplier transactions associated with product acquisitions. With this research objective of seeking explanations for network adoption and usage and testing hypothesized relationships with different transaction cost and social relational factors, a cross-sectional survey method has been selected (Babbie, 1990).

More specifically, the research design includes a telephone survey of 143 product buyers in the U.S. grocery retail industry. They were asked a series of questions concerning two broad areas: (i) how they deal with a major supplier in acquiring a key product; and (ii) how important electronic networks are in working and interacting with that supplier. These questions have been created from the operationalization of the major concepts in the hypotheses to be tested.

Presentation in this chapter is organized under two major sections: measurement and data collection. In the measurement section, the development and operationalization of the key constructs in this study is discussed. As for the data collection section, issues and procedures associated with the survey conducted are reported, including the rationale

for having chosen the grocery retail industry as the population of interest, sampling, design and execution of the telephone survey.

Measurement

As observed by Emmert (1989b), social science research often deals with the measurement of hypothetical constructs. These are concepts of which the presence or absence cannot be "seen" directly but can only be inferred, such as in the case of assessing attitudes or perceptions. Further complicating the observation of these hypothetical constructs is the fact that, unlike physical science research, there are no established "objective" measurement instruments (e.g., yardsticks or measuring cylinders). Due to the absence of these pre-established instruments, one of the chief reasons for the need to discuss measurement in any given study is to specify the set of procedures used for inferences to be made about the hypothetical constructs and relationships among them. This is the only way social science researchers can communicate to each other about standardized procedures of observation and description, and arrive at inter-subjective agreement about the appropriateness of these procedures. Furthermore, these standardized measurement specifications can serve the useful function of guiding later research efforts investigating similar, if not identical, hypothetical constructs.

In the context of the measurement procedures employed for the research project reported in this dissertation, few empirical studies of organizational electronic network use have attempted to integrate cross-disciplinary perspectives. As referenced in the last

chapter, the study conducted and reported by Kraut et. al. (1997)—and replicated in France (Steinfield et. al., 1997)—represents foremost efforts in drawing on insights based on inter-disciplinary theoretical guidance.[1] As an attempt to minimize unanticipated problems associated with design and execution, this study adopted some of the operational procedures employed by Kraut et. al. (1997). For instance, operationalization of the electronic network use measure in this study is based on adaptations from that used by Kraut et. al. (1997), which yielded a highly reliable measure (Cronbach's Alpha = .94). Other "successful" design strategies, such as the measurement the importance of interpersonal relationships, have also been adopted. (Further discussion of these operational adaptations is included in the description of individual variables below.)

Use of Perceptive Measures

In a meta-analysis of seventy-five innovation studies, Tornatzky and Klein (1982) defended the predominant use of perceptive measures in studying technological adoption and implementation. It was submitted that, even given the presence of "objective" conditions surrounding the decision to adopt an innovation, such as the actual technological costs, these conditions have subjective meaning to an adopter. For instance, one manager may view a set of costs as prohibitive, while another technology decision maker may consider the same figures as reasonable. In addition, a potential

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[1] There are research studies that have employed transaction cost analysis along with other organizational theories, such as those dealing with international business, marketing channel choice and strategic management. Reference to the dearth of empirical research integrating transaction cost theory and literature on social relations is restricted to the study of organizational information technology use.

adopter's perceptions are likely shaped by organizational attributes, for example, the financial resources available for investments in the company's information technology infrastructure. Therefore, recognizing the subjectivity of human actors in innovation adoption and use, it is appropriate to seek the perceptions of individuals, especially those in the organization who are most affected by the technology. Based on this argument by Tornatzky and Klein (1982), the design of the current research project lends itself to the recommended research strategy for surveying grocery buyers, who are most affected by the use of electronic networks to support transactions with suppliers.

Measurement of the dependent and most of the independent variables in this study mainly entails having survey respondents rate numerically a series of survey questions intended for the construction of Likert-type response scales. As described in the literature (Babbie, 1990; Emmert, 1989a), Likert-type scales are constructed by assigning numerical scores along a range of answer categories that indicate different levels of agreement with a question or statement. However, Likert scaling is not restricted to indicating the level of agreement, but has also been widely used with other response categories, such as approval (Babbie, 1990). In the current study, the electronic network use measures entails the scaling of perceived importance (see discussion on the "*importance of network use*" measure below).

Reflecting a characteristic of Likert scaling, as implied in another name for the technique—the method of summated ratings (Emmert, 1989a), multiple items were created *a priori* for most variables in this study. Sharing identical response categories, scores on items written to measure the same construct are summed to create composite,

index measures. Single-item measures cannot be subject to reliability and validity tests, and thus effectively carry the assumption that they are perfectly reliable and valid for assessing the attitudes and perceptions being assessed. When dealing with the measurement of hypothetical constructs that cannot be observed directly, indices are especially more desirable because of these reliability and validity considerations.

Dependent Variables: Electronic Network Adoption and Use

The central construct in this study is the implementation of electronic information networks to support transactions with the supplier of a key product. Adopting the operational definition by Kraut et. al. (1997), electronic network use deals with any computer-based communication that allows for the electronic exchange of information with a major supplier. (See Appendix A for the telephone survey instrument and the exact language respondents were read during the interviews.)

In this research, empirical assessment of the adoption and usage of electronic information networks to support transactions is performed separately with two variables, namely *information technology cluster* and *importance of electronic network use*, respectively. This measurement decision takes into consideration the recommendation by Tornatzky and Klein (1982). They contended that it is a fallacy commonly committed by researchers in assuming that organization-wide implementation or usage of a technology necessarily comes with adoption. One reason why adoption may not guarantee widespread usage in an organization is arguably that the individuals most affected by using the technology are often not the ones directly responsible for technological

adoption decisions. As such, it is recommended that research aimed at studying diffusion of innovations in organizations needs to distinguish between these two phenomena of adoption and practice/use, and incorporate separate measures for both constructs.

Information Technology Cluster

This variable of electronic network adoption aims at assessing whether a number of technologies that can enable electronic information exchange with a supplier are available for use in an organization. This is measured by the question, "Does your company use...," with a dichotomous response scale of "yes" or "no." The cluster of technologies surveyed include:

1. the Worldwide Web;
2. electronic data interchange (EDI) systems;
3. electronic point-of-sale (POS) systems;
4. computer-based on-line services (e.g., America On-line, Compuserve and Prodigy);
5. electronic mail for internal communication; and
6. electronic mail for communication with external suppliers.

Incorporated in the survey instrument are descriptions of these technologies, in anticipation that respondents might need clarifications (see Appendix A). For instance, if a respondent did not know what an EDI system is, the description, "a computer-based

system of exchanging data, such as pricing and billing information," would have been provided.

Selection of these six computer-based information technologies and networks were based on reported or potential use in organizations. Electronic mail, especially for internal communication, is a case in point (Barnes & Greller, 1994). As for the inclusion of the Worldwide Web in the technology cluster, it is due to the increasing discussion of the potential role of the Internet in supporting commercial transactions, promotional and marketing activities, as well as other business-to-business information exchanges (Raphel & Raphel, 1996). Computer-based on-line services are incorporated in the survey because they provide, among other features, electronic mail capabilities and gateway access to the Internet for some businesses. As for EDI and POS technologies, they have been widely reported as information systems and networks commonly used for supporting operations and transactions with suppliers and customers, especially in the retail sector (*Frozen Food Age*, August, 1996; *Progressive Grocer*, April, 1996).

Scores on these six technologies form the information technology cluster variable. Specifically, the cluster score is the total count of how many of the six technologies has/have been adopted. Therefore, the possible scores for the information technology measure range from 0 to 6.

Importance of Electronic Network Use

This variable is constructed to gauge computer-based information network use in supporting transactions. Respondents were asked to consider how important electronic

networks are to the execution of a number of activities. These activities are associated with various stages of a transaction—that is, the acquisition of a key product in the current research—as explicated in existing literature (e.g., Johnston & Vitale, 1988; Kambil 1993). This operationalization strategy was used by Kraut et. al. (1997), which appeared to be a fairly useful and reliable method of tapping the perceived importance of electronic networks in supporting core business activities.[2]

In operationalizing the importance of electronic network use variable, the perceived importance of electronic links to the following activities associated with the acquisition of a key product from a major supplier is measured:

1. developing the specifications of an order to acquire a key product;
2. seeking price information;
3. negotiating the terms of an agreement to purchase a key product;
4. ordering a key product;
5. monitoring the quality of the orders received;
6. fixing problems after-sales errors or problems; and
7. practicing just-in-time inventory management.

Each of these activities is rated with a five-point, Likert-type scoring scale, with "1" being "not important at all" to "5" being "very important." For those who do not use

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[2] As mentioned earlier, the items constituting the electronic network use variable yield a fairly reliable composite measure (Cronbach's Alpha = .94).

electronic networks for any or all of these activities, they were given a score of "9" ("don't use") to represent non-usage.

With the exception of #2 and #7 listed above, these items make up the highly reliable network use composite index in the study by Kraut et. al. (1997).[3] "Seeking price information" (#2) has been included in the current study due to the reason that this is reportedly an activity conducted electronically in the grocery industry (Lewis, 1996). As for the practice of just-in-time inventory management (#7), it has increasingly been discussed as a practice greatly facilitated by the use of electronic supplier-customer networks and systems in the retail sector, including grocers (Barnes & Greller, 1993; Gomes & Mentzer, 1991).[4] This demand-driven inventory management principle deals with the idea that better sales forecast resulting from the use of electronic data enable more efficient ordering and shipping on an as-needed basis (Clemons, 1993; Ratliff, 1996). Consequently, retailers are able to keep less in stock and minimize inventory and operating costs. Due to such reported benefits associated with using electronic information systems, the practice of just-in-time inventory management has been included in the assessment of the importance of network use in this study.

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[3] Kraut et. al. (1997) investigated the acquisition of key production input, while the current research focused on buying products. As such, "input" was replaced by "product" in the operationalization in this study.

[4] There are other labels used to refer to this just-in-time inventory management principle, for example, "continuous replenishment program" (CRP) or "computer assisted ordering" (Barnes & Greller, 1993; Ratliff, 1996). In fact, these terms, especially CRP, were mentioned by some of the survey respondents when asked about just-in-time inventory management.

Independent Variables: Transaction Cost Factors

Derived from transaction cost literature are a number of independent variables hypothesized to have an impact on electronic network use (H1-H3). They are *uncertainty*, *asset specificity* and *complexity of product description*. With two exceptions (product and time specificity to be discussed below), all independent variables described in this section are measured by multiple items, each using the five-point agree-disagree scale described earlier.

Uncertainty

Williamson (1975, 1978) posited that varying types and number of contingencies are usually embedded in the environment in which economic activities are coordinated. These contingencies create uncertainty, which serves to drive up transaction costs, in part, through complicating the contracts necessarily created to address the uncertainty. Similarly, it has been argued by communication scholars that organizations must consider and attempt to control uncertainty through planning (Beniger, 1986; Nass & Mason, 1990).

Measurement of uncertainty has been challenging as it is a complex, multi-dimensional construct. Much of the research dealing with the use of information technologies in supporting commercial activities and inter-organizational transactions has focused on what has been labeled as environmental uncertainty (e.g., Gomes & Mentzer, 1991; Sabherwal & King, 1992; Sabherwal & Vijayasarathy, 1994). Distinguished from internal uncertainty, this construct deals with contingencies arising outside the

organizational boundaries from diverse sources such as the political volatility of the market, unpredictability of the actions on the part of suppliers and customers, and complexity of production and marketing orientations. As such, it can be readily observed that the "sub-concept" of environmental uncertainty still entails multiple dimensions. Failure to distinguish among these dimensions has led to inconsistent results in existing literature that are confusing and difficult to interpret (Milliken, 1987).

As discussed in Chapter 2, the current research is focused on the importance of networks to the acquisition of a key product from a major supplier. Rather than focusing on unpredictable circumstances associated with internal task coordination and control, a more relevant dimension of uncertainty would be the contingencies associated with the efficient and cost-effective ordering and receiving of inventory as replenishment needs arise. Therefore, the survey items written for uncertainty are aimed at assessing the perceived predictability of changes in the availability and price of a product when it is needed.

Asset (Product, Time and Knowledge) Specificity

Three types of asset specificity are measured in the current study, namely *product specificity*, *time specificity* and *knowledge specificity*. Recalling the discussion in Chapter 2, this construct deals with the notion of the uniqueness of an asset needed by an organization which renders the same asset useless to another firm. Inserting these variables into the hypothesis, that asset specificity is positively associated with electronic network use (H2), yields the following "sub-hypotheses:"

H2a: Product specificity is positively associated with electronic network adoption and use.

H2b: Time specificity is positively associated with electronic network adoption and use.

H2c: Knowledge specificity is positively associated with electronic network adoption and use.

Product Specificity. This variable is derived from the "physical asset specificity" concept advanced by Williamson (1975) to refer to the unique machinery, equipment or any other type of physical materials specific to a transaction. In their adoption of transaction cost analysis to study the electronic networks and coordination, Malone et. al. (1987) also mentioned physical asset specificity as a key variable. Kraut et. al. (1997) labeled it "object specificity" in the empirical investigation of the extent to which a production input is useful only to a specific organization needing it. Adopting this definition to the current research, product specificity is defined as the extent to which a product is useful only to a specific organization needing it.

Product specificity is operationally measured by the variations in the label/brand name of a product in three levels: private/store, regional or national. A product with a private or store label (e.g., the Kroger label) represents high specificity, relative to regional or national labels, since only a particular store can use that product without repackaging. Similarly, a regional label is more specific than national brands because stores outside of the region do not carry it. An example is the Spartan brand that is only

available in a few mid-western states. (Treatment of product specificity as it relates to sampling procedures and the execution of the telephone survey is discussed more below in the data collection section.)

Time Specificity. This type of specificity deals with the time pressure involved in completing the transfer of an asset to the intended user (Malone et. al., 1987). The underlying logic is that due to the short time window within which a product must be delivered, there may be only one or a small number of suppliers capable of meeting the time pressure. For example, because of the highly perishable nature of produce, a grocery retailer may choose to order from a local supplier, rather than having inventory shipped from a distant farm.[5] Kraut et. al. (1997) attempted to measure this construct by observing the extent to which production is rushed and subject to rigid deadlines. However, using three survey items, the composite measure was not highly reliable (Cronbach's Alpha = .68).

In the current study, time specificity is operationally defined as the perishability of a product. It is varied by the type of product on which a respondent was asked to focus throughout the survey. "Fresh fruits and vegetables" and "dairy products" are considered high in perishability, while "breakfast cereals" and "confectionery goods" are coded as low in time specificity. (As in the case of product specificity, more discussion on the treatment of the time specificity measure will be presented later in this chapter.)

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[5] This is holding constant other factors affecting the choice of supplier, such as the quality of services, price, etc.

Knowledge Specificity. As another type of asset specificity, this has been explicated in the literature as human asset specificity (Williamson, 1975, 1979; Malone et. al., 1987) or human capital specificity (Joskow, 1985) that deals with skill transfer, learning-by-doing and other types of human capital development that are specific to a trading relationship. Kraut et. al. (1997) measured this construct with four items assessing the degree to which employees of trading firms possess knowledge and skills for dealing with each other and the industry as a whole.

Focusing on the dimension of relationship (rather than the industry as a whole), survey items constructed to measure knowledge specificity in the current study is based on this definition: the extent to which knowledge required to coordinate business activities is perceived to be useful only to a specific pair of trading organizations or units.

Complexity of Product Description

Malone et. al. (1987) defined this concept as "the amount of information needed to specify the attributes of a product in enough detail to allow potential buyers (whether producers acquiring production inputs or consumers acquiring goods) to make a selection" (pg. 486). At a practical level, it is rather difficult to implement "the amount of information needed" in a way that reflects how product description is conveyed in reality. The only attempt to measure this construct empirically was undertaken by Kraut et. al. (1997). Unfortunately, the results yielded two single-item measures tapping the ease and quickness with which a key input could be described.

The current study defines complexity of product description as the extent to which it is perceived to be difficult to describe a product. By this operationalization, complexity is gauged by the perceived adequacy of different forms of representing the product to convey its key attributes, such as pictures or multimedia representations (see Appendix A for questionnaire). In addition, the use of standardized codes provide "short-hand" descriptions of products that are simple to communicate, and hence effectively involve less complex product information than goods that do not come with a coding system. Some of the commonly used standardized coding systems in grocery retailing include uniform product codes (UPC), stock keeping units (SKU) and universal look-up numbers (ULN).

Independent Variables: Social Relational Factors

With respect to the impact of social relational factors, three variables are considered in this study, namely *importance of interpersonal relationships*, *mutual commitment* and *trust.*[6] All three variables entail Likert-type response ratings, with mutual commitment and trust using the five-point agree-disagree scale, while responses to the items dealing with interpersonal relationships vary along the continuum of importance, like the importance of network use measure described above.

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[6] Originally, a fourth variable was developed, i.e., *relative bargaining position* (Bakos & Treacy, 1986; Johnston & Vitale, 1988) and hypothesized to have a positive association with electronic network use. However, the four survey items written for this variable did not load together in post-hoc factor analyses. Therefore, this variable was dropped from further consideration in the study.

Importance of Interpersonal Relationships

Following the definition by Kraut et. al. (1997), this variable assesses the extent to which relationships that have already been established among individual members of the trading pair are perceived to be important to the two parties. This operationalization strategy is adopted in the current study, in part, due to the fact that the treatment led to a fairly reliable index measure in the Kraut et. al. study (Cronbach's Alpha = .85). For the survey respondents, an interpersonal relationship is defined as "any type of personal connection, interactions and knowledge between members of your company and the supplier" (see Appendix A).[7]

Furthermore, the measurement of the interpersonal relationship variable incorporates the same seven activities associated with the acquisition of a key product on which the importance of network use are rated. This design strategy provides for a common base for the comparison of the modalities of personal vs. electronic connections, and aids in providing a richer depiction of how interpersonal relationships affect perceptions toward the importance of network use. Kraut et. al. (1997) found the two modes of coordinating transactions to be complementary.

Also, like the importance of network use measure, the importance of interpersonal relationships is rated with the same five-point importance scale. This treatment of the concept as a continuous rather than dichotomous variable is consistent with Johnson's

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[7] Knowledge referenced here is at the personal level, rather than the institutional/organizational level, which is related to the knowledge specificity construct.

(1993) observation that relationships in organizational networks are not a matter of whether they exist or not, but that they are manifested in gradations.

Mutual Commitment

Recalling the literature review presented in Chapter 2, this construct is derived from the notions of mutuality of interests, respect and orientation as manifested in the commitment two parties to a relationship have toward each other (Johanson & Mattson, 1987; Powell, 1990). Specifically, inferred from existing literature is the argument that the adoption and use of an electronic interconnection between two trading units is an explicit demonstration of such mutual commitment (e.g., as indicated by substantial sunk costs).

The construct of mutual commitment has not been previously defined conceptually or operationally. It is proposed in the current research that mutual commitment gauges the extent to which decisions and actions of the two parties in a retailer-supplier relationship are reflective of concerns for each others' business interests and pledge to maintaining a successful business relationship. Survey items written to measure mutual commitment are based on this definition.

Trust

Trust is another elusive, multi-dimensional construct that makes measurement a complex task. Creed and Miles (1996) found this concept to be related to such sentiments as reputation and expectations of equitable treatment. Zaheer, McEvily and

Perrone (1996) argued that trust is a multi-level concept, at least to be distinguished between the interpersonal and inter-organizational levels. In order to avoid the potential problem of collinearity with the importance of interpersonal relationships variable, this research focuses on trust at the inter-organizational level. Inter-organizational trust deals with "the extent of trust placed in the partner organization by the members of a focal organization" (Zaheer et. al., 1996, pg. 5). To avoid defining a concept with itself, an alternative definition is adopted, that is, the extent to which an organization believes that its trading partner will refrain from malfeasance.[8] With modifications in wording to eliminate potential ambiguity and to fit the current study, survey items measuring inter-organizational trust were adopted from the Zaheer et. al. study (1996).[9]

Control Variables

Organizational Size

Organizational theories, such as the resource dependency perspective (Pfeffer & Salancik, 1978), call attention to the fact that the size of an organization often has implications for the slack resources available for investments in technology. Moreover, size is often associated with the power a firm possesses in bargaining situations. In the context of a trading relationship, especially when the business counterpart is relatively

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[8] This conceptual definition is adopted from Kraut et. al. (1997). While the conceptual definition is useful, the operational index was not reliable, with an alpha score of .43. Therefore, the survey constructed for the current study did not follow those reported by Kraut et. al. (1997).

[9] The five items assessing inter-organizational trust in that study yielded a composite measure of moderate reliability (Cronbach's Alpha = .77).

smaller, a larger organization may be able to control how transactions should be conducted (e.g., delivery schedule, pricing, etc.). Similarly, the decision to adopt a supplier-customer electronic linkage may be dictated by the larger and more powerful party.[10] Furthermore, as a specific consideration in this study, private store labels (i.e., high product specificity) are more likely to be available in large grocery chains than small independent stores. As such, an observed relationship between product specificity and electronic network use, or the magnitude of the association, might be affected by firm size. Therefore, care should be taken to control for the impact of company size in testing the hypothesized relationships.

As a control variable in this study, organizational size is measured by an index comprised of annual sales, total number of employees and total number of stores. Figures on annual sales are obtained from the *1997 Ward Business Directory of U.S. Private and Public Companies*, while the total number of employees and stores are provided by the survey respondents.

Integration with Major Supplier

Previous research has led to the conclusion that electronic networks use tends to be associated more with internal suppliers or trading firms with whom there is a close, pre-established relationship (Kraut et. al., 1997; Steinfield et. al., 1995). Besides,

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[10] As a case in point, in the interviews referenced earlier, one executive of a large magazine publishing firm contended that if his company should decide to transact with color separators and printers electronically, these suppliers would have to comply in order to continue getting business from the publishing firm.

whether a major supplier is internal or external is theoretically and empirically linked to the transaction cost predictors of asset specificity and uncertainty. Therefore, to avoid the specification error of failing to account for an important confound, the level of integration with the major supplier is included as a control variable.

Integration with major supplier is measured by the level of ownership the retailer has in the most important supplier dealt with in the last 12 months to acquire a key product. Three levels of this control measure, i.e., no ownership, partial ownership and full ownership, are recoded from five response categories for the major supplier question, as illustrated in Table 1.

Table 1 - Integration with Major Supplier

Original survey response categories for major supplier question	"Integration with Major Supplier" (level of ownership)
1. independent manufacturer or producer 2. independent wholesaler or distributor	1 (no ownership)
3. a partially-owned wholesaler or distributor 4. a joint-venture with another company	2 (partial ownership)
5. a wholly-owned wholesaler or distributor	3 (full ownership)

Data Collection

This section covers the issues and procedures related to data collection for the current study. Presented first is the rationale for the population (industry) selection, which is followed by the discussion of sampling procedures, as well as the design and execution of the telephone survey.

Population (Industry) Selection

The population selected for the empirical study undertaken is the U.S. grocery retail industry (SIC 5411). According to the standard industrial classifications, this category of grocery stores includes "supermarkets, food stores and grocery stores, primarily engaged in the retail sale of all sorts of canned goods and dry goods, such as tea, coffee, spices, sugar, and flour, fresh fruits and vegetables, and fresh and prepared meats, fish and poultry" (Hillstrom & Ruby, 1994).

The grocery retail industry has been selected for its empirical appeal as an interesting population for addressing the research question of understanding motivations for network adoption and use. For a number of years, electronic information systems and networks have reportedly led to some transformation in terms of strategies and business practices in the grocery industry. For instance, computers have extended the reach of retail managers to stores and allowed them to exercise more control (*The Economist*, March 4, 1995). Furthermore, the use of EDI and POS systems have been credited for leading to the adoption of more efficient and cost-saving operational principles and practices, including different variations of the just-in-time inventory management

concept, such as "quick response" or "continuous replenishment programs" (CRP) mentioned earlier (Barnes & Greller, 1994; Clemons, 1993). In the case of a large grocery chain, EDI also facilitates category management by eliminating the need to process paperwork associated with new or promotional items (*Frozen Food Age*, August, 1996).

At a industry-relational level, information technologies have also been found to be associated with changing the bargaining dynamics between retailers and suppliers in favor of network users over non-users (Sealey, 1994). Furthermore, as a mature, "classic" retail industry of over 100 years old, it provides a suitable context for observing how established orientations and patterns of doing business, based on such factors as interpersonal contact and trust, may affect perceptions toward the use of electronic networks.

In addition, from a practical, methodological perspective, there must be assurance for variability in the key measures, especially the dependent variables of network adoption and use. In this regard, academic findings and trade-press reports have confirmed varying levels of existing electronic network use, as well as continued interests in exploring such potential benefits as increased efficiency and enhanced relational marketing (e.g., McGee, 1991; Sealey, 1994; *Progressive Grocer*, April, 1996). For instance, according to a survey conducted by Frozen Food Age (July, 1996), retailers and wholesalers use EDI for an average of 63% of their orders and transactions, including interactions with manufacturers. Growing recognition for the strategic role played by information technologies is also reflected in the report that industrial participants consider

meeting challenges of changing technological innovations and capabilities as a top-rated problem to be tackled (*Progressive Grocer*, April, 1996).

Sampling Procedures

Ward's business directory of U.S. private and public companies (1997), along with the supplement published in April, was used as the sampling frame. Subsidiaries and divisions of larger grocery chains, as well as unclassified companies, were excluded from the sample population, based on the assumption that it is unlikely for technology decisions to be made at the store level.[11] In order to avoid effectively surveying the same company more than once, only corporate headquarters or holding companies of grocery stores were targeted in this study.

A total of 230 firms were contacted, with the hope of targeting a sample size of 120. Of these 230 potential companies, 43 were unusable due to either disconnected numbers or firms which are no longer in the grocery retail business, reducing the sample population to 197. There were 44 refusals to participate, including "implied" rejections from firms given unsuccessful attempts to set up interviews. One of the most commonly provided reasons for refusal to participate was company policy, especially among the larger grocery chains. Due to the competitive conditions in the grocery industry,

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[11] For the unclassified listings, there was no information about whether these companies were divisions or subsidiaries of a larger grocery chain. Furthermore, the annual sales figures were not provided either. As was discovered later during pretests, some of these unclassified companies are actually restaurants. It is likely that they were classified under SIC 5411 because they practice food retailing within the definition of the industrial classification.

employees were instructed not to respond to any inquiries, including academic research, to safeguard against the leaking of "trade secrets" to industrial rivals through the media. Upon termination of data collection, a total of 143 firms were surveyed, representing a response rate of 73%.

Sampling of organizations was stratified by size, based on the reported annual sales of each firm in the *Ward's Business Directory*. Large, medium and small firms have annual sales of $200 million and above, $25 to $199.99 million and below $25 million, respectively. This research decision was based on the consideration of the likely positive association between organizational size and network use, as addressed earlier in the measurement section. At the early design stage of this research (as specified in the research proposal), the intention was to have 30 firms representing each level of organizational size, thereby yielding a total of sample 120; this was to ensure equal representation of each category. Out of the total sample of 143, there are 48 large firms in both the large- and medium-sized categories and 47 small grocery retailers.

Sampling was also conducted such that variability in the measures of product specificity and time specificity would be ensured. As described earlier, product specificity varies with the brand names/labels of products, from national (non-specific) to regional to local/store (highly specific). Completed surveys were monitored in an on-going basis as an attempt to achieve a somewhat proportional distribution of firms along the three levels of the product specificity variable. As for time specificity, it was treated by selecting four product categories, two highly perishable (i.e., fresh fruits and vegetables and diary products) and two relatively low in perishability (i.e., breakfast

cereals and confectionery goods, e.g., potato and chips, candy, etc.). Each potential respondent was assigned one of the four product types on a random basis.

Telephone Survey

A survey research design was chosen for the empirical portion of this study because it is an effective method for measuring perceptions (Babbie, 1990). (The rationale for collecting perceptive data was discussed in the measurement section earlier.) Response rate is a critical factor in the present study, and as such, telephone interviewing was chosen over self-administered survey by mail, since real-time interviewing normally yields a considerably higher response rate (Babbie, 1990). Besides, telephone interviews bring timely results and are effective when the survey is limited in length.

Recalling an earlier discussion on identifying key informants based on how they are likely to be affected by technology use (Tornatzky and Klein, 1982), respondents targeted in each organization is "the person who is most responsible for acquiring" a key product. This strategy led to subjects who are major/head buyers, product or category managers for one of the four product categories pre-assigned to their companies. These are the people most knowledgeable of the suppliers with whom their companies do business. These informants also have first-hand experience with whether and how electronic networks are used to support transactions with major suppliers.

As an attempt to minimize unexplained error variance arising from unspecified product variations, respondents were asked to think of and focus on "one of the best selling type" of the pre-assigned category of product throughout the interview (see

Appendix A). Similarly, they were requested to consider the same major supplier, that is "the most important supplier you've worked with within the past 12 months," in the entire questionnaire. This is especially important to helping ensure that the relational factors assessed are based on the same set of retailer-supplier relationship.

Interviewers

Three interviewers were hired to help with conducting the telephone interviews. Each of them were given a two-hour training to introduce them to the survey and explain the flow of questions, particularly in parts where they are required to complete a questionnaire item with information provided by respondents. For instance, the code {TOP PRODUCT} in the survey protocol was to be replaced with the best selling product reported by each respondent. Also covered in the training sessions were the pay structure and scheduling issues. [12]

Pretesting

Ten companies selected from the unclassified sub-listing of firms in the *Ward's Business Directory* were contacted for pretesting the survey instrument. The pretest sample was not drawn from the actual sample population due to the concern of "wasting"

[12] The training sessions also included the use of the Survey System, a computer-assisted telephone interviewing (CATI) system in the Information Technology and Services Laboratory. The survey was originally intended to be executed with the use of the CATI system. However, due to problems related to system and network instability, it was quickly determined to be too risky to rely on the CATI system, and the data collection was conducted using paper-and-pencil questionnaires.

potential cases, given the small population. Besides, the main objective of the pretest was to check for ambiguity of wording, which was accomplished with the unclassified firms. As a result of pretesting, some items were revised, such as two of the questions written to measure operationally knowledge specificity.

Actual Telephone Interviews

The telephone interviewing took place during the first two weeks of September, 1997. Each sampled grocery retailer was contacted at the main number provided in the *Ward's Directory* and the key respondent identified.[13] Then, the interviewer would ask to be transferred to the potential informant, who would then be given the introduction to the project, promised anonymity and confidentiality, and invited to participate in the research. As an attempt to minimize rejection arising out of the coincidence of reaching potential respondents at a bad time, appointments were made for the survey to be executed at a more convenient time. In addition, in some cases, the key informant was not reachable during the first call. In those situations, messages were either left in their voice-mail or with their assistants, requesting for an appointment. When speaking to the

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[13] A survey log sheet was used to facilitate the management of calls and the recording of crucial information (see Appendix B). Interviewers were given these survey call logs with the telephone number and pre-assigned product category (measuring product specificity) prior to the first attempt to contact each sampled firm. They were instructed to use the log for recording the names and contact information of respondents, as well as appointment times, if necessary. As a project management tool, the log sheets were colored-coded: light pink, lavender and dark pink to represent small, medium and large firms. In addition, the call logs also served as a record of how many calls each interviewer was able to complete in an hour; this is related to the incentive portion of their pay.

assistants, they were also asked as to what day and time might be best for reaching the identified buyers/ product managers. In order to accommodate these contingencies of not being able to speak to a potential respondent during the initial call, up to seven callbacks were built into the design to follow up on appointments and messages left.[14]

Interview calls were made in the Information Technology and Services Laboratory of the Department of Telecommunication. Dillman (1978) recommended the use of a centralized interviewing site to maximize the opportunity for monitoring of calls, especially with inexperienced interviewers. It also enabled the interviewers to seek clarifications, as needed, throughout the data collection.

Chapter Summary

This chapter began the description of the empirical portion of this dissertation by reporting the methods and procedures employed in this dissertation. In doing so, issues and procedures adopted in the measurement of key variables and data collection—population selection, sampling and the execution and management of the telephone survey—were described above. Together with the results chapter to follow (Chapter 4), the presentation of the "technical" aspects of the empirical portion of this study will be completed.

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[14] Towards the end of the data collection, a number of potential respondents actually returned my call after six or seven messages have been left with them. In one case, the product manager interrupted a meeting he was having with his assistant to take my call, telling her that "this lady has been trying to reach me for over a week!"

Chapter 4

RESULTS

Continuing the description of the empirical portion this dissertation research begun in Chapter 3, the current chapter reports the results obtained from the telephone survey. Included in the presentation are procedures employed to interpret the data collected and to evaluate their fit with what has been conceptualized and proposed. Empirical evidence is furnished to reveal the presence (and absence) of significant relationships between the various transaction cost and social relational factors and electronic network adoption and use. Research findings also uncover differential patterns of association between the two sets of antecedent factors and the two criterion variables, i.e., adoption of electronic information networks and their perceived importance to supporting transactions with major suppliers.

This chapter is organized into three major sections. First, general steps taken to prepare the data for further statistical analysis are presented. In the second section, techniques used for the construction of index measures are described, including the discussion of validity and reliability issues associated with index construction. This is followed by the last section of the chapter, reporting the results of regression analysis conducted to assess the hypothesized relationships.

General Data Preparation

As commonly practiced in quantitative studies, before the results from the telephone survey could be used for testing the research hypotheses in the current research, a number of data processing steps needed to be performed. These procedures were necessary for "cleaning" the "raw" survey data and transforming them into appropriate formats for use in further statistical analysis. Procedures conducted to fulfill these data cleaning and transformation necessities were associated with the following major objectives: (i) data integrity checks; (ii) recoding of scale and response categories; and (iii) missing data treatment.[1]

Data Integrity Checks

An important data processing task was checking for entry errors, regardless of how much care has been taken to ensure accuracy when the data were entered. One data check procedure employed involved randomly selecting cases in the data set and comparing the scores with the original responses recorded in the paper questionnaires for those companies. Another technique used for detecting errors was generating univariate frequencies, an efficient statistical routine for checking data integrity that is widely practiced. Any unusual scores would have been revealed in the frequency tables, such as a score of "6" appearing in the distribution of a questionnaire item measured with a five-

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[1] In many cases, another common reason for conducting data checks is for identifying the presence of outliers, which would lead to false estimation of relationships. In the current research, since most variables are measured with Likert-type response scales with pre-assigned score ranges, the threat of outliers is not a concern.

point response scale. Furthermore, histograms were also consulted as aids for visualizing anomalies in the data. Using these techniques, several errors were identified and corrected.

Recoding of Scale and Response Categories

Most variables in this research have been assessed by the scaling method, particularly Likert-type. Scaling is a technique of validating the existence of a hypothetical construct, the relative magnitude of which is inferred by a range of numerical scores assigned to different levels of the construct (Arnold, 1989). This technique also aids in the development of operational indices, which will be discussed in the next major section on the "construction of index measures."

As introduced in the research design (Chapter 3—Methods and Procedures), the independent variables of product specificity and time specificity entail a scaling procedure that involved assigning scores to different types of product labels and products, as summarized in the following Tables 2 and 3.

Table 2 - Product Specificity

Product Label Type	Product Specificity (Scale of 1 - 3)
National	1 (low)
Regional	2 (medium)
local/store (private)	3 (high)

Table 3 - Time Specificity

Product Type	Time Specificity (Scale of 1 - 2)
Breakfast cereals Confectionery goods	1 (low)
Fresh fruits and vegetables Dairy products	2 (high)

For a number of reasons, it is not uncommon to find that originally assigned or recorded scale scores need to be recoded before further data processing and analysis can be applied meaningfully. One purpose served by data recoding is the grouping of cases that are similar in some observed dimension to facilitate a more efficient way of describing the sample along that characteristic. In the current study, a case in point is the questionnaire item gauging how integrated a retailer is with its major supplier, introduced in the last chapter (see Table 1 in Chapter 3). For the purposes of analyzing the level of integration, the key dimension of variation to be considered is whether a major supplier is an independent trading partner, a partially-owned operation or fully owned by the retailer. Whether this supplier produces the key product needed by the grocery buyer or is merely a distributor is not a critical distinction to be made. Therefore, the response categories of "independent manufacturer or producer" and "independent wholesaler or distributor" could be collapsed into one group, "no ownership." Following the same logic, the recoded category of "partial ownership" was created by grouping the two original

response categories of "partially-owned wholesaler or distributor" and "joint-venture with another company."

Furthermore, each company's total annual sales, total number of employees and total number of stores were all originally measured with real numbers spread out in large ranges. These raw numbers were collapsed into more manageable and interpretable number of scale categories for describing these items. The grouping criteria used are shown in the following tables (Tables 4, 5 and 6).

Table 4 - Total Annual Sales

Original Figures	Percentage of Cases	Grouped Categories and Scores
less than $25 million	32.4 %	1 (small)
$25 million to $199.99 million	34.4 %	2 (medium)
$200 million and above	33.2 %	3 (large)

Table 5 - Total Number of Employees

Original Figures	Percentage of Cases	Grouped Categories and Scores
1 to 99	20.3 %	1
100 to 299	20.4 %	2
300 to 999	18.6 %	3
1000 to 4999	18.7 %	4
5000 and above	22.0 %	5

Table 6 - Total Number of Stores

Original Figures	Percentage of Cases	Grouped Categories and Scores
1	16.9 %	1
2 to 4	20.6 %	2
5 to 14	22.1 %	3
15 to 70	19.8 %	4
71 and above	20.6 %	5

Another reason for data recoding is to ensure consistency in the directional ordering of scale scores for all items measuring the same operational construct. Expressed differently, a high score for all of the items constituting the same construct should indicate a high level of its presence or absence. For instance, scores of "5" on a five-point agree-disagree response scale across items should all indicate strong agreement. This is a concern associated with the construction of multi-item operational indices, which will be discussed in more detail below in the section on the construction of index measures.

Missing Data Treatment

Another data preparation necessity is associated with the identification and treatment of missing data. With survey research, missing values often result from respondents not being willing or able to answer one or more questions. A commonly

discovered reason for the lack of willingness to respond to a survey has to do with the wording of questionnaire items, which might be considered too sensitive or value-loaded by some respondents. In addition, a lengthy, laborious questionnaire can potentially exhaust the patience of some participants, causing them to abandon the survey before it has been completed. Missing data can also result from situations in which respondents are asked questions seeking knowledge they do not have. Furthermore, the inability to answer a question can also be traced to the item not being understood by a respondent. These potential pitfalls of survey research are discussed in the survey methodology literature (e.g., Babbie, 1990; Dillman, 1978; Schuman & Presser, 1981).

In order to minimize both the number of survey items that would be difficult to answer and the number of survey participants who would decline to respond to any given question, care was taken with the design of the questionnaire. As discussed in the previous chapter, one chief reason for pretesting the survey instrument was, in fact, to help to ensure that the above stated problems would be avoided.

None of the 143 respondents in the sample abandoned the telephone interview before it was completed. There were hardly any missing values in the items measuring the independent variables of this study. However, this is not the case with the dependent variables, especially the importance of electronic network use measure. Because of the different considerations associated with operationalization and measurement decisions, missing data from the telephone survey were not treated with the same method. Missing data treatment for the different variables is discussed below.

Dependent Measures

For a reason other than the common "don't know" and "no answer" problems discussed earlier, a "special" case of missing data was associated with the importance of electronic network use variable. Out of the 143 grocery buyers who participated in the survey, 43 indicated that they were not using any computer-based data networks with their major suppliers at the time.[2] These non-usage responses were coded as "9" ("don't use") in each of the seven items asking respondents about the importance of using electronic networks for carrying out various activities associated with the acquisition of a key product. In turn, these 43 cases were excluded from later analysis performed to test the relationships among the different independent variables and the importance of electronic network use. Because the missing information associated with this variable has special meaning, replacing them with other scores (such as the series mean value), would be inappropriate.[3]

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[2] A number of respondents qualified their non-usage by adding that they deal with their major suppliers via telephone and fax.

[3] One possibility considered was that the absence of network use could be interpreted as being equivalent to networks not being important at all to the acquisition of key products. (After all, the firms not using networks have been acquiring products via other means!) This interpretation would mean replacing the non-usage scores of "9" with "1" ("not important at all"). This data recoding strategy was adopted by Kraut et. al. (1997). However, there does not seem to be a strong enough theoretical or conceptual justification for treating the non-users as equivalent to the users who consider network use to be not important at all in this study. Furthermore, there is little to be gained empirically, given that these firms constitute almost one-third of the sample. Recoding this variable would cause the distribution to be censored below, i.e., a high concentration of responses clustering in the low end of the score range.

With the exclusion of this large proportion of cases, there is the concern that the sub-sample included in later analysis might be different from the excluded cases along some critical dimensions. Should such systematic differences exist, it would have implications on the representativeness of the group of cases analyzed and the generalizability of the research findings.[4] Therefore, the included cases are compared against the excluded firms, by observing whether the mean scores for the independent and control variables are different. As can be seen in Table 7, the two groups are different with respect to three variables: (1) The excluded non-users group rated complexity of product description to be lower than the 100 cases included in subsequent analysis. (2) The 43 buyers who did not use networks with their major suppliers considered interpersonal relationships to be more important than the network users. (3) The non-users also considered their suppliers to be relatively more trustworthy. As will be seen later in this chapter and Chapter 5, these group differences are consistent with the observed relationships between these three independent variables and the various criterion measures.

Listwise exclusion of cases with missing values were also applied to the measure for electronic network adoption, that is, the information technology cluster variable. Three respondents did not answer the questions gauging the adoption of six technologies that would allow for electronic exchange of information with suppliers. Recall from the

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[4] In examining reporting of survey research involving organizations, the issue of potential differences between firms included in the analyses and those in the non-response category, researchers have predominantly compared firm characteristics. Common attributes compared include size, as indicated by annual sales, number of employees.

Table 7 – Comparison of Electronic Network Users and Non-Users

Variable	Mean scores		Difference	
	Users (N = 100)	***Non-users (N = 43)***	t-score	Prob. Level
Uncertainty	2.35	2.17	-1.41	.17
Product Specificity*	1.90	2.07	1.19	.24
Time Specificity**	1.46	1.56	1.28	.21
Knowledge Specificity	3.74	3.86	.97	.34
Complexity of Product Description	2.67	2.17	-2.67	.01
Importance of Interpersonal Relationships	3.79	4.06	2.03	.05
"static" activities	3.79	4.10	2.09	.04
"dynamic" activities	3.80	4.03	1.68	.10
Mutual Commitment	4.18	4.19	.12	.91
Trust	3.91	4.19	2.32	.02
Organizational Size	2.82	2.51	-1.73	.09
Integration with Major Supplier*	1.55	1.46	-.83	.41

* Based on 3-point scale.

** Based on 2-point scale.

Note: The remaining items are based on a 5-point scale. Mean scores for multi-item indices are obtained from taking the mean of the summed, average score. For example, the mean score for mutual commitment of 4.18 is the average of the mean score for the four items measuring it, i.e., 16.72/4.

previous chapter that this information technology cluster measure reflects the total count of the six technologies adopted by a respondent's organization. Without a theoretically justifiable figure to be used for substituting the missing data in this criterion measure, the more conservative treatment of excluding these three cases from hypothesis testing was adopted.

Independent Measures

For the independent variables, among the common alternatives for treating missing data, the strategy adopted was that of replacing them with the mean scores of the items. Listwise exclusion of cases was ruled out as too "strict" of a missing data treatment for these variables due to a number of reasons. First, no survey question measuring any of the independent variables is critical to the extent of warranting the entire case to be excluded due to missing values. Secondly, there was not a single respondent who had consistently refused or failed to answer questions in the survey. Finally, given the listwise exclusion treatment of missing data in the two dependent measures, the analytic sample sizes of 100 and 140 do not lend much statistical power to hypothesis testing. Deleting more cases due to a small number of missing values in the independent variables would further attenuate the already limited statistical power in the study. Similarly, because of this consideration of statistical power, the option of pairwise deletion of scores was also deemed less desirable than replacing them.

Control Measures

For the two control variables, missing data were replaced after the raw scores have been grouped (discussed earlier). Missing values for the total number of employees and total number of stores were replaced by the average scores in the associated level of organizational size as stratified by annual sales. For instance, a missing value for the number of employees in a firm with medium-level annual sales was replaced by the mean score of cases in the same sales category. Due to the large ranges associated with these two items, this method of missing value replacement has been deemed a relatively more accurate "approximation" of the missing data than using the series means.

Construction of Index Measures

Babbie (1990) distinguished between "scales" and "indices," even though these labels have tended to be used interchangeably to refer to multi-item, operational measures.[5] A scale assumes a more rigid intensity structure than an index in the scaling of responses across items constituting the composite measure. One manifestation of this intensity structure is that the agreement with one item implies agreement with other items, as in the case of a Guttman scale. In other types of scales, the difference between any pair of scores must measure the same relative magnitude of the presence/absence of a construct across all items constituting the same scale. As such, scales are normally

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[5] The term "scale" described here in the context of composite measures should not be confused with scaling, the assignment of numerical scores to an operational construct, referenced earlier. An index, though not a scale in the strictest sense, involves scaling in form of pre-assigned numerical response categories.

created with items measured by at least interval-level scaling. Index measures deal with more relaxed intensity requirements, as long as the scaling patterns are the same across items forming the intended composite measure. Unlike scales, indices can be created with ordinal-level measures, a characteristic of Likert-type scaling. Following these "technical" specifications as described by Babbie (1990), the composite measures in the present research are best attributed as indices.

Because of the requirement that an index must consist of items with the same scaling patterns, the need for scores to be recoded sometimes arise. This is generally the case when items have been worded in opposite directions. In the context of the five-point, agree-disagree response scales used in this study, this wording direction issue is manifested in relatively high scores (e.g., 4 or 5) on some items being associated with relatively low scores of other items measuring the same construct. For instance, in examining the content of two of the items measuring uncertainty, a high score on (i.e., strong agreement with) these two statements would suggest the perception of low uncertainty.[6] However, for the other three uncertainty items, strong agreement would indicate a high level of uncertainty. Therefore, even assuming that these five items were unidimensional indicators of uncertainty, the response scales of the first two items mentioned must be reverse-coded (reflected), before the uncertainty index could be

---

[6] The two items are: "You can easily get a replenishment of {TOP PRODUCT} anytime you need it;" and "Your company has a great deal of control over the fluctuations of price you pay to acquire {TOP PRODUCT}" (Appendix A).

constructed from summing all these items.[7] Another example is the reflection of the item, "you will not hesitate to switch to a different supplier," to convey a high (instead of low) level of mutual commitment when the score is high.

Construct Validity and Factor Analysis

Validity is the extent to which a variable measures what it purports to measure. In working with hypothetical constructs, it is particularly important that *construct validity* be established, that is, the extent to which the operationalized indicators indeed assess the theoretical constructs. In the context of the current study, the operationalized indicators are the survey questions.

Convergent and Discriminant Validity

Examining the wording of survey items represents an attempt to check construct validity through face validation, i.e., the extent to which the questions read or sound as if they measure the intended variables. A "stricter" construct validation method involves the statistical assessment of two types of validity evaluated in conjunction with each other. These two types of validity are *convergent* and *discriminant* validity (Bollen, 1989; Campbell and Fiske, 1959; Nunnally & Bernstein, 1994).[8]

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[7] Unidimensionality is discussed in the next section on construct validity and factor analysis. As it turned out, the two reflected uncertainty items did not load on the same factor as the other three items when factor analysis was run, and were excluded from the construction of the uncertainty index.

[8] Discriminant and convergent validities are often discussed in association with the use of multi-trait, multi-method matrices, introduced by Campbell and Fiske (1959). In

Convergent validity deals with the extent to which the operational measures of a hypothetical construct have strong associations with one another. Statistically, an index with high convergent validity means that the inter-item correlations among its indicators are both positive and significant.[9] In the context of the current research, the items measuring trust, for instance, must be highly and positively correlated with one another.

Discriminant validity is established when it can be confirmed that the indicators of one construct is not actually tapping a different underlying trait. In empirical terms, the inter-item correlations among operational measures of the same constructs ought to be higher than the associations between these measures and the indicators of other constructs.[10] Following the above trust example, the inter-item correlations among the trust items must be higher than their correlations with other survey questions.

(*continue from previous page*)
these types of construct validation designs, at least two types of methods, e.g., Guttman scales and Likert-type indices, are used to measure each construct (trait), and two or more traits are assessed. Although this study only employed one method, the principles of comparing relative associations among items measuring the same construct vs. those tapping different underlying hypothetical traits are still applicable to the evaluation of construct validity here.

[9] If multiple methods were used, the correlations between the different methods measuring the same trait must be statistically significant.

[10] In the multi-trait multi-method context, the correlations among items measuring the same trait ought to be higher than: (i) the correlations with any other item with which these items do not share a common method or trait; and (ii) the correlations of different traits measured by the same method.

Unidimensionality

In addition to establishing the convergent and discriminant validity of operational indices, construct validation also involves verifying the unidimensionality of composite measures. Recalling the discussion in Chapter 3, like all hypothetical constructs, the variables in the current study are complex and multi-dimensional. Examples include the concepts of uncertainty and trust. *A priori* operationalization was aimed at tapping a single dimension of each of these constructs. The need to establish construct validity deals, in part, with the *a posterior* confirmation that an index measure is consisted of unidimensional indicators.

Factor Analysis

Factor analysis is a statistical technique used for establishing the various considerations associated with construct validation described above. This method identifies underlying factors that are accountable for different "pools" of common variance in the data (Nunnally & Bernstein, 1994). In the (unlikely) absence of measurement, sampling and other types of research design errors, these empirically extracted factors should match with the theoretical constructs of a study.

In factor analysis, validity is established, in part, by examining factor loadings, which are the correlations between operational items and extracted factors. For convergent and discriminant validity to be established, the factor loading of each item on the underlying construct it is supposed to measure must be significantly higher than its cross-loadings on other factors. Unidimensionality is verified if survey items written for

one construct do not load on more than one factor separately. A widely used decision rule for interpreting factor analytic results is that the absolute value of the factor loading of an item must be at least .60 and that of cross-loadings must not be higher than .40 (Nunnally & Bernstein, 1994).

To establish convergent and discriminant validity, as well as unidimensionality, the survey items constructed for the independent variables of this study were factor analyzed using SPSS for Windows 6.1 (Norusis/SPSS, Inc., 1993). The principal components method was used to extract factors sequentially, such that each additional factor accounts for the largest amount of common variance left to be explained in the data.

Furthermore, to help with the interpretation of factors extracted, a varimax rotated solution was requested. Varimax rotation aims at maximizing the variance of the squared loadings in the identification of factors (hence the name "varimax" for "variance maximization"). In addition, this method of rotating extracted factors is intended to produce a solution with orthogonal factors, i.e., ones that are uncorrelated with each other. As can be seen, these features of varimax rotation are desirable for maximizing construct validity. Moreover, having orthogonal indices would also help to reduce the potential problem of multicollinearity among the predictor variables in regression analysis.

Based on the above techniques, procedures and criteria for evaluating factor analytic results, survey items measuring the five theoretical constructs of mutual commitment, trust, complexity of product description, uncertainty and knowledge

specificity were factor analyzed. Items with low factor loadings and/or high cross loadings were eliminated, resulting in a five-factor solution (see Table 8). Items with high factor loadings on each of the five factors were summed for the construction of indices. For instance, due to low factor loadings on the intended construct and high cross loadings, four of the six items intended to measure knowledge specificity were excluded. Similarly, both the measurement indices for mutual commitment and trust each excluded an item that did not load together with the other items constituting the composite measure.

Aside from the independent variables, the items measuring the importance of electronic network use were also factor-analyzed. Somewhat surprisingly, the seven activities associated with the acquisition of a key product loaded on two separate factors (see Table 9 for factor loadings). These results indicate that the responses to the seven items did not follow a consistent pattern. Indeed, as can be seen in Figure 2, it would appear that networks were considered to be more important to some activities than others. Specifically, electronic linkages have been rated to be more important for activities that do not seem to require much interaction with the suppliers than tasks that would likely require more back-and-forth exchanges. In other words, higher perception of network importance appears to be associated with product acquisition activities that are more "static" than "dynamic" in nature. Based on these observations, two separate importance of network use indices were created, which will be labeled as "importance of network use to 'static' activities" and "importance of network use to 'dynamic' activities." (Further elaboration on the conceptual differences between these two measures will be presented

Table 8 - Indices Resulting from Factor Analysis

Factor (variance explained)	Factor Loadings
Mutual Commitment (27.9 %)	
You believe that this supplier is as committed as you are to the success of your business relationship	.84
You believe that this supplier cares about the success of your business	.80
The success of your supplier's business is important to you	.74
This supplier is very responsive to your company's needs	.74
Trust (15 %)	
You have complete confidence that this supplier will not take advantage of you, even if given the opportunity to do so	.79
Overall, you would consider this supplier to be trustworthy	.79
You have complete confidence that this supplier will always keep promises made to your company	.79
Complexity of Product Description (10.1%)	
Multimedia representation of {TOP PRODUCT}, that is some combination of text, picture or sound, is necessary to describe the features of the product	.90
Only a picture or other visual representation of {TOP PRODUCT} can describe adequately the features of the product	.85
Uncertainty (8.6 %)	
The availability of {TOP PRODUCT} changes a great deal over the course of a year	.75
The amount of {TOP PRODUCT} changes a great deal from one order to the next	.66
The price you pay for {TOP PRODUCT} changes a great deal from one order to the next	.65
Knowledge Specificity (8.1 %)	
Having only general knowledge of grocery suppliers is not enough for doing business with this supplier effectively	.81
Having only general knowledge of grocery retailing is not enough for doing business with your company effectively	.80

Table 9 - Importance of Electronic Network Use

Factor (variance explained)	Factor Loadings
Importance of Network Use to "Static" Activities (17.1 %)	
Developing specifications of an order	.82
Ordering a key product	.79
Seeking price information	.68
Importance of Network Use to "Dynamic" Activities (43.4 %)	
Fixing after-sales errors or problems	.81
Monitoring the quality of the orders received	.75
Practicing just-in-time inventory management	.74
Negotiating the terms of an agreement to purchase a key product	.60

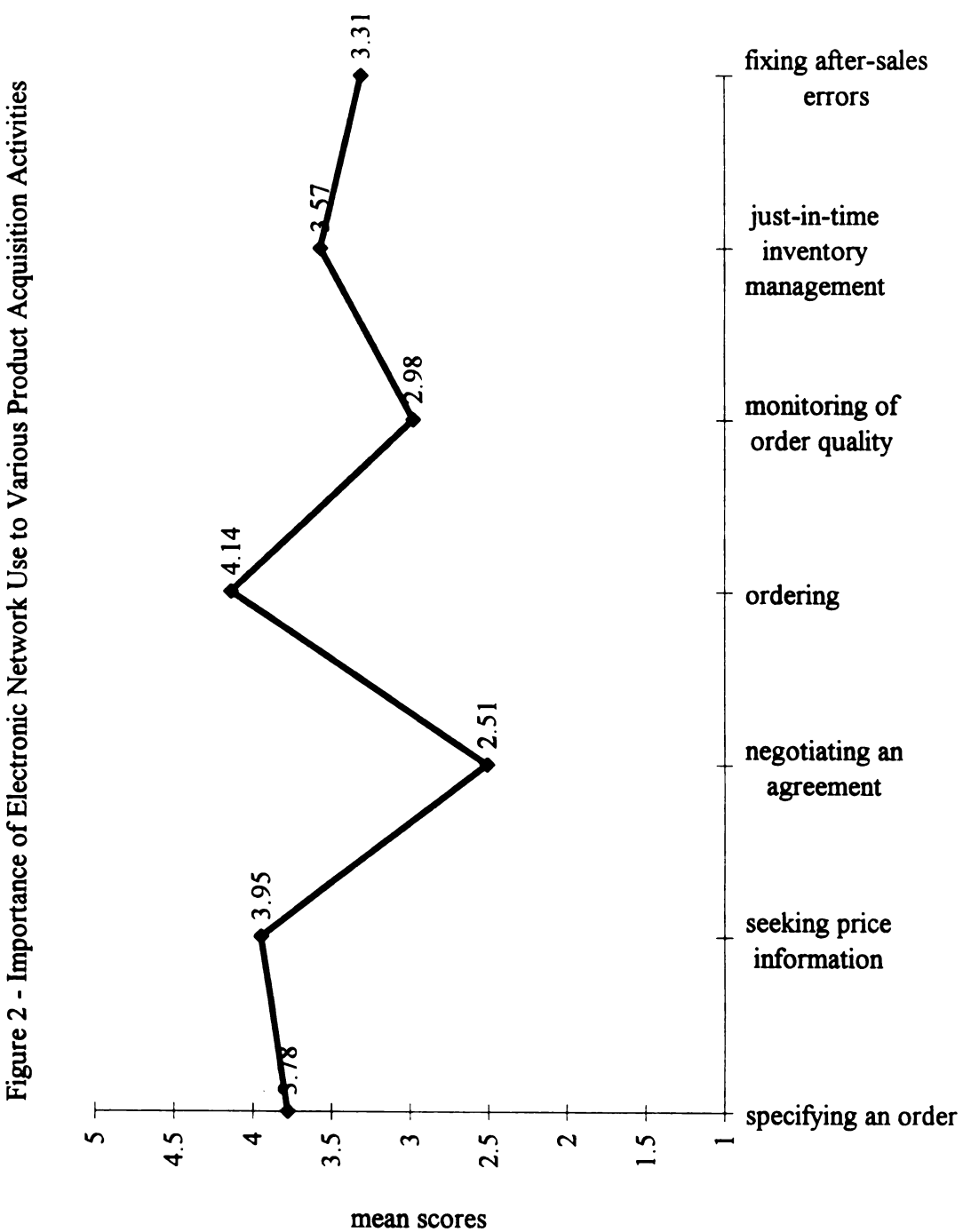

Figure 2 - Importance of Electronic Network Use to Various Product Acquisition Activities

in Chapter 5—Discussion.) These two indices were analyzed separately in the hypothesis-testing phase of the data analysis.

Recall that the same seven activities have been used to gauge the importance of interpersonal relationships, and that the rationale of this design strategy was such that there would be a common base for the comparison of the modalities of personal vs. electronic connections. For this reason, the same treatment of constructing two separate variables for the importance of interpersonal relationships was applied when analyzing the two importance of electronic network use measures, producing "the importance of interpersonal relationships to 'static' activities" and "the importance of interpersonal relationships to 'dynamic' activities." The seven items, which load on the same factor, were added to form one composite measure when the criterion variable was the information technology cluster.

Also factor-analyzed are the three indicators of the organizational size index, i.e., annual sales, total number of employees and total number of stores. The scores of these three measures had to be standardized first, because they were based on different scale ranges, i.e., three ("1" to "3") for annual sales and five ("1" to "5") for the other two items.

Reliability

Aside from validity concerns, it is important to check the reliability of the index measures created. Reliability in general deals with the extent to which measurement of a

construct is consistent. A reliable measure should produce almost identical results across different measurements in the same research settings.

In the context of index construction, the most relevant type of reliability is that of internal consistency, i.e., how well the items summed to form an index "hang together" (Babbie, 1990). Statistically, this is observed by examining the size of inter-item correlations. High reliability is indicated by strong associations among items constituting the index. As a commonly used measure of internal consistency reliability, Cronbach's Alpha is computed based on inter-item correlations ("standardized item alpha" in SPSS output). Table 10 shows the alpha scores for all the indices in this study.

As can be seen, the survey yielded moderately reliable index measures. These reliability results are not uncommon for indices based on only two to three items. Overall, the social relational variables have been measured more reliably than the transaction cost factors. In particular, caution needs to be called especially to the lack of internal consistency reliability in the indices of uncertainty and knowledge specificity. Unfortunately, the lack of reliability in measurement attenuates the strength of associations, which, in turn, has negative implications on hypothesis testing. Absence of a relationship cannot be confidently attributed to the "failure" of theoretical predictions or conceptual reasoning.

Table 10 - Internal Consistency Reliability of Index Measures

Index	Cronbach's Alpha (α)
Importance of Network Use (based on 100 cases)[1]	
"static" activities	.71
"dynamic" activities	.75
Transaction Cost Factors	
Uncertainty	.51
Knowledge specificity	.52
Complexity of product description	.76
Social Relational Factors	
Mutual commitment	.84
Trust	.82
Importance of interpersonal relationships[2]	.84
"static" activities	.83
"dynamic" activities	.72
Control variable	
Organizational size	.94

[1] When the "don't use" responses for the 43 excluded cases were replaced with "1" (as discussed in an earlier footnote), the seven items loaded on the same factor, and Cronbach's Alpha came out to be .92. This data structure is likely a result of having one-third of the sample scoring in a consistent pattern in all seven items constituting the index. Again, this is a procedure that is hard to defend, although it yields a more respectable alpha score.

[2] This is the alpha score when the seven items were summed to form one index.

Hypotheses Testing

Regression Analysis

Given that the current research is aimed at examining the relationships among a number of independent variables and each of the dependent variables in this study, *multiple regression* analysis was deemed the most appropriate statistical technique (Hair, Anderson, Tatham & Grablowsky, 1979). This method entails estimating the mathematical best-fit plane that summarizes the relationship between the dependent (criterion) and independent (predictor) variables. The key is to minimize the error of estimation. In particular, the estimation method of *ordinary least squares* (OLS) was employed, which minimizes the sum of squared deviations of the criterion variable.

Like most statistical techniques, for OLS regression analysis to function "properly," a number of assumptions must be met. Among them, the distribution of the observed variables must be linear and normal. In general, regression analysis is fairly robust with respect to violations of these two assumptions. In other words, even if the distributions are not perfectly linear or normal, the OLS estimates will not be affected very much. However, OLS is less tolerant with violations of the assumption of homoscedasticity, i.e., the variance of the criterion variable must be constant across different levels of the independent variables. Another key assumption is that errors must not be correlated because for some systematic, common cause failed to be specified in the regression model. These assumptions were checked by examining descriptive statistics, histograms, scatterplots and residual plots; there are no serious violations of these assumptions.

Another important consideration when running regression analysis is that predictors are not highly correlated with each other. In the event that two regressors are highly correlated with one another, the problem of collinearity is present (multi-collinearity, if more than two highly correlated regressors). When this is the case, the magnitude of the impact a particular predictor has on the criterion is really attributable to the predictor's high correlation with another strong regressor. As discussed in methodological literature, there is no ideal way for treating the problem of collinearity. One method is to enter the two (or more) highly correlated regressors into separate regression equations and observe their effects in isolation from one another. As can be seen in the Pearson Product-Moment correlations (Table 11), mutual commitment is highly correlated with trust, raising the possibility that collinearity might be a problem. This was noted when regression analysis was conducted.

In interpreting regression results for the purposes of testing hypotheses, a number of statistics are meaningful. First, there is the regression coefficient, which is statistically the partial correlation between a predictor variable and the criterion variable. This coefficient indicates the strength of association between the predictor and the criterion, while controlling for the impact of other regressors. When standardized, regression weights, also known as betas (ß), allow for the relative magnitude of impact among different regressors to be compared. Since the measurement in this study involves different levels of scaling, standardized beta weights were examined when evaluating the research hypotheses. For instance, product specificity was measured with three levels

Table 11 – Pearson Product-Moment Correlations

	itcluster	netuse1	netuse2	uncert	timespec	prodspec	knowspec	complex	interrel	mutcom	trust	majsup
itcluster												
uncert	.02	-.04	.10									
timespec	-.10	-.06	-.07	.23**								
prodspec	.01	.12	.13	-.17*	-.04							
knowspec	.13	.16*	.21*	.03	.02	.02						
complex	.06	.17*	.30**	.29**	-.03	-.03	-.03					
interrel	-.14	.22*+	.40**++	.10	.02	-.12	.17*	.12				
mutcom	-.02	.17*	.04	-.04	.27**	.01	.13	-.15	.31**			
trust	-.13	-.05	.08	.00	.18*	.01	.09	.00	.16	.56**		
majsup	.04	-.01	-.01	.06	.11	-.04	-.07	.08	.07	.15	.10	
orgsize	.40**	-.02	.13	-.11	-.05	.15	.27**	-.11	-.06	.07	.01	-.23**

** $p < .01$
* $p < .05$
+ "static" activities
++ "dynamic" activities

netuse1 = importance of electronic network use to "static" activities
netuse2 = importance of electronic network use to "dynamic" activities
itcluster = information technology cluster
uncert = uncertainty
timespec = time specificity
prodspec = product specificity
knowspec = knowledge specificity
complex = complexity of product description
interrel = importance of interpersonal relationships
mutcom = mutual commitment
majsup = integration with major supplier
orgsize = organizational size

("1" to "3") while a series of 5-point Likert-type indices were used to measure other predictor variables.

Due to the fact that the research hypotheses in this study are directional, two pieces of information about the beta weights are needed for confirming/rejecting the hypothesized relationships. The first point to note is the mathematical signs of the beta weights, i.e., whether they are positive or negative. Because all relationships have been hypothesized to be positive, a negative beta will result in the rejection of the associated hypothesis. In addition to the direction of association, the beta weights must be statistically significant, at least at the probability level of .05. In other words, there must be less than a 5% chance that the observed relationship is due to random error.

Another important statistic in regression analysis is R-square, or the "coefficient of determination." One commonly held interpretation of R-square is that it indicates the proportion of variation of a criterion about its mean that is explained by the regressors (Hair et. al., 1979). Therefore, the higher the value of R-square, the more variance in the data is said to be explained, and, in turn, the better the estimation or prediction is considered. Another reading of R-square is that the statistic conveys the extent to which the model of predicted associations among the predictors and criterion fit the data empirically (Norusis/SPSS, Inc., 1993).

When there is a large number of predictors, as in the case of the current study, it is useful to observe the adjusted R-square value. As the name implies, this statistic adjusts for the number of predictors used in the estimation of the mathematical best-fit plane. By taking into consideration the degrees of freedom in the regression equation (given the

number of predictors and sample size), this adjusted coefficient of determination provides some indication of the parsimony of the estimation model. As such, it is not uncommon for the size of adjusted R-square to increase, while that of R-square drops, when poor predictors are removed from the regression equation.

Regression Results

This section presents the regression results of the current study. To restate the six hypotheses tested, they are:

H1: Uncertainty is positively associated with electronic network adoption and use.

H2: Asset (product, time and knowledge) specificity is positively associated with electronic network adoption and use.

H3: Complexity of product description is positively associated with electronic network adoption and use.

H4: (Importance of) interpersonal relationships is positively associated with electronic network adoption and use.

H5: Mutual commitment is positively associated with electronic network adoption and use.

H6: Trust is positively associated with electronic network adoption and use.

The following presentation will be organized by the separate regression runs associated with each of the three dependent measures.

Information Technology Cluster

Table 12 shows the multiple regression results for predicting the first dependent measure of the study, that is, the information technology cluster. Note that the two control variables are among the regressors that are statistically significant at the alpha level of .05. In particular, organizational size has a strong positive relationship with the information technology cluster (ß = .43), suggesting that the larger an organization is, the more likely it is that a larger share of the technology cluster has been adopted. With respect to the measure of integration with the major supplier, the positive beta weight (ß = .15) indicates that the higher the retailer-supplier integration is, a grocery retailer's technological adoption level is likely to be higher as well.

None of the transaction cost variables, i.e., uncertainty, asset (product, time and knowledge) specificity and complexity of product description, appears to have notable impact on the dependent variable. Given the insignificant betas, the observed patterns of associations between these predictors and the criterion could have appeared by chance or due to random error alone. Consequently, the three transaction cost hypotheses (H1 to H3), as they relate to predicting adoption of the information technology cluster, must be rejected.

As for the social relational factors, two of them are found to be statistically significant regressors, namely the importance of interpersonal relationships (ß = - .17, $p < .05$) and trust (ß = - .18, $p < .05$). However, contrary to what was hypothesized (H4 and H6), both of them are shown to have a negative relationship with the dependent variable. These empirical results suggest that when interpersonal relationships are considered

Table 12 - Regression of Information Technology Cluster

Independent Variable	Standardized Beta (ß)		Probability Level	
	Original model	Modified model	Original model	Modified model
Transaction Cost Factors				
uncertainty	.06		.44	
product specificity	-.05		.53	
time specificity	-.11		.20	
knowledge specificity	.06		.49	
complexity of product description	.12		.15	
Social Relational Factors				
importance of interpersonal relationships	-.17	-.11	.04	.17
mutual commitment	.12		.23	
trust	-.18	-.14	.05	.08
Control Factors				
organizational size	.43	.44	.00	.00
integration with major supplier	.15	.16	.05	.04

Original Model	Modified Model
N = 140	
Multiple R = .50	Multiple R = .47
R-square = .25 (F = 4.35, p = .00)	**R-square = .22** (F = 9.36, p = .00)
Adjusted R-square = .19	**Adjusted R-square = .19**

highly important to dealing with suppliers, the number of information technologies adopted is smaller. Regarding trust, the more a grocery retailer trusts its major supplier, the less likely it is to have adopted a large share of the information technology cluster. As far as the mutual commitment variable is concerned, although the regression coefficient sign is positive, as hypothesized (H5), the beta weight is not significant; hence, H5 must be rejected.

As far as the overall model fit is concerned, R-square is .25, while adjusted R-square is .19. Dropping the regressors that are not statistically significant (at $p < .05$) reduces R-square to .22 and adjusted R-square remains unchanged. These results suggest that the original regression model was not very parsimonious (given that adjusted R-square does not change). However, in the "modified" model, the interpersonal relationships variable no longer appears as a significant regressor ($ß = -.11$, $p = .17$), and the beta for trust becomes marginally significant ($ß = -.14$, $p = .08$). This can be attributed to the association these two variables have with eliminated regressors which appear to share a small portion of common variance explained in the data. In particular, interpersonal relationships is significantly correlated with knowledge specificity ($r = .17$, $p < .05$), while trust is highly associated with mutual commitment and time specificity ($r = .18$ and .56, respectively) (see Table 10 for zero-order correlations).

Importance of Electronic Network Use

When the dependent variable is one of the two network usage measures, the pattern of relationships observed are quite different from the results associated with the

adoption variable. First, the two control variables, namely organizational size and integration with major suppliers, do not seem to have much impact on the perceived importance of electronic network use to various transactional activities associated with the acquisition of a key product. This can be seen in the regression results shown in Tables 13 and 14. Beta weights for these two variables in both sets of runs are not statistically significant.

Importance of Electronic Network Use to "Static" Activities. When the regression criterion is the importance of electronic network use to the three "static" activities of specifying an order, seeking price information and ordering a key product, the transaction cost hypotheses (H1 to H3) must again be rejected (see Table 13). Despite this, it is noteworthy that several of the transaction cost variables demonstrate the hypothesized direction of association with the importance of electronic network use. These variables are product specificity, knowledge specificity and complexity of product description, which all have positive regression weights, although they were only approaching statistical significance at the probability level of .05. Attention should be called to the relatively small sample size of 100, which does not lend much statistical power to the regression analysis. Given a larger N value, these beta weights would have been statistically significant.

As for the effects of social relational factors, the perceived importance of interpersonal relationships to the "static" activities has a positive, albeit weak, association with the extent to which electronic network use has been viewed as important to the same set of activities ($\beta = .17$, $p > .05$). Therefore, H4 must be rejected. As for the factors of

Table 13 - Regression of Importance of Electronic Network Use to "Static" Activities

Independent Variable	Standardized Beta (ß)		Probability Level	
	Original model	Modified model	Original model	Modified model
Transaction Cost Factors				
uncertainty	-.10		.32	
product specificity	.18	.19	.07	.05
time specificity	-.04		.72	
knowledge specificity	.18	.18	.07	.08
complexity of product description	.17	.14	.11	.16
Social Relational Factors				
importance of interpersonal relationships to "static" activities	.17	.17	.12	.12
mutual commitment	.28	.28	.03	.03
trust	-.25	-.25	.03	.03
Control Factors				
organizational size	.09	-.09	.38	.41
integration with major supplier	.08	-.08	.43	.42

Original Model	Modified Model
N = 100	
Multiple R = .44	Multiple R = .42
R-square = .19 (F = 2.10, p = .03)	**R-square = .18** (F = 2.46, p = .02)
Adjusted R-square = .10	**Adjusted R-square = .11**

Table 14 - Regression of Importance of Electronic Network Use to "Dynamic" Activities

Independent Variable	Standardized Beta (ß)		Probability Level	
	Original model	Modified model	Original model	Modified model
Transaction Cost Factors				
uncertainty	.08		.45	
product specificity	.11	.12	.23	.19
time specificity	-.08		.43	
knowledge specificity	.09	.10	.38	.31
complexity of product description	.21	.24	.05	.01
Social Relational Factors				
importance of interpersonal relationships to "dynamic" activities	.33	.31	.00	.00
mutual commitment	-.09		.47	
trust	.08		.49	
Control Factors				
organizational size	.09	.08	.56	.44
integration with major supplier	.01	-.03	.93	.75

Original Model	Modified Model
N = 100	
Multiple R = .50	Multiple R = .49
R-square = .25 (F = 3.03, p = .00)	**R-square = .24** (F = 4.88, p = .00)
Adjusted R-square = .17	**Adjusted R-square = .19**

mutual commitment and trust, they are found to be statistically significant regressors. As hypothesized (H5), regression analysis finds mutual commitment to have a positive relationship with the perception of how important electronic network use is to the "static" activities associated with acquiring a key product ($\beta = .28$, $p < .05$). With respect to trust, although this variable shows a strong relationship with network use ($\beta = -.25$, $p < .05$), the association is not in the hypothesized direction. This result leads to the rejection of H6. What is suggested here is that the more a grocery retailer trusts a major supplier, the less likely electronic networks will be viewed as important for these more "static" activities of doing business with this supplier.

As far as the overall fit of the regression model is concerned, R-square is .19 (adjusted R-square = .10). Eliminating insignificant regressors (uncertainty and time specificity) leads to a .02 drop in R-square and a .01 increase in adjusted R-square. Again, what can be observed here is that the original conceptual model is not parsimonious, as a number of predictors do not contribute to the overall estimation of the best-fit regression equation. With respect to changes in the effects of individual regressors, the beta weight of product specificity ($\beta = .19$) is found to be significant at the .05 probability level. Dropping uncertainty from the modified regression equation is likely a major cause, as this variable has a significant negative relationship with product specificity ($r = -.17$, $p < .05$). At the same time, the impact of complexity of product description is attenuated, which can also be attributed to the absence of uncertainty in the regression model ($r = .29$, $p < .01$).

Importance of Electronic Network Use to "Dynamic" Activities. Regression results for predicting the perceived importance of electronic network use to the more "interactive" activities associated with product buying are shown in Table 14. To recapitulate these "interactive" activities, they are those associated with: (i) negotiating the terms of an acquisition agreement; (ii) monitoring the quality of an order; (iii) practicing just-in-time inventory management; and (iv) fixing after-sales errors. Interestingly, a different set of predictors are found to be significantly associated with the perceived importance of electronic network use to these activities than the more "static" ones discussed above.

First, the complexity of product description variable is found to be a statistically significant predictor of the perceived importance of network use ($\beta = .21$, $p < .05$). Also, as hypothesized (H3), the more complex the product description is perceived to be, the more important respondents view network use to be in supporting transactions with a major supplier of the product. As for the other transaction cost variables, they do not yield significant results, leading to the rejection of H1 and H2 (see Table 14).

With respect to the social relational factors, unlike earlier results, neither trust nor mutual commitment is found to have any meaningful association with the perceived importance of network use outside of chance alone. Consequently, H5 and H6 must be rejected. Nevertheless, the importance of interpersonal relationships to the same set of "dynamic" activities yields a beta weight that is both positive and strong ($\beta = .33$, $p < .01$). In other words, the more important interpersonal relationships are thought to be in

interacting with a major supplier, the more likely the retailers are to consider electronic network use to be important to help in carrying out the same activities as well.

As shown in Table 14, the regression model shows an overall fit at the magnitude of R-square = .25 (adjusted R-square of .17). When only the variables that have significant correlations with the criterion variable are included in the regression equation, R-square drops to .24, and adjusted R-square increases by .02 to .19. Complexity of product description and the importance of interpersonal relationships remain strong regressors. These negligible changes suggest that the other transaction cost and social relational factors do not contribute to the explanation of why electronic networks have been perceived to be important to supporting interactions with major suppliers of key products.

Chapter Summary

Detailed in this chapter were the techniques used to prepare and analyze the data collected to test the proposed relationships between the adoption and use of electronic information networks and the various transaction cost and social relational variables. Results of hypotheses testing are summarized in Table 15. Together with the description of research design procedures and issues (Chapter 3—Methods and Procedures), this chapter completes the report on the "technical" aspects of the empirical portion of this dissertation. More discussion on linking the research findings with existing theoretical and empirical literature will be presented in the next chapter (Chapter 5—Discussion).

Table 15 - Summary of Findings

Independent Variables and Hypotheses*	Dependent Variables		
	Information Technology Cluster	Importance of Electronic Network Use to	
		"Static" Activities	"Dynamic" Activities
1. Uncertainty	Rejected	Rejected	Rejected
2a. Product Specificity	Rejected	**Rejected (but marginally significant β)**	Rejected
2b. Time Specificity	Rejected	**Rejected**	Rejected
2c. Knowledge Specificity	Rejected	**Rejected (but marginally significant β)**	Rejected
3. Complexity of Product Description	Rejected	**Rejected (but marginally significant β)**	**Supported**
4. Importance of Interpersonal Relationships	**Rejected (but significant negative β)**	N/A	N/A
"Static" activities	N/A	Rejected	N/A
"Dynamic" activities	N/A	N/A	**Supported**
5. Mutual Commitment	Rejected	**Supported**	Rejected
6. Trust	**Rejected (but significant negative β)**	**Rejected (but significant negative β)**	Rejected

* All independent variables were hypothesized to be positively associated with the dependent variables.

Chapter 5

DISCUSSION

Reported in the previous chapter are the findings of this research and whether the data are consistent with *a priori* conceptualization. The current study finds that a sizeable portion of the surveyed retailers were not using electronic information networks to support their product acquisitions from major suppliers (43 out of 143 cases). This indicates that the level of electronic network use to support retailer-supplier transactions may not be as high as that suggested by what appears to be inflated general perception. In addition, lending mixed support to hypothesized relationships, this study reveals differential patterns of associations between the adoption and use of electronic information networks and the various transaction cost and social relational factors. Predictors of adoption are not the same ones that are found to be accountable for electronic networks being perceived to be important to aiding the coordination and control of supplier-retailer interactions. Furthermore, depending on the nature of the transactional activities, different "mixes" of transaction cost and social relational considerations are found to be associated with networks being viewed as important to facilitating the acquisition of key products.

This chapter extends the discussion of the results reported in Chapter 4, linking the findings back to existing literature. Insights and guidance are sought to qualify the empirical observations and explain why they are or are not consistent with the hypotheses of the study. Presentation in this chapter begins with the general observations of

analyzing separately the different measures of electronic network adoption and use. This is followed by the discussion of the two sets of research hypotheses tested in the study, i.e., those derived from the literature on transaction cost analysis and social relations in organizations. In discussing whether the data collected are consistent with each hypothesis, conceptual and methodological considerations are incorporated, factoring in the limiting conditions associated with such issues as measurement and analytic specifications.

Adoption and Use of Electronic Information Networks

In the current study, due to a number of factors related to *a priori* conceptualization and *post hoc* analysis, multiple measures of electronic network adoption and use have been constructed. Before proceeding to the discussion related to specific hypotheses, this section presents some general observations about the different results associated with these various dependent measures.

Adoption vs. Usage

Recall from earlier discussion that the design of this study followed the strategy of separating the conceptual and operational definition of adoption from that of usage, as proposed by Tornatzky and Klein (1982). Indeed, this research decision appears to have been sound, as evident in the differential results generated that have interesting conceptual and practical implications. As the regression analysis shows, the adoption of the information technology cluster is associated with the independent variables in

different ways than the two variables measuring the perceived importance of electronic network use.

One possible explanation for these different patterns of associations could be due to the different operational treatment of the adoption and usage variables. As described before, the adoption variable is more general, measuring at the overall organizational level the availability of a cluster of information technologies that enable electronic exchange of information. As for the importance of electronic network use variable, this notion is tied to the interactions associated with a specific trading pair, that is, the grocery buyer interviewed and a major supplier. Therefore, predictor variables that are strongly associated with the information technology cluster may not be related to the perceived importance of electronic network use in the same way or magnitude. It is possible that while electronic linkages adopted may not be rendered important to supporting one specific set of buyer-supplier transactions, other buyers managing different product categories in the same company may find electronic exchange of information with their suppliers to be important. In addition, technological adoption may be motivated by other priorities than facilitating the coordination and control of product acquisition activities (such as various reasons associated with attaining competitive advantage or meeting strategic necessities referenced in Chapter 1—Introduction).

Aside from these operationalization considerations, there are likely some other conceptual reasons that can help shed light on the results. Some of the most readily observable differences between adoption and usage are seen in their different

relationships with the two control variables in the study, i.e., organizational size and the level of integration with a major supplier. These are discussed in turn below.

Organizational Size

Organizational size is found to have a significant association with the adoption of the cluster of six information technologies that can enable electronic exchange of information ($\beta = .43$, $p < .01$; see Table 11). In fact, more than any other contingencies faced by the organization that are associated with its needs and environment (reflected by the transaction cost and social relational factors), size accounts for the strongest empirical reason for the number of technologies adopted to enable electronic exchange of information. (Organizational size, measured by the composite of a firm's total annual sales, total number of stores and employees, has the largest beta weight). Recall that the information technology cluster is made up of the WWW, EDI, POS, on-line services, internal and external email systems. Given this operationalization of adoption, the regression result indicates that the number of information technology functions and systems adopted increases with the size of the grocery retailer. This finding is consistent with predictions based on the resource contingency perspective, which posits that the size of an organization has direct implications on how much slack resources are available for investment in technologies.

Along these cost considerations, the results of the current study also show that once technologies have been adopted, organizational size no longer appears to be an important determinant of usage. (Beta weights for the regression of the two importance

of electronic network use criterion variables on organizational size were not statistically significant; see Tables 13 and 14). This empirical observation is consistent with the findings of Kraut et. al. (1997): Organizational size in four U.S. industries (advertising, magazine publishing, pharmaceutical and women's apparel) studied was also found to be not significantly related to how important network use is perceived to be in transacting with a major supplier. It would appear, then, that this relationship between firm size and technological use is fairly stable, even in the presence of varying contextual conditions associated with distinct norms and characteristics of different industrial settings.

At an intuitive level, the differential associations of organizational size with adoption and perceived importance of usage appear quite logical. Consider that the highest technological costs are generally incurred during initial implementation. Relatively speaking, the operating costs thereafter are usually significantly smaller, especially with regard to the six types of technologies used to gauge network adoption in the current project. As such, it is not surprising to find organizational size to be a critical determinant of technological adoption, but that it becomes less of a factor influencing later usage, that is, the perceived importance of network use to dealing with a major supplier to acquire a key product.

Integration with Major Supplier

As for the other control variable in the current study, empirical observations show that a larger portion of the information technology cluster is more likely to be adopted by grocery retailers who are integrated with their major suppliers ($\beta = 15$, $p < .05$; see Table

11). This finding is also consistent with existing research concluding that electronic linkages are more likely to be considered important in situations where the major supplier is an internal unit or a trading partner with whom a firm has a pre-established, long-term business relationship (Kraut, et. al., 1997; Steinfield et. al., 1995).

Moreover, this observed positive relationship between technological adoption and the level of retailer-supplier integration is also suggestive of the possible perception that electronic interconnections are beneficial to supporting smoother interfacing with major suppliers. This appears to be a manifestation of what Malone et. al. (1987) proposed to be the electronic integration effect (described in Chapter 2—Review of Theoretical and Empirical Literature).

Adding further insights into the advantages of electronic integration is the conceptual analysis of inter-organizational connectivity in grocery distribution by Clark and Schiano (1996). In particular, they made the following observation (pg. 285):

> "EDI ordering is only faster or more efficient when the data transmission process is more tightly integrated with the order-processing information systems within the manufacturer, which enables EDI orders to bypass some steps of the less automated phone or fax ordering process."

This position is offered to explain why the factor of speed alone is not sufficient for explaining why EDI is not as attractive as it was originally thought to be; this is because ordering via telephone and fax has been rendered to be just as fast and efficient. In fact,

this point is consistent with anecdotal comments offered by some survey respondents in the current study (from the non-usage portion of the sample) that the reason why they are not using networks is that they still rely on telephone and fax communications. It would appear that for electronic information networks to be adopted, such advantages beyond faster transactions as those associated with the tighter coupling of activities need to be available and recognized. For instance, potential benefits to be considered may include a reduction in the amount of paperwork processed and data entry errors.

Similar to the findings associated with organizational size, the level of retailer-supplier integration has also been found to have no effect on the importance attributed by adopters to network use for supporting activities associated with buying key products from these major suppliers. (Regression analysis shows that the beta weights for the integration variable are not statistically significant; see Tables 12 and 13.) These results are contrary to those reported by Kraut et. al. (1997), which found network use to be perceived as more important to the acquisition of a key production input from an integrated supplier than from an external contractor. A possible explanation for these contradictory findings may be the extent to which value is added after the object of a transaction is obtained. In the current study, the object traded between supplier and retailer is a finished product ready to be purchased by an end-customer. This is in contrast to intermediate, industrial products or services studied by Kraut et. al. (1997). After acquisition, value is added to the input before finally being sold to consumers, e.g., fabric is sponged, cut and sewn before a dress is made. What appears to be suggested is that electronic networks are perceived to be important to enhancing tighter coupling and

interfacing of production activities internal to an organization where the value-adding intensity is higher. When little value is to be added, electronic linkages are considered to be equally effective (or not effective) in supporting interactions with internal units as well as external trading partners.

Importance of Electronic Network Use to "Static" vs. "Dynamic" Activities

As reported in the results chapter, the importance of electronic network use to the seven activities associated with the acquisition of a key product were found to load on two separate factors. To recap, the "static" activities include specifying an order, seeking price information and ordering; the "dynamic" activities include negotiating the terms of an acquisition agreement, monitoring the quality of orders received, practicing just-in-time inventory management and fixing after-sales errors or problems. What is suggested in these findings is that there is (are) some abstract dimension(s) concerning electronic communication and information exchange in which these activities vary qualitatively. One possible source of difference is the likely amount, frequency and complexity of interactions between the retailer and supplier necessitated in carrying out these transactional tasks. It is quite logical to expect more frequent and complex interactions with suppliers to be associated with contract negotiations, quality monitoring and problem fixing (the "dynamic" activities) than ordering or seeking price information (the "static" activities).

Conceptually, there are a number of reasons why communication and interactions conducted via electronic networks would be deemed more appropriate for the "static"

tasks and activities than the "dynamic" ones. (Recall that the mean scores on the "static" items are higher than those on the "dynamic" ones; see Figure 2, Chapter 4.) This is especially true when electronic network use is considered in comparison and contrast with face-to-face interactions. Negotiations and problem solving likely rely on real-time back-and-forth exchanges between two parties. Face-to-face meetings provide by far the highest level of interactivity among all communication modalities, including many electronic networks. It follows logically that the execution of "dynamic" activities would still rely heavily on face-to-face interactions and less so on electronic networks. Moreover, relative to the "dynamic" transactional tasks, the "static" ones incur relatively less demand on interactive communication. Therefore, it is not surprising to find computer-based networks to be considered more important to the "static" activities than the "dynamic" ones.

Nohria and Eccles (1992) offered some additional insights on when electronic networks may substitute for face-to-face interactions (pg. 299):

> "...electronically mediated exchange can substitute for face-to-face interaction only when the identities of the interactants are not very important, when the circumstances at hand are certain and unambiguous, when the actions necessary are standard and routine, and when on-going interaction does not depend on a robust structure of relationships."

It is likely that the identity of the person in the supplier firm is less important to the tasks of seeking price information or specifying an order than to situations involving the

negotiations of a contract or trying to correct an order problem. Likewise, compared to the "dynamic" activities, the "static" ones also appear to be relatively less ambiguous, more standard and routine, as well as less reliant on robust relationships.

Furthermore, having coordination routines, patterns and rules can help to eliminate the need to treat each situation as new and provide stability to an organization's operations (Galbraith, 1973; March & Simon, 1958, 1993). Borrowing these insights from organizational theories, it can be inferred why networks may be instrumental to automating some standard and routinized tasks (i.e., the "static" ordering activities) but not other less routine ones (i.e., the "dynamic" interactions). For instance, once a retailer-supplier EDI connection is implemented, a system and routine for performing such standard activities as price check and ordering can be developed and followed. On the other hand, activities involving negotiations or problem solving are likely less routine, but may instead require different treatment across situations. As such, it would be more difficult to routinize or automate the execution of the "dynamic" activities electronically than the "static" ones.

In addition, as has been alluded to in the earlier discussion, there may be pre-established patterns of communication that have proven to be effective for dealing with some uncertain, ambiguous or complex tasks (Chapter 2). A case in point, again, relates to the anecdotal reports on the interactions with suppliers being done on the phone or by fax. These established communication strategies and routines might preclude the tendency and motivation to perform the same tasks electronically via computer networks.

Related to this point of established patterns of interactions is the notion of power structure. For instance, Weisband, Schneider and Connolly (1995) argued that information technologies have the potential of equalizing status or power in bargaining and negotiations. Other writings have offered complementary propositions (e.g., Bakos & Treacy, 1986). Powerful buyers or sellers may not want to relinquish their more advantageous position. As such, although network use might be allowed to automate some of the ordering activities, electronic exchange of information that has implications on negotiations, bargaining and other more sensitive types of interactions would be discouraged. This would further explain the differential perceptions of importance attributed to the coordination and control of different transactional activities.

At the methodological level, it is very likely that some of the insignificant results found in this study are partly due to the less than perfectly reliable indicators of network use. Having these seven items split up into two separate variables is less desirable than if the items constituted a single composite index. The two criterion measures gauging the importance of network use yield moderate internal consistency reliability (α = .71 and .75). If summed to form one index, Cronbach's Alpha would be .92.

Transaction Cost Hypotheses (H1 to H3)

As described in Chapters 2 and 3, there are a number of transaction cost variables that are proposed to influence the adoption and use of electronic information networks. Results reported in Chapter 4 show that the hypotheses associated with these variables have received mixed support from the empirical observations undertaken in this study.

This section provides a discussion of these transaction cost variables and their relationships with electronic network adoption and use.

Uncertainty (Hypothesis 1)

H1: *Uncertainty is positively associated with electronic network adoption and use.*

In the current study, uncertainty has not been found to have significant impact on electronic network adoption or use, leading to the rejection of Hypothesis 1. This finding could be attributable to a number of conceptual reasons, measurement problems, or a combination of both of these effects.

At the conceptual level, it is not unreasonable to expect the adoption and use of electronic networks to be encouraged when there is a high level of certainty (low uncertainty) associated with product availability and price. Recalling the earlier quote from Nohria and Eccles (1992), electronically mediated exchanges are likely to be more effective when situations involve higher certainty. Also discussed previously, some organizational theorists (e.g., Galbraith, 1973; March & Simon, 1958, 1993) would argue that lower uncertainty can facilitate the development and implementation of routines and programs to manage standard tasks. Again, the reason is that the need to treat each electronic order or price seeking activity as a new, unique situation is eliminated.

In addition, as discussed in Chapter 3, it has been widely recognized that uncertainty is highly complex and multi-dimensional. As such, while it is an important

construct to consider in research dealing with information technologies, it is a concept that is difficult to measure directly, and is often manifested or embedded in other hypothetical constructs. For instance, it has been argued that the complexity and compatibility variables in diffusion of innovations research "are merely indices of the degree and type of 'uncertainty-arousing' potential" (Tornatzky & Klein, 1982, pg. 41).

Moreover, in the present study, it can be observed that uncertainty is correlated with other transaction cost variables, specifically complexity of product description, product specificity and time specificity (see Table 11, Chapter 4). The presence of these associations appears to be consistent with what Tushman and Nadler (1978) conceptualized, that conditions related to task complexity and the environment faced by an organization are sources of uncertainty and, in turn, information processing needs. However, the empirical findings in the current study appear to suggest that uncertainty does not increase the need for coordination and control through the use of electronic information networks.

Unfortunately, due to methodological caveats, it cannot be ascertained as to whether the insignificant results associated with uncertainty indeed refute theoretical predictions. After all, the uncertainty index suffers from a lack of reliability; the three-item measure yields a Cronbach's Alpha score of only .51 (Table 10, Chapter 4). In addition, it is possible that the dimension of uncertainty operationally measured—(perceived) predictability of changes in the availability and prices of a product when it is needed—might not have been the "correct" one, as it relates to motivation for network adoption and use.

Asset (Product, Time and Knowledge) Specificity (Hypothesis 2)

H2: *Asset (product, time and knowledge) specificity is positively associated with electronic network adoption and use.*

As shown in the regression results (Table 12, Chapter 4), in the presence of other antecedent and control variables, none of the asset specificity measures are found to have any noteworthy impact on the adoption of the information technology cluster. It would appear that factors related to the social relational conditions (interpersonal relationships and trust) and organizational characteristics (size and integration with major supplier) could better explain the conditions that favor technological adoption. These results suggest that considerations of reduction in coordination costs are relatively less important than viewing technology as a functional substitute for interpersonal relationship and trust in managing retailer-supplier transactions. This finding has practical implications for managers trying to decide whether to adopt an electronic link with a trading partner. Rather than focusing solely on potential increase in cost efficiencies, how electronically mediated interactions fit in with the established reliance on social relational ties need to be considered.

One possible reason for the insignificant results for the asset specificity measures could be traced to the problem of measurement. Operationally defining product and time specificity by the brand name and product types, respectively, takes advantage of objective attributes rather than relying on subjective rating. While this strategy avoids

the methodological pitfalls associated with perceptive measurement (e.g., uncontrolled sources of variance stemming from individual differences in respondents), and appears logical for the grocery industry, these are nonetheless single-item measures. Consequently, reliability cannot be assessed. As for knowledge specificity, the two-item measure yields an internal consistency reliability score of only .52. This lack of reliability has likely contributed to attenuating the strength of associations observed.

As reported in the previous chapter, some measures of asset specificity have been found to have some effects on the perceived importance of network usage for some transactional activities. Specifically, both product and knowledge specificity have been shown to be partly, albeit moderately, accountable for grocery buyers viewing electronic network use to be important in supporting the "static" activities associated with acquiring a key product. (The two beta weights approach statistical significant at the .05 level; see Table 13). These observations are similar to findings by Kraut et. al. (1997), that the more specific an object is to the organization and the more knowledge about the supplier and industry needed in general, the higher is the perception concerning the importance of electronic network use.

In addition, these results concerning product and knowledge specificity are consistent with the predictions of transaction cost theory. They lend moderate support to the proposition that network use is partly motivated by the desire to reduce the costs of coordinating and controlling transactions involving highly asset-specific products (discussed in Chapter 2). A product bearing a retailer's private label (high product specificity) is unlikely to be produced by more than one or a few suppliers. Given the

need to engage in recurring transactions with this supplier (or small number of suppliers), automating the ordering process has the appeal of reducing coordination costs. Moreover, as long as the retailer needs to replenish a store-label product supplied by a particular trading partner, there is a guarantee for long-term business over which to spread technological investment and operational costs. After all, the supplier cannot sell the highly asset-specific product to another store without repackaging. Likewise, the retailer cannot easily switch to a different supplier without requiring the latter to make relationship-specific investments in producing and/or distributing private-label products.

Similar logic applies to the finding concerning knowledge specificity characterizing retailer-supplier transactions. Having highly specific knowledge about each other can facilitate the joint effort to automate pricing and order processing electronically. Furthermore, the average respondent in this study attributed fairly high importance to the need for both retailers and suppliers to know each other beyond basic industrial practice in order to do business effectively (mean score = 3.74). This observation implies the existence of idiosyncrasies in the highly complex and intricate grocery retail industry. It also suggests a considerable amount of strategizing being practiced by the industry participants. These two points have received wide support from trade press reports. In addition, many survey participants in the current study were adamant about not letting the information they provided "leak" to competitors. Such volatility characterizing the industry, in turn, renders it difficult to develop and implement standard programs and routines to manage many complex transactions. This difficulty likely applies to automation as well. Therefore, it is not surprising to find that

negotiations, monitoring and problem fixing (the "dynamic" transactions) activities cannot be readily automated and carried out electronically.

Complexity of Product Description (Hypothesis 3)

H3: *Complexity of product description is positively associated with electronic network adoption and use.*

In the current study, complexity of product description is a significant predictor for computer-based networks being viewed as important to the transactional activities that are more "dynamic" in nature (see Table 13). In other words, the more difficult it is to describe the critical attributes of a key product needed, the more a grocery buyer is likely to rely on electronic networks for pre- and post-sales negotiations and interactions with their suppliers. This finding also receives support from the fact that the average rating for the complexity of product description was significantly higher among the network users than the non-users (see the comparison of the two groups reported in Table 7, Chapter 4).

This observation can be traced partly to the fact that variations of products are often associated with various forms of standardized codes used in the grocery industry (e.g., UPCs, ULNs, SKUs, etc.). It would also appear that the more complex a product is, the more efficient these codes tend to be in describing the grade or quality that is desired in the product. For instance, one respondent reported that there are different numbers associated with different grades of bananas. While it would be difficult to describe in words precisely the shade of yellow that an order of bananas should have, the

standardized codes serve as an efficient short-hand description for this otherwise highly complex communication task. Since these product codes can be easily transmitted over networks, whenever there is a problem with an order, or when an urgent replenishment is needed (just-in-time), interactions with the supplier can be expedited.

Consistent with the finding by Kraut et. al. (1997), this empirical observation rejects the hypothesis advanced by Malone et. al. (1987) that electronic linkages are associated with lower complexity of product description. A possible explanation is that, if a set of product attributes could be easily described, existing communication mechanisms might suffice (e.g., faxing and telephoning). As such, it would be less worthwhile or justifiable to invest in a state-of-the-art electronic network. Moreover, recall from the conceptual discussion in Chapter 2 that, compared to a decade ago, the technologies available today are more sophisticated; they are more capable of supporting multi-media representation of product features that may be otherwise challenging to describe verbally or in writing alone. Empirical observations in this study concerning the construct of complexity of product description appear to confirm this proposition. In turn, this "revelation" calls for a change in the seemingly out-dated conceptualization originally proposed by Malone et. al. (1987).

Conceptual reasons aside, certain characteristics about grocery retailing may offer some pragmatic explanations for the observed patterns of associations between complexity of product description and the two network use measures. As a case in point, many grocery retailers rent shelf space in their stores to product vendors. The suppliers themselves are responsible for monitoring the inventory levels and stocking the shelves.

A famous example is Frito-Lay chips. Sales people scan shelves with hand-held electronic devices, and the codes associated with different types of chips requiring replenishments are transmitted electronically back to distribution centers. In these types of arrangements, regardless of the level of product description complexity, there would be minimal interaction between the retailers and suppliers after a contract has been negotiated and signed. Communication needs arise when there are "exceptions" to the agreement, such as when there are order problems to be resolved. Under these arrangements, it is likely that the grocery stores would not interact with the suppliers on a regular basis for the purposes of ordering (the "static" activities). This fact was confirmed by a number of respondents in the survey. For instance, one buyer said that the only time the supplier of a candy product would be contacted is if a store customer complained that a certain type of candy was not on the shelf. As a result, electronic network use to support such sparse communication would not be important. Again, in these contexts, the complexity of product description appears to be irrelevant (hence, explaining the insignificant relationship with the importance of electronic network use to "static" activities).

An electronic linkage with a supplier may become more useful when a supplier needs to be informed of a problem or a special product need that involves highly complex product description. Rather than having to relay verbally problems with an order that is difficult to describe, the product code and other order information stored electronically in an EDI system can be recalled to facilitate problem fixing. Similar logic also applies to negotiations, when the exchange of complex product specifications can be enhanced by

the use electronic data networks. Networks in this context would likely play a supplemental or complementary role to other modalities of coordination and control, e.g., interpersonal contact. Indeed, as will be discussed below, networks have been found to supplement/complement interpersonal relationships in executing the "dynamic" activities.

Social Relational Hypotheses (H4 to H6)

Reported in Chapter 4 are the different associations between the social relational variables proposed (interpersonal relationships, mutual commitment and trust) and the various network use and adoption measures. This section provides a discussion on these findings.

Importance of Interpersonal Relationships (Hypothesis 4)

H4: *(Importance of) interpersonal relationships is positively associated with electronic network adoption and use.*

Perceptions toward interpersonal relationships present another interesting case in which the associations are different with technological adoption and the importance attributed to electronic network use. As far as adoption of the information technology cluster is concerned, it is found to have a negative relationship with the perceived importance of interpersonal relationships ($\beta = -.17$, $p < .05$; Table 12). In other words, the more a grocery buyer views "personal connections, interactions and knowledge" with members of the supplier firm to be important to their transactions, the less likely his/her

company would have adopted a large portion of the information technology cluster. What can be inferred are signs of substitutability between the two modalities of dealing with suppliers in the acquisition of a key product. When interpersonal contact is not considered crucial to the coordination and control of interactions, electronically mediated communication can suffice.

However, the results are altogether different in the assessment of the importance of electronic network use. Perceived importance of interpersonal relationships does not appear to have a significant association with that attributed to electronic network use for supporting transactional activities that are more "static" in nature ($\beta = .17$, $p > .05$; Table 13). It would appear that this finding is quite logical, especially when considering that a lack of trust in the supplier motivates network use to perform these routine activities (trust has a significant negative beta weight of -.25; Table 13). Intuitively, interpersonal relationships as a coordination and control mechanism would not be perceived important when there is a lack of trust.

With respect to the more non-routine, "dynamic" activities that are likely to require more recursive interactions between the grocery retailer and supplier, a significant positive relationship has been observed ($\beta = .33$, $p < .01$; Table 14). In other words, it would appear that electronic networks have been regarded as complements to interpersonal contact in these transactional contexts. This is consistent with a previous finding that there is a complementary relationship between the importance of electronic network use and interpersonal relationships (Kraut et. al., 1997). When interactions are complex and ambiguous, redundancy in communication channels is often desired. For

instance, Sitkin, Sutcliff and Barrios-Choplin (1992) reported that the use of multiple media and multiple communicators is especially associated with ambiguous tasks. This argument is also consistent with the information processing perspective that task ambiguity would contribute to the need to increase an organization's information processing capacity. In this regard, electronic networks appear to provide additional capacity as an additional modality for supporting "dynamic" interactions. Furthermore, as described by a respondent, when there is a problem with an order, he would call the supplier as well as reference the electronic order information. In this regard, the use of an electronic network with the supplier supplements the interpersonal communication necessitated to resolve the problem.

Other existing literature can also help to explain the differential patterns of associations with the two measure of network use. From a media richness perspective, the "dynamic" tasks that are more complex and ambiguous than the "static" tasks necessarily require the richest communication media, i.e., face-to-face interactions (Daft & Lengel, 1984; Trevino, Daft & Lengel, 1990). Therefore, in supporting these more media-rich tasks, the more likely function of electronic networks is to complement or supplement face-to-face interactions, rather than substituting the latter in serving as the sole medium of business exchanges. Furthermore, according to what has been reported as of the present, electronic interconnections, such as EDI, are useful for automating invoicing and exchanging straightforward pricing and shipping information; many ordering and payment processing activities beyond simple information exchange still require human intervention (Clark and Schiano, 1996). In this regard, technological

capabilities are merely complements to and supplements for improved communications and efficiency, and are not regarded or used as substitutes for interpersonal connections and interactions.

Mutual Commitment (Hypothesis 5)

H5: *Mutual commitment is positively associated with electronic network adoption and use.*

Powell (1996) contended that organizations in a trading relationship are sometimes willing to forego fears of vulnerability and collaborate when they have complementary resources; these resources could be anything, from materials to labor, and even information technology. Coupled with the discussion so far about varying electronic network use in different types of transactional activities, this observation helps to explain the patterns of relationships between mutual commitment and the various technology and network use measures. In particular, mutual commitment has been found to have a significant, positive relationship with the perceived importance of electronic network use to "static" activities ($\beta = .28$, $p = .03$; Table 13). However, this is not the case with the "dynamic activities" ($\beta = -.09$, $p = .47$; Table 14).

The above results appear logical and credible, as one would expect that committing to a trading relationship and forgoing the feeling of vulnerability would proceed progressively, starting with interactions that are the least "threatening." As such, automating the coordination and control of more routine, mundane activities, such as

those associated with getting and receiving standard pricing and ordering information, would be indicative of early signs of mutual commitment to the relationship. With respect to the more intricate types of the interactions involving negotiations and problem-solving, they may be deemed too important to be handled electronically but rather better handled by other means, especially face-to-face interactions. In this regard, it would appear that whether there is a high level of mutual commitment should have little direct effect on how important an electronic linkage is to supporting the "dynamic" activities.

Consistent with these observations about vulnerability and mutual commitment, Hart and Estrin (1991) observed that electronic networks have the effect of shifting the nature of interdependence among organizations. They concluded that while information processing is enhanced, new vulnerability is created as the firms come to depend on the electronic interconnections in their transactions with one another. This argument appears to help explain why electronic networks are perceived to be important to supporting "static" activities between trading partners highly committed to one another, but not interactions that are more ambiguous and complex, i.e., the "dynamic" activities.

Furthermore, it has been argued that electronic networks can facilitate the establishment of mutuality by providing the infrastructure for "reliable, prompt, and relatively low-cost information" (Parkhe, 1993, pg. 821). In turn, this translates into reduction in coordination efforts and safeguards against opportunism. It is likely that at the early stages of transacting with one another, mutual commitment is manifested in the form of "credible, significant non-recoverable investments on both sides" (pg. 821). It would appear that investing in an electronic interconnection is a sign of mutual

commitment of the more tangible nature. As a history of cooperation accumulates, mutuality that develops will likely become less reliant on the tangible investments made; rather the more affective aspects of commitment to each other (such as trust) may become more dominant.

On this note, anecdotal comments provided by a number of surveyed buyers in the current study may help to explain why mutual commitment is not a significant predictor of electronic network use to the "dynamic activities." These respondents commented that their willingness to cooperate with their suppliers was strictly because that was the nature of conducting business. To the extent that a trading partner's success is tied to their own, they are committed to the business relationship. As such, they would not want to relinquish the desire to be assured that they are not being cheated by their suppliers. Therefore, it is not surprising to find that negotiations, monitoring and problem solving did not rely heavily on electronically mediated interactions. While the (perhaps superficial) display of mutual commitment allows for routine, non-threatening activities to be coordinated and controlled electronically, the "dynamic" activities are too important to the protection of self-interests to be performed electronically. The most robust modality of interaction would still be required, even if networks are used to exchange information to supplement the face-to-face negotiations and bargaining. This finding adds practical insights into the extent to which retailer-supplier transactions can be automated, based on how vulnerable the parties would likely feel as a result.

Trust (Hypothesis 6)

H6: *Trust is positively associated with electronic network adoption and use.*

Perhaps the most "surprising" finding of the current study is the negative association between trust and technological adoption and use. Particularly, a larger portion of the information technology cluster has been adopted in firms that do not necessarily consider their trading partners to be trustworthy ($\beta = -.18$, $p = .05$; Table 12). Similarly, electronic network use has been perceived to be more important for supporting the more "static" activities when the level of trust in the supplier is low ($\beta = -.25$, $p = .03$; Table 12). Also, compared to the network users, non-users reported significantly higher trust in their suppliers (see Table 7, Chapter 4, for mean score difference). As argued in Chapter 2, one would expect intuitively that before two firms trading with one another would invest in an electronic interconnection and open up their information base to one another, trust should be present as a necessary condition. But as can be seen in the results of this research, this need not be the case.

One possible explanation for the negative relationships observed is that electronic networks help to increase the span of control (Beniger, 1986; Kipnis, 1996). Recall from the methods chapter that information is the basis of control and makes processes easier to monitor (Nass & Mason, 1990). Also, as discussed earlier, electronic networks increase the bandwidth of human interaction and help to reduce uncertainty involved in a situation. It would appear that electronic supplier-retailer interconnections in this context might serve as a functional substitute for trust as a mechanism for control, coordination

and coping with the conditions (e.g., uncertainty) surrounding the transactions that occur with the acquisition of a key product.

Another possible explanation for the negative association is in the conceptualization of trust, given the different dimensions associated with the concept. (To recap, trust in the current study is conceptualized as the belief that one's trading partner will refrain from malfeasance.) More specifically, the manifestations of two parties appearing to trust each other may be the result of deliberate actions rather than the reality of truly feeling the presence of affective bonds with one another. This is highly plausible, and has empirical support from the current study (trust and mutual commitment are highly correlated, $r = .56$, $p < .01$). Clark and Schiano (1996) articulated the logic behind this argument (pg. 284):

> "[trust]...must not be constructed through nebulous psychological trust-building exercises...but through the deliberate undertaking of irreversible actions that commit both parties equally and irrevocably to the success of the relationship."

Given this characterization, while a respondent might not perceive a high level of trust in a supplier in the psychological sense, contractual and other mechanisms are able to substitute for this lack of affective sense of confidence and security. Expressed differently, even if a grocery retailer is reportedly not trusting of its major supplier, the presence of a contract would be a sufficient indication of commitment for routine activities to be automated with the use of networks. Another safeguard against opportunism disguised as trust is that of reputation. Several respondents in the current

study contended that their suppliers would unlikely take advantage of them because of negative reputational ramifications. These observations are consistent with Granovetter's (1985) argument concerning the need for institutional arrangements to enforce trust, which was reviewed in Chapter 2. The gap between conceptual reasoning and empirical observations stems from viewing trust and electronic information networks as complementary, rather than substitutable, control and coordination mechanisms.

Chapter Summary

In this chapter, conceptual reasons and methodological caveats were traced to help explain the results obtained. Arguments presented in existing literature were cited to qualify the "story" on why the adoption and use of electronic networks are associated in different ways with the proposed transaction cost and social relational variables. In addition, the lack of reliability in some of the measures and how that attenuates the strength of associations has also been discussed. Summary of the findings discussed above, implications of these observations for future research, along with other concluding remarks, will be presented in the next—and last—chapter of this volume.

Chapter 6

SUMMARY AND CONCLUSIONS

As the concluding chapter, this section of the dissertation focuses on tying together the different pieces of the study, i.e., conceptualization, research design and findings. The chief objective is to close the discussion by addressing the following issues: What are the answers to the research question? What are the limiting conditions due to conceptual caveats and drawbacks related to various aspects of the research design? What are the implications of the current study for future research and "real-world" organizational practice?

In response to the above questions, this chapter is divided into the following sections: First, a summary of the main findings of the current study is provided. Then, conceptual and methodological limitations are discussed. Finally, the chapter concludes with theoretical and practical implications of this dissertation.

Summary of Findings

Reiterating the chief purpose of the research undertaken, it is to investigate the following research question (stated in Chapter 1):

> ***What are the factors influencing organizational adoption and use of electronic information networks in retailer-supplier transactions associated with product acquisitions?***

Derived from transaction cost and social relational analyses, several factors antecedent to organizational adoption and use of electronic information networks are proposed and tested.

The current study finds that the level of electronic network use to support retailer-supplier transactions may not be as high as generally perceived. After all, a sizeable portion of the surveyed retailers were not using electronic information networks to support their product acquisitions from major suppliers (43 out of 143 cases). With respect to hypotheses testing, empirical observations show that significant factors influencing the adoption and use of electronic information networks are different. Furthermore, associations between predictor factors and the perceived importance of electronic network use vary across two sets of retailer-supplier transactions. To recap, they are the "static" and "dynamic" transactional activities/tasks associated with the acquisition of a key product from a major supplier. In particular, controlling for the impact of organizational size and retailer-supplier integration, the following results were obtained:

1. Adoption of the information technology cluster is motivated by the role played by technology as a functional substitute for trust and interpersonal relationships as mechanisms of coordination and control.

2. In conducting the "static" transactions, i.e., those that involve routine, straightforward communication of price and order information, electronic network use is perceived as important when:

   a. the supplier is not considered trustworthy; again, this result suggests that electronic information networks and trust are viewed as alternative coordination and control mechanisms.

   b. the retailer-supplier electronic interconnection is regarded as a tangible indication of mutual commitment between the trading parties.

3. In conducting the "dynamic" transactions, i.e., those that involve higher complexity, ambiguity or need for recursive interactions with the supplier, electronic network use is perceived as important when:

   a. networks are considered to be complementary/supplemental to interpersonal relationships as a coordination and control mechanism.

   b. networks are perceived to facilitate the representation and communication of a product's critical features, which are otherwise difficult to describe (high complexity of product description).

Limitations

Like most empirical research, the current study is tempered with a number of conditions constraining the interpretations and generalizations of the findings. This section discusses the limitations associated with the research design and model specifications in this dissertation research.

Research Design

Measurement

Empirical tests of hypothesized relationships and how they can be interpreted are constrained by the way constructs have been operationally defined and measured. For instance, it is possible that the negative relationships observed between trust and electronic network adoption and use may be attributed to the affective dimension of trust measured (discussed in Chapter 5). A different pattern of associations might be found if another dimension of trust were to be tapped, such as that related to confidence derived from and enforced by the existence of a legal contract. Another case in point is the construct of uncertainty. Preceding discussions (Chapter 5) pointed out the fact that the "wrong" dimension of uncertainty might have been explicated in the current study. Therefore, the absence of statistically significant relationships with the various information technology and electronic network variables may be due to the use of inappropriate operational procedures.

Aside from limitations related to operationalization, reliability of measures developed in this study is likely another source of measurement caveats. Unreliable

measures attenuate the strength of associations observed. Therefore, the absence of a hypothesized relationship may be due to measurement problems. Specific cases include the composite indices for uncertainty and knowledge specificity, which suffer from low internal consistency reliability (reported in Chapter 4). Because of this methodological problem, it cannot be concluded confidently that, in reality, uncertainty and knowledge specificity indeed have no influence on organizational adoption and use of electronic information networks (discussed in Chapter 5).

Furthermore, because the current study used a cross-sectional design to test the presence and strength of hypothesized relationships, causality cannot be overstated. When considering the issue of temporal sequence, interpersonal relationships have existed long before electronic communication networks have been introduced to support trade. However, it would not be surprising to find that electronically mediated interactions may alter the way interpersonal contact is viewed in day-to-day business trading. Therefore, to tease apart explained variance attributable to the two different directions of association between interpersonal relationships and electronic networks, overtime data would be desired. Similar logic applies to other variables proposed to be the antecedent factors in this study.

Population Selection

When designing the current study, caution was taken to ensure that the population selected maximizes the generalizability of findings. Bearing this objective in mind, the grocery retail industry was chosen, in part, because it shares many common

characteristics with other industries, particularly in the retail sector (e.g., apparel). For instance, standardized product coding (e.g., SKUs, ULNs, etc.), which is associated with the complexity of product description construct, is practiced in other retail businesses as well. Furthermore, it seems reasonable to expect interpersonal relationships to be viewed as important in varying extent to negotiations and problem-solving situations across different industrial settings.

Notwithstanding these commonalities, unique characteristics associated with grocers limit the extent to which findings of this research can be generalized to organizations in other industries. As a case in point, the notions of product and time specificity are likely to be qualitatively different across businesses. In turn, whether an inter-organizational electronic link is viewed as a complementary or substituting communication modality to different networks of social and interpersonal relations may vary across industries.

Sample Sizes

Of the 143 completed surveys, 100 and 140 were included in analyzing the importance of electronic network use measures and the information technology cluster, respectively. These sample sizes do not yield much statistical power for the analyses conducted, and constrain the extent to which the results obtained can be generalized. Therefore, a limiting condition of the current study stems from the relatively small sample sizes available for the empirical tests of the hypotheses developed in this research.

Model Specifications

As reported in preceding chapters, there is inadequate fit between empirical observations and hypothesized relationships among variables. R-square values range from .19 to .25, indicating that the regression models fail to account for the entire pool of variance found in the data. This is despite the fact that these R-square values are within the general range of those found in similar studies. For instance, Kraut et. al. (1997) reported an R-square score of .29 (adjusted R-square = .24) with 17 predictors of the importance of electronic network use. Sabherwal and Vijayasarathy (1994) studied three predictors of the use of telecommunication links with suppliers, yielding an R-square of .14 (with no control variables). Aside from measurement and other research design problems discussed above, the lack of fit between propositions and empirical findings may be attributable to missing variables and/or relationships among them.

Among possible missing explanatory factors, the power dynamics between retailers and suppliers in the grocery industry may not have been adequately accounted for in the current study.[1] One missing link in the current study could be the failure to measure directly the possible presence of powerful retailers or suppliers dictating the implementation and use of electronic interconnections. As qualitative interviews referenced earlier suggest (see Footnote 10, Chapter 3), a firm may be forced to interact with a more powerful trading partner electronically as a prerequisite to continuing the business relationship.

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[1] A case in point is the construct of relative bargaining position. Had the measurement of this concept been successful, the regression results might have been improved.

Furthermore, as alluded to briefly in the last chapter, there may be other forces influencing the use of electronic networks with major suppliers that have no direct connection with the retailer-supplier relationship or transaction cost considerations. It is possible that technology was adopted for other reasons (e.g., to capture customer purchase patterns); using it for electronic transactions might have come later as a spin-off or "after-thought" to facilitate the coordination and control of product acquisition activities. Therefore, considering other organizational attributes may contribute to investigating the factors influencing electronic information network use. In this regard, explanatory/predictor factors derived from the theory of diffusion of innovations (Rogers, 1962, 1986, 1995) may be highly useful. For instance, by looking at a variable such as compatibility, it is possible to explore how the existing orientation towards technology in an organization may impact on using networks to transact with trading partners.

In addition, more rigorous application of the information processing approach (Galbraith, 1973; Thompson, 1967; Tushman & Nadler, 1978) may be useful to identifying motivating factors for network adoption and use. This theoretical perspective was used in the current research to guide the general conceptualization of electronic networks as a mechanism for coordination and control. As a "fit" theory arguing for a match between information processing capacity with needs, it can offer helpful guidance in explicating the contingencies and task ambiguities surrounding various retailer-supplier transactions that create information processing needs. In turn, how different roles and functions served by electronic networks can satisfy these various needs faced by organizations may be identified and tested.

Implications

Previous conceptual work grounded in transaction cost analysis offers valuable insights into how electronic networks may help to reduce costs associated with buyer-seller transactions. The current study shows that a number of social relational factors influence organizational adoption and use of electronic networks in ways that are not explained by transaction cost variables. Empirical support for this observation is provided by the findings summarized above. In particular, the lack of trust in a trading partner has been found to be a significant factor associated with technological adoption and electronic network use. In addition, technology is seen as a functional alternative to interpersonal relationships in coordinating and controlling "static" transactions, while playing a complementary role in "dynamic" ones. Mutual commitment has also been found to be a crucial factor influencing organizational network use. The only transaction cost factor that is significantly correlated with network use is the complexity of product description. Future research efforts devoted to the refinement of the conceptualizations and measurement proposed in this study can further test the relative utility of transaction cost and social relational analyses.

It would appear that, in constructing a theoretical model of factors antecedent to electronic network adoption and use, social relational conditions should be considered in conjunction with transaction cost variables. In addition, the consideration of other constructs, such as those related to the retailer-supplier power structure and other organizational attributes, may be useful to increasing the explanatory and predictive

power of a model of organizational network adoption and use. As discussed above, it would be valuable to consider and incorporate insights derived from other theories, such as the diffusion of innovations and the information processing approach. Last, but not least, the incorporation of overtime analysis of a set of key factors would also be meaningful in distinguishing between the antecedents to and the effects of technology use on inter-organizational coordination and control.

At a practical level, this research shows that electronic network use in commercial transactions is not as prevalent as existing hype would suggest. After all, one-third of the grocery retail companies surveyed did not consider electronic networks to be important to their interactions with major product suppliers. Therefore, the level at which technology can actually facilitate trade should not be overstated.

Moreover, findings in this research also lead to the recommendation that retailers should not be concerned solely with technological implementation and operational costs. Decisions to adopt and use electronic networks need to factor in the varying complementary and substituting roles technologies play in relation to the pre-existing social relational conditions characterizing trade with suppliers. For instance, as a mechanism for coordinating and controlling transactions, how does an electronic link fit in with established interpersonal relationships with the trading partner? To what extent is the supplier trustworthy? Do both the retailer and supplier feel sufficiently committed to the business relationship to open themselves up to new interdependencies and vulnerabilities associated with electronic trading?

Conclusions

In conclusion, this dissertation represents a beginning attempt to integrate complementary bodies of literature to investigate organizational adoption and use of electronic information networks. While a number of social relational and transaction cost factors have been identified as influential to network use in supporting commercial transactions, the current study could not exhaust all critical factors to be considered. Possible theories to explore have been suggested for future research efforts in continuing the investigation of the factors antecedent to electronic network adoption and use to support commercial transactions.

It would appear that much excitement and momentum has been gathered over the emerging phenomenon of electronic commerce. This is, in part, fuelled by the exponential growth of the Internet and its popularity. Empirical observations in this research show that the actual use of electronic buyer-seller information networks falls short of the level inferred by the prevailing hype. Continued research in the actual roles and functions served by information technology in commercial transactions can help to separate the "true" value of using inter-firm electronic networks from sheer hype.

APPENDIX A

APPENDIX A

SURVEY INSTRUMENT

Information Technology Cluster – Questions 36-43

Importance of Electronic Network Use – Questions 44-51

Uncertainty – Questions 62-66

Product Specificity – Question 13

Time specificity – Question 1

Knowledge Specificity – Questions 17-22

Complexity of Product Description – Questions 67-70

Importance of Interpersonal Relationships – Questions 52-60

Mutual Commitment – Questions 31-35

Trust – Questions 23-26

Organizational Size – Questions 72-73 (and annual sales from Ward's Business Directory)

Integration with Major Supplier – Question 14-15

Questionnaire # _____

1. Hello, I'm _____ calling from Michigan State University. We're doing a survey of grocery buying across the country. Could you please tell me the name of the person most responsible for buying {PRODUCT CATEGORY}.

   [WRITE DOWN NAME IN SURVEY LOG.]

fresh fruit and vegetables..1
dairy products.....2
breakfast cereals.....3
confectionery goods.....4

2. May I have his/her telephone number please?

   [ENTER PHONE NUMBER INTO SURVEY LOG.]

3. Could you please connect me to him/her?

4. [IF SPEAKING TO BUYER'S SECRETARY:]

   Hello, I'm _____ calling from Michigan State University. May I speak to _____?

   [IF ASKED WHAT THIS IS REGARDING:]

   We're doing a survey of grocery buyers as part of a doctoral thesis project to understand how retailers do business with their suppliers, and how computer networks support trade.

   [BE PREPARED TO TAKE DOWN FAX NUMBER FOR ME TO FAX LETTER ABOUT THE PROJECT.]

5. [TO BUYER:]

   Hello, I'm _____ calling from Michigan State University. We're doing a survey of grocery buyers as part of a doctoral thesis project to understand how retailers do business with their suppliers, and how computer networks support trade. Your organization has been selected at random, and your participation is voluntary. This survey will take only about 15 minutes, and your contribution will be very valuable to the project. Of course, any information you give will be kept confidential, and will not be attributed to you or your company. Would you be willing to participate?

   yes..1
   no...2

   [IF THE ANSWER IS 1, THEN SKIP TO QUESTION 7]

6. [IF ANSWER TO QUESTION 5 IS "NO":]

   Your expert input will be very important to this study. Perhaps, I could call back at a more convenient time for you?

7. Before I proceed with the survey, I would like to confirm that you are responsible for acquiring {PRODUCT CATEGORY}. Is that correct?

yes..1
no...2

[IF THE ANSWER IS 1, THEN SKIP TO QUESTION 9]

8. [IF ANSWER TO QUESTION 7 IS "NO":]

   May I have the name and phone number of the right contact person?

9. What is your title please?

   _____

10. This interview will focus on the way you acquire a key product from a major supplier. What would you say is one of the best selling type of {PRODUCT CATEGORY} for your firm?

    [USE THE SURVEY LOG TO RECORD THIS PRODUCT AND SUBSTITUTE INTO {TOP PRODUCT} IN SUBSEQUENT QUESTIONS.]

    [IF THE ANSWER TO QUESTION 1 IS 1, THEN SKIP TO QUESTION 14.]

11. Does your firm carry your own label of {TOP PRODUCT} or a brand only sold in a local market but not else where in the country?

    [IF MORE THAN ONE MARKET, ASK TO THINK OF MOST IMPORTANT MARKET.]

yes.....1
no.....2

don't know/no answer..9

12. Does your firm carry a regional label or brand of {TOP PRODUCT}?

yes.....1
no.....2

don't know/no answer..9

13. For the product questions in this survey, please think of _____ of {TOP PRODUCT}.

the local or store label or brand.. 1
a regional label or brand..... 2
a national label or brand..... 3

don't know/no answer..... 9

14. Now, I would like to ask you some questions about how you deal with suppliers. Please think of the most important supplier you've worked with in the past 12 months to acquire {TOP PRODUCT}.

15. Is this supplier:

an independent manufacturer or producer.. 1
an independent wholesaler or distributor.. 2
a partially-owned wholesaler or distributor.. 3
a joint-venture with another company..... 4
a wholly-owned wholesaler or distributor..5

don't know/no answer..... 9

16. For the following questions, please indicate how much you agree or disagree with them, on a scale of 1 to 5. "1" means "strongly disagree" and "5" means "strongly agree." You may use any number in between.

17. This supplier is very knowledgeable of your company's specific product needs?

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

18. This supplier knows more about the way your company acquires {TOP PRODUCT} than any other suppliers?

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

19. Having only general knowledge of grocery retailing is insufficient for doing business with your company effectively?

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

20. Your company is very knowledgeable of the products this supplier provides?

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

21. Your company knows more about the way this supplier conducts business than any other retailers?

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

22. Having only general knowledge of grocery suppliers is insufficient for doing business with this supplier effectively?

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

23. Overall, you would consider this supplier to be trustworthy.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

24. You have complete confidence that this supplier will always keep promises made to your company.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

25. You have complete confidence that this supplier will not take advantage of you even if given the opportunity to do so.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

26. You will be hesitant to transact with this supplier unless detailed terms of a contract are clearly specified.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

27. When negotiating the terms of an acquisition with this supplier, they generally accept your terms without much rebuttal.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

28. When negotiating the terms of an acquisition with this supplier, you often feel that they have more leverage over your company.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

29. Your business is critical to this supplier.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

30. This supplier is a critical supplier to your company.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

31. You believe that this supplier is as committed as your company is to the success of your business relationship.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....

don't know/no answer..9

32.You will not hesitate to switch to a different supplier.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

33. This supplier is very responsive to your company's needs.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

34. You believe that this supplier cares about the success of your business.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....

don't know/no answer..9

35. The success of your supplier's business is important to you.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

36. Now, I'd like to ask for your input on how important electronic networks are in working with this supplier to acquire {TOP PRODUCT}. By an electronic network, we mean a connection between computers of your firm and your supplier, which allows you to exchange information electronically with each other. This includes modem connections, local area networks, electronic mail, electronic data interchange, Lotus Notes or the Internet.

37. Does your company use:

38. the Worldwide Web

[IF NEED TO EXPLAIN: the portion of the Internet that supports pictures and sound.]

yes.....1
no.....2

don't know/no answer..9

39. an electronic data interchange system

[IF NEED TO EXPLAIN: a computer-based system of exchanging data, such as pricing and billing information.]

yes.....1
no.....2

don't know/no answer..9

40. an electronic point-of-sale system

[IF NEED TO EXPLAIN: a system that scans and records credit and debit card and sales information electronically.]

yes.....1
no.....2

don't know/no answer..9

41. a computer-based on-line information service, such as CompuServe, America Online and Prodigy

yes.....1
no.....2

don't know/no answer..9

42. electronic mail for communication within your company

yes.....1
no.....2

don't know/no answer..9

43. electronic mail for communication with external suppliers

yes.....1
no.....2

don't know/no answer..9

44. On a scale of 1 to 5, "1" being "not important at all," "5" being "very important," please tell me how important electronic networks are to the following activities:

45. developing specifications of an order

not important at all..1
.....2
.....3
.....4
very important.....5

don't use.....9

46. seeking price information

not important at all..1
.....2
.....3
.....4
very important.....5

don't use.....9

47. negotiating the terms of an agreement to purchase {TOP PRODUCT}

not important at all..1
.....2
.....3
.....4
very important.....5

don't use.....9

48. ordering {TOP PRODUCT}

not important at all..1
.....2
.....3
.....4
very important.....5

don't use.....9

49. monitoring the quality of the orders received

not important at all..1
.....2
.....3
.....4
very important.....5

don't use.....9

50. practicing just-in-time inventory management

[IF NEED TO EXPLAIN: keeping less in stock & reordering more often.]

not important at all..1
.....2
.....3
.....4
very important.....5

don't use.....9

51. fixing after-sales errors or problems

not important at all..1
.....2
.....3
.....4
very important.....5

don't use.....9

52. Next, I'd like to ask you about the importance of interpersonal relationships in working with this supplier. By interpersonal relationships, we're including any type of personal connection, interactions and knowledge between members of your company and the supplier.

53. Again, on a scale of 1 to 5, "1" being "not important at all," "5" being "very important," please tell me how important interpersonal relationships are to the following:

54. developing specifications of an order

not important at all..1
.....2
.....3
.....4
very important.....5

don't use.....9

55. seeking price information

not important at all..1
.....2
.....3
.....4
very important.....5

don't use.....9

56. negotiating the terms of an agreement to purchase {TOP PRODUCT}

not important at all..1
.....2
.....3
.....4
very important.....5

don't use.....9

57. ordering {TOP PRODUCT}

not important at all..1
.....2
.....3
.....4
very important.....5

don't use.....9

58. monitoring the quality of the orders received

not important at all..1
.....2
.....3
.....4
very important.....5

don't use.....9

59. practicing just-in-time inventory management

[IF NEED TO EXPLAIN: keeping less in stock & reordering more often.]

not important at all..1
.....2
.....3
.....4
very important.....5

don't use.....9

60. fixing after-sales errors or problems

not important at all..1
.....2
.....3
.....4
very important.....5

don't use.....9

61. As a final set of questions, I'm going to read you a number of statements {TOP PRODUCT}. Please tell me how much you agree or disagree with them, again on a scale of 1 to 5, "1" being "strongly disagree" and "5" being "strongly agree:"

62. The availability of {TOP PRODUCT} changes a great deal over the course of a year.

63.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

63. You can easily get a replenishment of {TOP PRODUCT} anytime you need it.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

64. The amount of {TOP PRODUCT} to be acquired changes a great deal from one order to the next.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

65. The price you pay for {TOP PRODUCT} changes a great deal from one order to the next.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

66. Your company has a great deal of control over the fluctuations of price you pay to acquire {TOP PRODUCT}.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

67. Is there a standard coding system, such as UPC, for describing variations of {TOP PRODUCT}?

yes.....1
no.....2
don't know/no answer..9

68. When ordering {TOP PRODUCT}, it is difficult to create a verbal description for it.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

69. Only a picture or other visual representation of {TOP PRODUCT} can describe adequately the features of the product.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

70. Multimedia representation of {TOP PRODUCT}, that is some combination of text, picture and sound, is necessary to describe adequately the features of the product.

strongly disagree.....1
.....2
.....3
.....4
strongly agree.....5

don't know/no answer..9

71. To wrap up this interview, I'd like to ask you just a few general questions about your firm.

72. How many stores do you have around the country?

73. How many employees do you have?

74. How many employees are in charge of buying activities?

75. These are all the questions I needed to ask you. Thank you very much for your time and cooperation!
[IF RESPONDENT WANTS A COPY OF THE REPORT, ASK FOR ADDRESS.]

send report.....1
no need to send report..2

76. [ENTER THE 3-DIGIT COMPANY NUMBER, AS PRINTED IN THE SURVEY LOG.]

_____

APPENDIX B

APPENDIX B

SURVEY LOG

(ALL FIELDS IN BOLD MUST BE COMPLETED.)

Main number:* _____ Company number:* _____

Completed (date & time): _____ or **Refused (date & time):** _____

Interviewer's name: _____ **Questionnaire number:** _____

Product Category:* _____

Company Name:* _____

Buyer's name: _____

Phone number: _____ Fax number: _____

Secretary's Name: _____

Appointment (date & time): _____ _____

_____ _____

1st attempt (date & time): _____ 5th attempt (date & time): _____

2nd attempt (date & time): _____ 6th attempt (date & time): _____

3rd attempt (date & time): _____ 7th attempt (date & time): _____

4th attempt (date & time): _____ 8th attempt (date & time): _____

Address (if they want report): _____

_____

Comments/Notes (include date):

* *Information in these fields was available prior to the first call.*

REFERENCES

REFERENCES

Anderson, E. (1985). The salesperson as outside agent or employee: A transaction cost analysis. *Marketing Science*, *4*(3), 234-253.

Allen, T. J., & Hauptman, O. (1990). The Substitution of Communication Technologies for Organizational Structure in Research and Development. In J. Fulk & C. Steinfield (Eds.), *Organizations and communication technology* (pp. 275-294). Newbury Park, CA: Sage Publications, Inc.

Allen, T. J., & Scott Morton, M. S. (Eds.) . (1994). *Information technology and the corporation of the 1990s: Research Studies*. New York: Oxford University Press.

Arnold, W. E. (1989). Scaling techniques. In P. Emmert & L. L. Barker (Eds.), *Measurement of communication behavior* (pp. 117-133). New York: Longman.

Babbie, E. (1990). *Survey research methods* (2nd. ed.). Belmont, CA: Wadsworth Publishing Company.

Bakos, J. Y. (1991). A strategic analysis of electronic marketplaces. *MIS Quarterly*, *September*, 295-310.

Bakos, J. Y., & Treacy, M. E. (1986). Information technology and corporate strategy: A research perspective. *MIS Quarterly*, June, 107-119.

Barnes, S., & Greller, L. (1994). Computer-mediated communication in organization. *Communication Education*, 43(April), 129-142.

Beniger, J. R. (1990). Conceptualizing information technology as organization, and vice versa. In J. Fulk & C. Steinfield (Eds.), *Organizations and communication technology* (pp. 29-45). Newbury Park, CA: Sage Publications, Inc.

Beniger, J. R. (1986). *The control revolution: Technological and economic origins of the information economy.* Cambridge, MA: Harvard Univeristy Press.

Biggart N. W., & Hamilton, G. G. (1992). On the limits of a firm-based theory to explain business networks: The bias of neoclassical economics. In N. Nohria & R. Eccles (Eds.), *Networks and organizations: Structure, form, and action* (pp. 471-490). Boston, MA: Harvard Business School Press.

Benjamin, R., & Wigand. R. (1995). Electronic markets and virtual chains on the information superhighway. *Sloan Management Review*, Winter, 62-72.

Bollen, K. A. (1989). *Structural equations with latent variables.* New York: John Wiley & Sons.

Bradach, J. L., & Eccles. R. G. (1991). Price, authority and trust: From ideal types to plural forms. In G. Thompson, J. Frances, R. Levacic & J. Mitchell (Eds.), *Markets, hierarchies and networks: The coordination of social life* (pp. 277-292). London, UK: Sage Publications Ltd.

Bradley, S. P. (1993). The role of IT networking in sustaining competitive advantage. In S. P. Bradley, J. A. Hausman & R. L. Nolan (Eds.), *Globalization technology and competition: The fusion of computers and telecommunications in the 1990s* (pp. 113-142). Boston, MA: Harvard Business School Press.

Bradley, S. P., Hausman, J. A., & Nolan, R. L. (Eds.). (1993). *Globalization technology and competition: The fusion of computers and telecommunications in the 1990s.* Boston, MA: Harvard Business School Press.

Brousseau, E. (1995). Contracts as modular mechanisms: Some propositions for the study of "hybrid forms." *International Journal of the Economics of Business*, *2*(3), 409-439.

Brynjolfsson, E., Malone, T., Gurbaxani, V. & Kambil, A. (1994). Does information technology lead to smaller firms? *Management Science*, *40*(12), 1628-1644.

Burns, T., & Stalker, G. M. (1961). *The management of innovation.* London, UK: Tavistock Publications Limited.

Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multi-method matrix. *Psychological Bulltetin*, *56*, 81-105.

Child, J. (1987) Information technology, organization, and the responses to strategic challenges. *California Management Review*, *30*(1), 33-50.

Clark, T. H., & Schiano, W. T. (1996). Seven levels of interorganizational connectivity: An examination of the U.S. grocery distribution channel. *Proceedings of the 49th Annual Conference on System Sciences* (pp. 281-289). Hawaii.

Clemons, E. K. (1993). Information technology and the boundary of the firm: Who wins, who loses, who has to change. In S. P. Bradley, J. A. Hausman & R. L. Nolan (Eds.), *Globalization technology and competition: The fusion of computers and telecommunications in the 1990s* (pp. 219-242). Boston, MA: Harvard Business School Press.

Coase, R. (1937). The nature of the firm. *Economica, 4*, 64-73.

Contractor, N. S., & Eisenberg, E. M. (1990). Communication networks and new media in organizations. In J. Fulk & C. Steinfield (Eds.), *Organizations and Communication Technology* (pp. 143-172). Newbury Park, CA: Sage Publications, Inc.

Creed, W. E. D., & Miles, R. E. (1996). Trust in organizations: A conceptual framework linking organizational forms, managerial philosophies, and the opprotunity costs of controls. In R. M. Kramer & T. R. Tyler (Eds.), *Trust in organizations: Frontiers of theory and research* (pp. 16-38). Thousand Oaks, CA: Sage Publications, Inc.

Daft, R. L., & Lengel, R. H. (1984). Information richness: A new approach to managerial information processing and organization design. In L. L. Cummings & B. M. Staw (Eds.), *Research in organizational behavior, 6* (pp. 191-134). Greenwich, CT: JAI Press.

Davidow, W. H., & Malone, M. S. (1992). *The virtual corporation.* New York: HarperCollins Publishers.

Dillman, D. A. (1978). *Mail and telephone surveys: the total design method.* New York: Wiley.

Dow, G. K. (1988). Configurational and coactivational views of organizational structure. *Academy of Management Journal, 13*(1), 53-64.

Dwyer, f. R., Schurr, P. H., & Oh, S. (1987). Developing buyer-seller relationships. *Journal of Marketing, 51*(April), 11-27.

The Economist (1995, March 4). A survey of retailing: Change at the check-out.

Eisenberg, E. M., Farace, R. V., Monge, P. R., Bettinghaus, E. P., Kurchner-Hawkins, R., Miller, K. I., & Rothman, L. (1985). Communication linkages in interorganizational systems: Review and synthesis. In B. Dervin & M. J. Voight (Eds.), *Progress in communication sciences* (pp. 231-261). Norwood, NJ: Ablex.

Emmert, P. (1989a). Attitude measurement. In P. Emmert & L. L. Barker (Eds.), *Measurement of communication behavior* (pp. 134-153). New York: Longman.

Emmert, P. (1989b). Philosophy of measurement. In P. Emmert & L. L. Barker (Eds.), *Measurement of communication behavior* (pp. 87-116). New York: Longman.

Flanagin, A. J., Monge, P., & Fulk, J. (1997, May). *The effects of formative interorganizational relationships on subsequent interaction.* Paper presented at the 47th annual conference of the International Communication Association, Montreal, Canada.

Frances, J., Levacic, R., Mitchell, J., & Thompson, G. (1991). Introduction. In G. Thompson, J. Frances, R. Levacic & J. Mitchell (Eds.), *Markets, hierarchies and networks: The coordination of social life* (pp. 277-292). London, UK: Sage Publications Ltd.

Frozen Food Age (1996, August). Chain's consumer focus draws praise of brokers, 20.

Frozen Food Age (1996, July). PRWs upgrading tech savvy; value-added services soar, 1, 19 & 24.

Galbraith, J. (1973). *Designing complex organizations.* Reading, MA: Addison-Wesley Publishing Company.

Gomes, R., & Mentzer, J. T. (1991). The influence of just-in-time systems on distribution channel performance in the presence of environmental uncertainty. *Transportation Journal*, Summer, 36-48.

Granovetter, M. (1985). Economic action and social structure: The problem of embeddedness. *American Journal of Sociology, 91*(3), 481-510.

Grover, V. (1992). An Empirically Derived Model for the Adoption of Customer-based Interorganizational Systems. *Decision Sciences, 24*(3), 603-640.

Gurbaxani, V., & Whang, S. (1991). The impact of information systems on organizations and markets. *Communications of the ACM, 34*(1), 59-73.

Hair, Jr., J. F., Anderson, R. E., Tatham, R. L., & Grablowsky, B. J. (1979). *Multivariate data analysis.* Tulsa, OK: Petroleum Publishing Company.

Hammond, J. H. (1993). Quick response in retail/manufacturing channels. In S. P. Bradley, J. A. Hausman & R. L. Nolan (Eds.), *Globalization technology and competition: The fusion of computers and telecommunications in the 1990s* (pp. 185-214). Boston, MA: Harvard Business School Press.

Hart, P., & Estrin, D. (1991). Inter-organizational networks, computer integration, and shifts in interdependence: The case of the semiconductor industry. *ACM Transactions on Information Systems*, *9*(4), 370-398.

Hennart, J. (1986). What is internalization? *Review of World Economics*, *122*(4), 791-804.

Hess, C. M., & Kemerer, C. F. (1994). Computerized loan origination systems: An industry cse study of the electronic markets hypothesis. *MIS Quarterly*, September, 251-275.

Hillstrom, K., & Ruby, M. K. (Eds.). (1994). *Encyclopedia of american industries. Volume two: Service & non-manufacturing industries*. Detroit, MI: Gale Research.

Johanson, J., & Mattson, L. G. (1987). Inter-organizational relations in industrial systems: a network approach compared with transaction-cost approach. *International Studies of Management and Organization*, *17*(1), 34-48.

Johnston, H. R., & Lawrence, P. R. (1988). Beyond vertical integration: The rise of the value-adding partnership. *Harvard Business Review*, July-August, 94-101.

Johnston, H. R., & Vitale, M. R. (1988). Creating competitive advantage with inter-organizational information systems. *MIS Quarterly*, June, 153-165.

Joskow, P. L. (1985). Vertical integration and long-term contracts: The case of coal-burning electric generating plants. *Journal of Law, Economics, and Organization*, *1*(1), 33-80.

Keen, P. G. W. (1990). Telecommunications and organizational choice. In J. Fulk & C. Steinfield (Eds.), *Organizations and communication technology* (pp. 295-312). Newbury Park, CA: Sage Publications, Inc.

Kipnis, D. (1996). Trust and Technology. In R. M. Kramer & T. R. Tyler (Eds.), *Trust in organizations: Frontiers of theory and research* (pp. 39-50). Thousand Oaks, CA: Sage Publications, Inc.

Konsynski, B. R., & McFarlan, E. W. (1990). Information partnerships--Shared data, shared scale. *Harvard Business Review*, September-October, 114-120.

Kraut, R., Steinfield, C., Plummer, A. C., Butler, B., & Hoag, A. (1997). *Coordination modes and producer-supplier integration: Empirical evidence from four industries*. Manuscript submitted for publication in the *Organization Science* and the *Journal of Computer-Mediated Communication* Special Issue on Virtual Organizations.

Lawrence, P. R., & Lorsch, J. W. (1967). *Organization and environment: Managing differentiation and integration*. Boston, MA: Harvard Business School.

Lewis, L. (1996). Adding ABC, ECR & EDI to distribution formula. *Frozen Food Age*, *44*(9), 1, 16 & 42.

Malone, T. (1987). Modeling Coordination in Organizations and Markets. *Management Science*, *33*(10), 1317-1332.

Malone, T. & Crowston, K. (1994). The interdisciplinary study of coordination. *ACM Computing Surveys*, *26*(1), 87-120.

Malone, T. W., & Rockart, J. F. (1993). How will information technology reshape organizations? In S. P. Bradley, J. A. Hausman & R. L. Nolan (Eds.), *Globalization technology and competition: The fusion of computers and telecommunications in the 1990s* (pp. 37-56). Boston, MA: Harvard Business School Press.

Malone, T., Yates, J., & Benjamin, R. (1989). The logic of electronic markets, *Harvard Business Review*, (May-June): 166-171.

Malone, T., Yates, J., & Benjamin, R. (1987). Electronic markets and electronic hierarchies: effects of information technology on market structure and corporate strategies. *Communications of the ACM*, 30 (6), 484-497.

March, J. G., & Simon, H. A. (1993). *Organizations* (2nd ed.). Cambridge, MA: Blackwell Publishers.

March, J. G., & Simon, H. A. (1958). *Organizations*. New York: John Wiley.

Markus, M. L., & Robey, D. (1988). Information technology and organizational change: Causal structure in theory and research. *Management Science*, *34*(5), 583-598.

McGee, J. V. (1991). *Implementing systems across boundaries: Dynamics of information technology and integration*. Unpublished doctoral dissertation, Harvard University, Boston, Massachusetts.

Milliken, F. J. (1987). Three types of perceived uncertainty about the environment: State, effect, and response uncertainty. *Academy of Management Review, 12*(1), 133-143.

Morgan, G. (1986). *Images of organization.* Newbury Park, CA: Sage Publications, Inc.

Nass, C., & Mason, L. (1990). On the study of technology and task. In J. Fulk & C. Steinfield (Eds.), *Organizations and communication technology* (pp. 46-68). Newbury Park, CA: Sage Publications, Inc.

Newcomb, T. (1953). An approach to the study of communicative acts. *Psychological Review, 60*, 393-404.

Nohria, N., & Eccles, R. (1992). Face-to-face: Making network organizations work. In N. Nohria & R. Eccles (Eds.), *Networks and organizations: Structure, form, and action* (pp. 288-308). Boston, MA: Harvard Business School Press.

Norusis, M. J./SPSS Inc. (1993). *SPSS for Windows. Release 6.0.* Chicago, IL: SPSS Inc.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). New York: McGraw-Hill, Inc.

Ouchi, W. G. (1991). Markets, bureaucracies and clans. In G. Thompson, J. Frances, R. Levacic & J. Mitchell (Eds.), *Markets, hierarchies and networks: The coordination of social life* (pp. 246-255). London, UK: Sage Publications Ltd.

Parkhe, A. (1993). Strategic alliance structuring: A game theoretic and transaction cost examination of interfirm cooperation. *Academy of Management Journal, 36*(4), 794-829.

Pfeffer, J. & Salancik, G. R. (1978). *The external control of organizations: A resource dependence perspective.* New York: Harper and Row.

Porter, M. E., & Millar, V. E. (1985). How information gives you competitive advantage. *Harvard Business Review*, July-August: 149-160.

Powell, W. W. (1996). Trust-based forms of goverance. In R. M. Kramer & T. R. Tyler (Eds.), *Trust in organizations: Frontiers of theory and research* (pp. 51-67). Thousand Oaks, CA: Sage Publications, Inc.

Powell, W. W. (1990). Neither market nor hierarchy: Network forms of organization. *Research in Organizational Behavior, 12*, 295-336.

Progressive Grocer (1996, April). 63rd Annual Report of the Grocery Industry Supplement.

Raphel, M., & Raphel, N. (1996). What *you* can do on the internet. *Progressive Grocer*, May, 31-32.

Ratliff, M. (1996). *A glossary of food industry terms.* Department of Marketing and Supply Chain Management, Michigan State University, East Lansing, Michigan.

Rogers, E. M. (1995). *Diffusion of innovations* (4th ed.). New York: Free Press.

Rogers, E. M. (1983). *Diffusion of innovations* (3rd ed.). New York: Free Press.

Rogers, E. M. (1962). *Diffusion of innovations*. New York: Free Press.

Sabherwal, R., & King, W. R. (1992). Decision processes for developing strategic applications of information systems: A contingency approach. *Decision Sciences*, *23*(4), 917-938.

Sabherwal, R., & Vijayasarathy, L. (1994). An empirical investigation of the antecedents of telecommunication-based interorganizational systems. *European Journal of Information Systems*, *3*(4), 269-284.

Schuman, H., & Presser, S. (1981). *Questions and answers in attitude surveys: Experiments on question form, wording and context.* Orlando, Fl: Academic Press, Inc.

Sealey, P. S. (1994). *The strategic impact of information technology on the relationship between the supplier and the retailer in the grocery industry.* Unpublished doctoral dissertation, The Claremont Graduate School, Claremont, California.

Sheppard, B. H., & Tuchinsky, M. (1996). Interfirm relationships: A grammar of pairs. *Research in Organizational Behavior*, *18*, 331-373.

Sitkin, S. B., Sutcliffe, K. M., & Barrios-Choplin J. R. (1992). A dual-capacity model of communication media choice in organizations. *Human Communication Research*, *18*(4), 563-598.

Steinfield, C., & Caby, L. (1993). Strategic organizational applications of videotex among varying network configurations. *Telematics and Informatics*, *10*(2), 119-129.

Steinfield, C., Caby, L., Jaeger, C., & Kraut, R. (1997, June). *Electronic data networks and inter-firm relations: A French and U.S. comparative analysis.* Paper presented at Global Networking '97, Calgary, Canada.

Steinfield, C., Kraut, R., & Plummer, A. C. (1995). The impact of interorganizational networks on buyer-seller relationships. *Journal of computer mediated communication, 1* (3). Available http://www.usc.edu/dept/annenberg/vol1/issue3/vol1no3.html.

Thompson, J. D. (1967). *Organizations in action.* New York: McGraw-Hill.

Tornatzky, L. G. & Klein, K. J. (1982). Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Transactions on Engineering Management, EM-29*(1), 28-45.

Trevino, L. K., Daft, R. L., & Lengel, R. H. (1990). Understanding managers' media choices: A symbolic interactionist perspective. In J. Fulk & C. Steinfield (Eds.), *Organizations and communication technology* (pp. 71-94). Newbury Park, CA: Sage Publications, Inc.

Tushman, M. L., & Nadler, D. A. (1978). Information processing as an integrating concept in organizational design. *Academy of Management Review, 3*, 613-624. (Reprinted in D. A. Nadler, M. L. Tushman, & N. G. Hatvany (Eds.), *Managing organizations: Readings and cases* (pp. 291-301) Boston, MA: Little, Brown and Company.)

Valente, T. W. (1995). *Network models of the diffusion of innovations.* Cresskill, NJ: Hampton Press, Inc.

Ward's business directory of U.S. private and public companies. (1997). Detroit, MI: Gale Research.

Williamson, O. E. (1981). The economics of organization: The transaction cost approach. *American Journal of Sociology, 87*(3), 548-575.

Williamson, O. (1979). Transaction-cost Economics: The Governance of Contractual Relations. *Journal of Law and Economics, 22*(October), 233-262.

Williamson, O. (1975). *Markets and Hierarchies: Analysis and Antitrust Implications.* New York: Free Press.

Zaheer, A., McEvily, B., & Perrone, V. (1996). Does trust matter? Exploring the effects of interorganizational and interpersonal trust on performance. Unpublished manuscript. University of Minnesota, Carlson School of Management, Minneapolis.

Zucker, L. G. (1986). Production of trust: Institutional sources of economic structure, 1840-1920. In B. M. Straw & L. L. Cummings (Eds.), *Research in organizational behavior* (Vol. 8, pp. 53-111). Greenwich, CT: JAI.