Cycle Time Reduction : The Role of Interorganizational Information Systems

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To the Graduate Council:

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Dedicated to Hema and Abhi, the loves of my life.

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ABSTRACT

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Interorganizational information systems (IOIS) are increasingly playing an important role in bringing about organizational transformations, reducing cycle times, and changing markets. In response to these changes brought about by information technology, organizations are focusing their efforts and resources on achieving increased customer responsiveness and shorter cycle times. Cycle time reduction (CTR) has become a key agenda for organizations wishing to increase customer service and reduce costs. This is especially true in the U.S. apparel industry which is facing new and complex challenges in terms of achieving increased customer responsiveness, reduced inventory, and effective time management.

The results derived from statistical analyses conducted on a highly reliable and valid data set collected from leading U.S. apparel retailers and manufacturers provide insights about differences in IOIS configurations across the retailers and apparel manufacturers, testifying to the existence of two general models of interorganizational coordination mechanisms to achieve CTR. The research also provides important insights into the relative importance of various interorganizational coordination mechanisms impacting CTR under different conditions of interdependency, trade-offs among the various interorganizational coordination mechanisms, and the configurations of various IOIS in order to achieve CTR.

TABLE OF CONTENTS

CHAPTER **PAGE**

CHAPTER **PAGE**

CHAPTER **PAGE**

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

Cycle Time Reduction (CTR) has become a key agenda for organizations wishing to increase customer service and reduce costs (Wetherbe, 1995). In order to compete effectively in the global marketplace, operating and organizing to achieve fast cycle time is increasingly becoming a cardinal concern for research and technology managers (Meyer, 1993). Time-based revolutions are redefining entire industries and putting tardy competitors out of business (Peters, 1990). Product life cycles have shortened dramatically and continue to shrink (Peters, 1992). With rapid developments in information technology, the pressure to dramatically reduce product development cycle time is on the rise (Reinertsen and Preston, 1991). The philosophy of cycle time reduction is best explained as reduction of cycle time in organizational processes in a way that reduces cost and/or increases customer service (Wetherbe, 1995). Reducing cycle time can usually be accomplished with little or no additional capital investment or human resources (Brown, 1994). In order to implement successful CTR programs, organizations are seeking the help of information systems technology (Knorr and Thiede, 1991).

In order to use information system technologies effectively to reduce cycle time, organizations need an integrated approach that includes focusing on groups external to the organization, such as distributors, customers and suppliers. Today the most dramatic and potentially powerful uses of information systems technology involve networks that transcend organizational boundaries (Cash & Konsynski, 1985). In recent years, many large organizations have undergone profound transformations, streamlining their operations. These

transactions typically moved away from vertical integration toward more interorganizational arrangements (Bensaou, 1993). These emerging interorganizational arrangements take the form of complex cooperative relationships - that have been variously described as interorganizational information systems (Barrett & Konsynski, 1982; Cash & Konsynski, 1985), "information partnerships" (Konsynski & McFarlan, 1990) and "electronic integration" (Venkatraman & Kambil, 1991) within a broader spectrum of electronic markets and electronic hierarchies (Malone, Yates, & Benjamin, 1987).

An "Inter-Organizational Information System (IOIS) is an integrated data processing/data communication system utilized by two or more separate participant firms" (Barrett, 1987). Implicit in this definition is "the interpenetration of organizational boundaries" (Heide & John, 1990) which implies more than just the analysis of internal business processes conducted within a single organization. The rationale for such cross-organizational communication links includes process efficiencies, performance increases, and competitive benefits (Konsynski, 1992). It is therefore proposed that the interorganizational information systems resulting from these interchanges can play a critical role in cycle time reduction.

While there are several mechanisms that facilitate CTR, here the focus is on the phenomenon of cycle time reduction that explicitly leverages the capabilities of interorganizational information systems.

The rest of the dissertation is organized as follows. First, the importance of the research and the research questions that are to be answered will be discussed. Second, as a part of theory development we review the dominant theoretical backgrounds to be drawn from organization theory, transaction costs economics, political economy, and information

theory. This theoretical material is used in developing the logic for an information processing view of cycle time reduction. Third, a conceptual research model that articulates the fit between interdependency and IOIS as a critical condition for improved CTR performance is formulated. Further, the proposed research constructs are operationalized into research variables and hypotheses. Fourth, the research methods employed in conducting the research will be presented. Fifth, data analysis and interpretation of the results are carried out. Finally, the results will be discussed in the light of the contributions of the research, limitations of the research, and directions for future research.

2. IMPORTANCE OF THE RESEARCH

In this section, both the practical and theoretical importance of this research will be established. Also, the importance of the research setting will be discussed in the light of the emerging importance of cycle time research in organizations and the choice of the U.S. apparel industry. Finally, the research questions to be answered will be stated.

2.1. PRACTICAL IMPORTANCE

The research has significance for practicing managers. Anecdotal evidence suggests that significant improvements in cycle times can be achieved through electronic networks and interorganizational systems (Riggins & Mukhopadhyay, 1994). Indeed, Wetherbe (1995) suggests that interorganizational information systems provide an effective lever in bringing about cycle time reduction in business processes. The U.S. apparel industry provides a perfect research setting to carry out this investigation.

2.2. THEORETICAL IMPORTANCE

The research has important implications for theory in three distinct areas. First, an increased understanding of the different configurations of IOIS in bringing about CTR will be gained. The results will contribute to the area of cycle time research. Second, the study of interorganizational information processing view of CTR will be examined. Findings here will contribute to the IOIS literature and IS literature. Finally, the integrated interorganizational information processing view in achieving CTR performance will be

explained. Findings here will contribute to interorganizational coordination, supply chain management, and configurations/gestalts literature.

2.3. THE IMPORTANCE OF THE RESEARCH SETTING

2.3.1. The Emerging Importance of Cycle Time Reduction

In response to the new challenges of global competition and faster response times many organizations are having to focus on the cycle times of various business processes both within and across their organizational boundaries. As a direct result of this emerging business reality of the 1990's, organizations are beginning to investigate their interdependent business processes, relationships, and technology with a view to achieving fast cycle time (Meyer, 1993). In recognition of this interdependency, organizations seek external alliances and partnerships with their customers, suppliers, and competitors (Konsynski, 1992). Underlying the attempts to establish interorganizational relationships for mutual benefit is the deployment of sophisticated IOIS to facilitate cycle time reduction.

2.3.2. The Role of Interorganizational Information Systems(IOIS)

IOIS, based on computer and telecommunication technologies, is increasingly playing a critical role in organizations, affecting the nature and structure of competition (Johnston & Vitale, 1988). In particular, the increase in use of IOIS across organizational boundaries has led some to argue that IOIS is an effective lever to achieve CTR in organizations (Wetherbe, 1995). An issue among IS practitioners today is: "How best to leverage IOIS capabilities to restructure business relationships with external business partners to achieve cycle time reduction." The corresponding issue for the information systems (IS) and

organization studies researchers is: "How best to develop a research framework that guides research efforts systematically as well as offer insights for management practice."

Despite the importance of these issues, managers and researchers alike still have very little understanding of what new organizational, managerial, and technological skills become necessary for the effective management of cycle time reduction. Hence, a research agenda investigating into these and other related issues is critical both in the present and in the future.

2.3.3. The Choice of the U.S. Apparel Industry

The selection of the US apparel industry as the setting for this research is based on the following factors. The US apparel industry is facing new and complex challenges in terms of achieving increased customer responsiveness, reduced inventory, and effective time management (Sprinkle et al., 1991). Developments in information systems technology have filtered through the various operations in the industry. Adoption of new technologies such as modular management and quick response strategy places a tremendous burden on apparel manufacturers to look closely at their internal business processes, external suppliers and customers in an effort to reduce time and improve customer satisfaction (Christmas, 1994). More than 75% of the plant managers interviewed in a recent apparel industry survey have listed programs to speed up production time as their top priority (Bailey, 1994). In the U.S. apparel industry, $26 billion is lost every year due to cycle time problems (Wetherbe, 1995). The criticality of overall cycle time is apparent when the flow of information across the various organizations in the apparel industry is considered. Electronic linkages between textile mills, apparel manufacturers, and retailers in the soft goods industry are critical as the

industry participants face a mature market with shrinking market share (Konsynski, 1992). Organizations need to consider additional services and value-added features in order to differentiate themselves in highly competitive markets. For the apparel industry, CAD equipment and advanced systems such as EDI have created a new level in terms of both performance and criticality (DeWitt, 1994).

Despite the significance of these developments to business practices within the industry , no study has explored these phenomena. Issues that warrant study include: the use of interorganizational information systems affecting the cycle time reduction in, and across, organizations. Systematic research in this area is timely and important for several reasons:

1. In view of the emergence of hybrid organizations or partnership-like arrangements as opposed to traditional, pure forms of organizations such as market and hierarchy, the interorganizational level of analysis has become attractive (Bensaou, 1993).
2. The growing use of information systems technology applications to support applications across organizational boundaries in general, and the significant growth rate in the adoption of IOIS such as EDI in organizations (Riggins & Mukhopadhyay, 1994) in particular are significant pointers to the emerging importance of these applications.
3. Existing studies on interorganizational information systems have focused on its sponsors (Clemons, 1990; Clemons & Row, 1988; Clemons & Weber, 1990; Copeland & McKenney, 1988). Hence, research focusing on IOIS participants, lacking in current literature, has the potential to uncover factors

which could promote successful use of IOIS (Teo., Tan., Wei., & Woo, 1994).

4. Underlying these new interorganizational relationships is a notion that recognizes important cycle time reduction benefits for organizations involved in the relationship (Drucker, 1992).

5. At a basic level, the theoretical argument is that cycle time reduction corresponds to a shift away from internal, market-based exchange toward more bilateral and cooperative exchanges (Hammer & Champy, 1993).

6. The cycle time reduction dimension in IS research would benefit from greater momentum in the light of the rigorous competition and internationalization of business.

2.4. RESEARCH QUESTIONS TO BE ADDRESSED

The research proposed here addresses three key related issues:

1. What are the dominant sources of interdependency which affect the need for organizations to seek cycle time reduction across their organizational boundaries?

2. Given their needs for cycle time reduction, how do organizations effectively leverage the individual and collective interorganizational coordination capabilities of i) the structure of their relationship, ii) the socio-political processes within which their relationship is embedded, and iii) the interorganizational applications of information technology?

3. How does the relationship between sources of interdependency and interorganizational coordination mechanisms reflect on the CTR performance of the relationship?

2.5. SUMMARY

Time-based revolutions are redefining entire industries and developments in information technology are dramatically reducing time to market and shortening product life cycles. A critical element in such time-sensitive markets is the deployment of interorganizational information systems. IOIS play a critical role in bringing about organizational transformations, increased interdependencies, and reduced cycle times. In order to identify existing IOIS configurations and applications and to understand the role of IOIS in bringing about CTR, this research will investigate the retailer-manufacturer relationships in the U.S. apparel industry.

3. THEORY DEVELOPMENT

From a research perspective, two issues are important: a) a general concern with CTR among organizations (Peters, 1990; Stalk, 1988; Wetherbe, 1995); and b) the specific concern with the comparative role of IOIS in enabling and facilitating CTR. Within the second category, researchers have been more concerned with developing frameworks linking IOIS and competitive strategy (Barrett, 1987; Cash & Konsynski, 1985; Johnston & Vitale, 1988; Porter & Millar, 1985) or based on new institutional theories of economics such as transaction and agency costs (Gurbaxani & Whang, 1991; Malone, Yates, & Benjamin, 1987).

However, interorganizational arrangements have had a rich research tradition from an organization theory perspective (Hall, 1977; Schmidt & Kochan, 1977; Van de Ven, 1976) that has not been well integrated within the context of emerging IOIS capabilities. Therefore this research adopts the information-processing view of organization from an intra-organizational focus (Daft & Lengel, 1986; Galbraith, 1977; Tushman & Nadler, 1978) to an interorganizational level of analysis. It is proposed that an information-processing view of IOIS provides us with the rationale to integrate the different dominant perspectives applied to IOIS-enabled mechanisms in CTR.

Specifically, it is argued that three types of interdependency - environmental, relationship, and internal - give rise to a set of interorganizational information requirements which are appropriately balanced by a set of interorganizational coordination mechanisms -

structure, process, and technology - that reflect the total available interorganizational information system capabilities to process information.

3.1. DOMINANT THEORETICAL PERSPECTIVES

3.1.1. Organization Theory

The interorganizational relations framework (Clark, 1965; Evans, 1966; Warren, 1971) and early marketing channels literature (Etgar, 1976; Hunt & Nevin, 1974) represent the first attempts by researchers to conceptualize the relationship between two or more independent organizations as a separate, and important, level of analysis. Relationships at this level are described in terms of its structural characteristics, such as centralization, formalization, and complexity, (Aiken & Hage, 1968), or their behavioral or process characteristics, such as power, influence, and conflict (Gaski, 1984; Marrett, 1971; Schmidt & Kochan, 1977). The relevance of this perspective to the present context is that IOIS will most certainly affect and be affected by these structural and behavioral characteristics (Markus & Robey, 1988).

A major limitation in this stream of research is that researchers have simply extended or adapted research constructs from an intra-organizational setting to an inter-organizational level without articulating their distinct role or benefits in the new level of analysis. Further, the empirical work has been predominantly restricted to relationships between public sector organizations (Clark, 1965; Warren, 1971). Thus, this proposed research bridges these research gaps and offers an opportunity to address more relevant and important issues in the area of CTR.

3.1.2. Transaction Cost Economics

Based on a rational, economic argument, this theory specifies the comparative efficiency of various forms of governance under different conditions (Williamson, 1975). Briefly, it relates the governance structure of an interorganizational relationship to the presence of transaction-specific assets required to support the transaction, and which could be potentially exploited by the other members of the dyad. The relevance of this perspective to the present context has been well articulated by Malone et al. (1987) and Clemons and Row (1988).

There has been steadily increasing research in this theoretical domain. While some studies have provided empirical support for the relationship between asset specificity and vertical integration (Joskow, 1987; Klein, Crawford, & Alchian, 1978; Masten, 1984; Monteverde & Teece, 1982), others have reported the absence of such a relationship (Klein, Frazier, & Roth, 1990; Masten, Meehan, & Snyder, 1991). The empirical work in the area of IT-mediated patterns of integration and IT-induced asset specificity has been absent with the possible exception of Venkatraman and Zaheer (1990), who did not find the expected relationship.

3.1.3. Political Economy

Benson (1975) and Zald (1970) suggest a holistic approach to looking at interorganizational relationships, with an explicit recognition of the economic and political dimensions of the dyad. More specifically, it is concerned with 1) the external forces, 2) the internal, organizational dimensions, and 3) their interaction as they influence the nature of the relationship within the dyad (Bensaou, 1992). The contribution of the political economy

paradigm to the present context is primarily due to its holistic approach to this level of analysis, whereby it explicitly addresses the whole relationship over time.

The governance structure of the dyad may be shaped by internal dimensions ranging from a market-like relationship with an independent firm, to a hierarchy-like relationship (Williamson, 1975). Between these two extremes lies a wide range of coordination strategies where the market mechanism is modified through some kind of formal or informal contractual arrangements between the parties involved (Blois, 1972). Moreover, structural arrangements are embedded within the socio-political processes of the dyad (Eccles & White, 1988; Granovetter, 1985), representing the allocation and use of power and control as well as corresponding sentiments and behaviors (e.g., conflict, conflict resolution, commitment, and cooperation).

3.1.4. Information Theory

In his conceptualizing of the information theory, Weiner (1948) contends that an organization's cohesiveness and purpose are a result of its ability to acquire, use, retain, and transmit information. Shannon (1948), similarly argued that this intrinsic ability of organizations to generate and transmit information had the potential to promote interdependency among organizations. Reasoning on this line, one can argue that organizational interconnections often grow from a need to share information, controls, and protocols. The rationale for such communication links include efficiencies, performance increases, and competitive benefits (Konsynski, 1992). The need to achieve ever better process efficiencies and faster response times is a direct result of information interdependency among organizations (Barrett, 1987). In an increasingly networked world,

these interdependencies assume a greater importance in the overall CTR efforts of organizations. The contribution of information theory to the present context is the inclusion of the information dimension in the identification of interorganizational information processing needs.

3.2. AN INFORMATION PROCESSING VIEW OF CTR

Since Frederick W. Taylor's (1912) historical work in time and motion studies provided an impetus to the creation and practice of scientific management, the time dimension of business has assumed increasing importance over the last several decades. Barnes (1958) in his study of time and motion aspects of industrial management argues that compression of time in every business activity will lead to improvements in process efficiencies. These early philosophies of time have been incorporated in subsequent studies in business management (Barnes, 1960). However, cycle time reduction as a separate research entity has not received attention until recently.

Time-based competition is the strategy of compressing time out of every aspect of the product delivery system. The rapid escalation of global competition is demanding dramatic reductions in the time-to-market cycle, along with higher quality levels and lower costs (O'Neal, 1993). CTR transcends into a competitive advantage for a company through improved profits, reduced lead time, improved delivery dependability, improved quality, and increased productivity (Ehie & Stough, 1995). Reduction in cycle times leading to rapid response to customers is becoming a major quality attribute and a means for obtaining or maintaining a competitive edge (Jordan, 1993). In spite of the growing importance of CTR

for businesses, cycle time research lacks a theory-based and empirically-supported basis. To fill this important void, this research will offer a theoretically-rich perspective of IT-enabled CTR by integrating four different, well-grounded perspectives - organizational theory, political economy, transaction cost economics, and information theory.

While these four perspectives contribute to our understanding of interorganizational information processing needs, each is concerned with a part of the larger phenomenon. Collectively, they address the structure, process, and technology dimensions as well as their determinants within a holistic perspective. The value-added sought in this section is to provide an information-processing view that systematically integrates these four different perspectives. In fact, when brought together along an information-processing view, they complement each other and provide insight into determinants, components, and implications of different strategies for IOIS-enabled CTR.

3.3. THE INTERORGANIZATIONAL INFORMATION PROCESSING MODEL

The basic logic in this model (see Figure 1) is that: 1) organizations can be conceptualized as information processing systems (Galbraith, 1977; March & Simon, 1958); and 2) the basic function of organizational design can be seen as to creating the most appropriate configurations of structure, process, and technology to facilitate the collection, processing, exchange, and distribution of information (Duncan, 1972; Galbraith, 1977). The basic axiom is that the fit between interorganizational information processing needs and interorganizational information processing capabilities is a strong determinant of CTR effectiveness and performance (Riggins & Mukhopadhyay, 1994). Although empirical

studies do not directly test this axiom, several streams of research support it (Burns & Stalker, 1966; Drazin & Van de Ven, 1985).

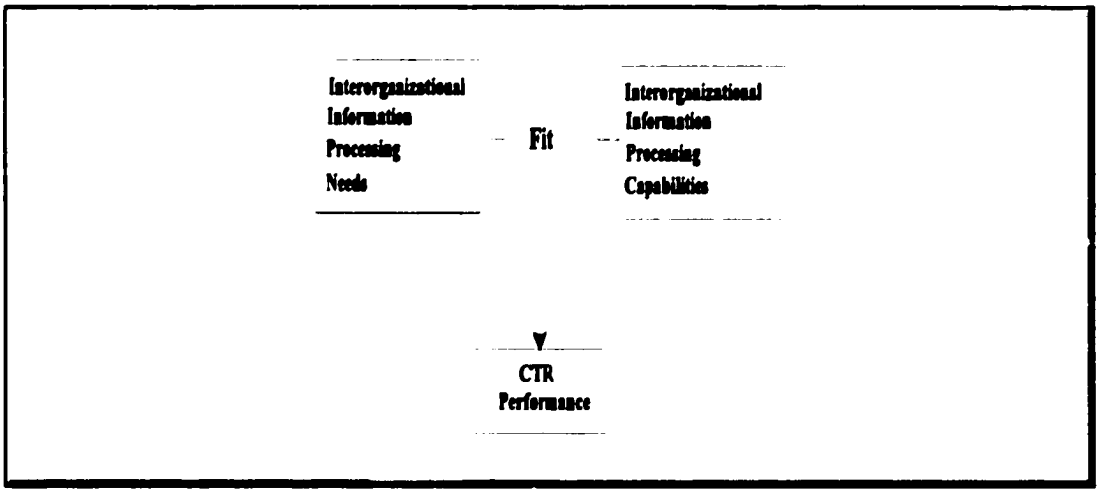


Figure 1. An Interorganizational Information Processing Model

3.4. SUMMARY

The above argument presents a conceptual basis to guide research in the area of CTR strategies, in particular those that explicitly leverage IOIS capabilities. The proposed conceptual model develops the logic of an information processing view of IOIS-enabled CTR which allows to bring together four dominant theoretical backgrounds typically applied separately: organization theory, transaction cost economics, political economy, and information theory. This conceptual model will be used to develop a specific research model to conduct research in the IOIS-enabled CTR mechanisms.

4. RESEARCH DEVELOPMENT

This research builds on the perspectives originating from organizational theory, transactional cost economics, political economy, and information theory. In the context of research development, it is important that all concepts and research constructs be carefully defined, and their relationship to each other explicitly stated (Bacharach, 1989) in the form of a research model. Once the constructs are made explicit, on operationalization of the constructs into measurable variables is undertaken. This will dictate the type of measurements needed in the research methods. During this process of conceptualizing and operationalization, the link between theory building and theory testing will be established, and testable hypotheses developed.

4.1. PROPOSED CONCEPTUAL RESEARCH MODEL

Figure 2 presents the proposed research model with the IOIS requirements derived from different types of interdependency and the IOIS capabilities derived from an array of CTR mechanisms.

4.2. INTERDEPENDENCY STATES

The proposed model of IOIS-enabled CTR recognizes three generic sources of interdependency leading to the IOIS needs of a relationship: 1) environmental interdependency about the general business processes surrounding the interorganizational relationship, 2) relationship interdependency about a focal firm's business relationship with

a partnering organization, and 3) internal interdependency about the specific function jointly accomplished. Figure 3 shows the three generic sources of interdependency. A and B are

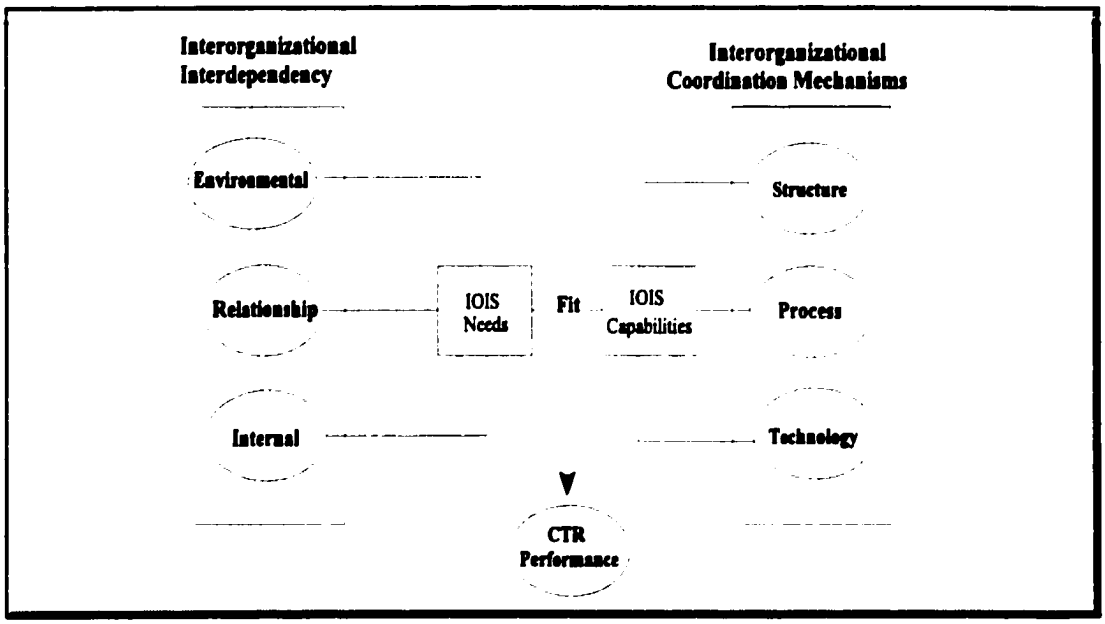


Figure 2. A Research Model of IOIS Role in CTR

organizations and E is the environment within which they function. Intuitively, we can propose that the greater the dimension of interdependency, the greater are the IOIS needs.

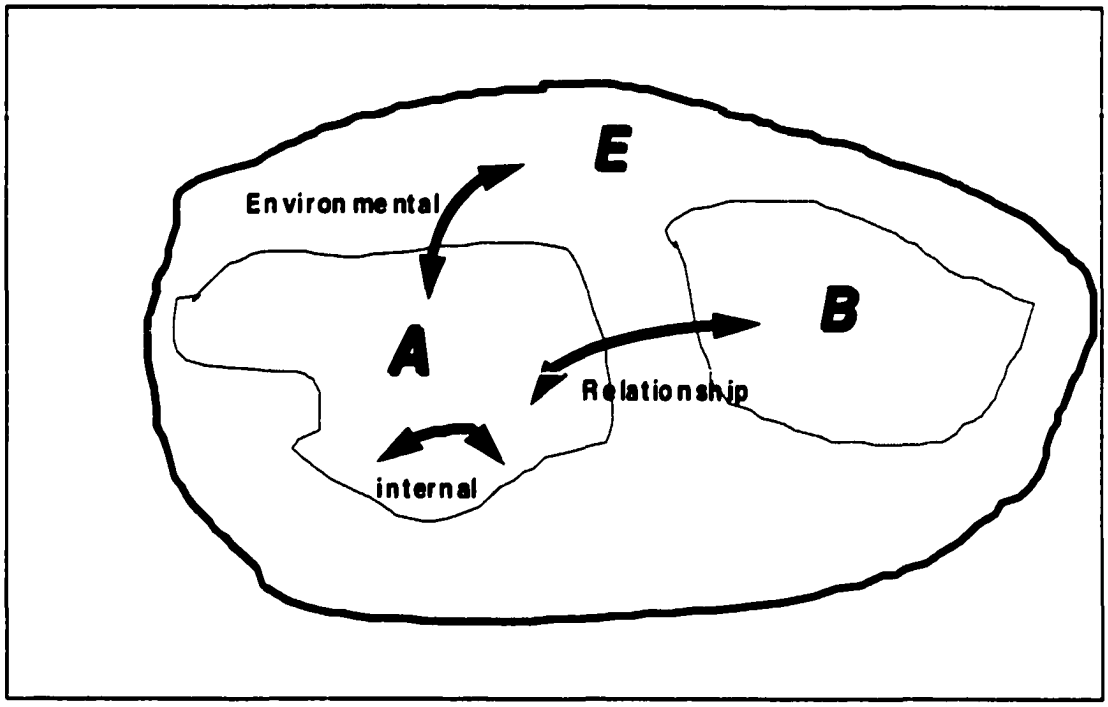


Figure 3. Generic Sources of Interdependency between Organizations

4.2.1. Environmental Interdependency

Thompson (1967), Dill (1969), and Duncan (1972) define the determinants of environmental interdependence in terms of two dimensions: 1) the ***homogeneity-heterogeneity*** of the environment or the degree of similarity/dissimilarity of the elements of the population dealt with, and 2) ***stability-dynamism*** of the environment or the degree to which contingencies remain basically the same over time or are in a continual process of change. Pfeffer and Salancik (1978) and Williamson (1975) have related the perception of environmental interdependence to the ***concentration-capacity*** of the environment or the

degree to which resources are controlled by a small number of relevant organizations. In the context of the research setting, homogeneity-heterogeneity and stability-dynamism dimensions measure the product (apparel item) characteristics that is being studied. Similarly, concentration-capacity measures the market characteristics for that apparel item.

4.2.2. Relationship Interdependency

In this research, relationship interdependency is defined as the interdependence a dyad member experiences about its relationship with another member. This type of interdependency has traditionally been subsumed under either the general environmental interdependency or the specific internal interdependency. When there is a predominance of market-like transactions, environmental interdependency is the critical thrust; for predominantly hierarchical transactions, internal interdependency is the relevant thrust. In the view of the emergence of hybrids (Williamson, 1990) or partnership-like arrangements with independent firms differing in their capabilities and goals as partners (Gardner & Cooper, 1988), it is important to recognize this type of interdependency as in between broader environmental interdependency and the narrower internal interdependency. More specifically, as we move away from arms-length market transactions towards newer types of strategic partnerships, the interdependency due to the relationship between the partners needs to be recognized separately.

Two primary classes of determinants of relationship interdependency can be derived from recent work in MIS literature on partnership (Cooprider, 1990; Henderson, 1990) and new applications of political economy and exchange theory to marketing channels research

(Anderson & Weitz, 1989; Gardner & Cooper, 1988). ***Mutual interdependency*** reflects the degree to which the two dyad members depend upon each other and it relates among others to the balance of power and influence among the two dyad members, their respective switching costs or economic dependency on each other's business. The ***climate of the relationship*** represents another set of factors which may reduce or increase the level and importance of interdependency about each other partner's future behavior. Goal compatibility, trust, and history of the relationship are some of the components of a dyad's climate. ***Goal compatibility*** represents the extent to which both the dyad members perceive their relationship as a long- term relationship which adds value and generates mutual benefits (Eliashberg & Michie, 1984; Schmidt & Kochan, 1977). ***Trust*** has been argued to contribute to the increase of interdependency about potential partnering behavior by the other dyad member (Axelrod, 1984; Dore, 1983; Ouchi, 1980) thus reducing the need to monitor each other. ***Power-dependency*** (Frazier, 1983; Stern & El Ansary, 1972) affects the perceived interdependency about potential partnerships. In particular, specific investments made for a particular relationship (called asset specificity) may hold one partner dependent on the other (Anderson, 1985; Heide & John, 1990). Thus, retailer's asset specificity and manufacturer's asset specificity both measure the mutual interdependency and power-dependency in this research setting.

4.2.3. Internal Interdependency

There are three types of interdependency stemming from technological requirements within organizations: pooled, sequential, and reciprocal interdependency (Thompson, 1967).

Each of these interdependencies has an appropriate method of coordination. It is the task of structure to facilitate the exercise of the appropriate coordination processes.

Pooled interdependency is said to exist when each part in the organization renders a discrete contribution to the whole and each is supported by the whole (Thompson, 1967). Pooled, or generalized, interdependency is coordinated by standardization, and is least costly in terms of communication and decision effort. In the case of ***sequential interdependency***, in addition to the parts exhibiting the properties of pooled interdependency, direct interdependence between the organizational parts can be pinpointed and the order of that interdependency can be specified. Thus sequential interdependency is not symmetrical, is coordinated by planning and is intermediate in effort required. In the event of ***reciprocal interdependency***, the outputs of each part becomes the input for the others. Reciprocal interdependency is coordinated by mutual adjustment and is most demanding of communication and decision effort.

In this research setting, the three types of internal interdependency discussed above can be measured by the task interdependency that exists in the function being investigated (purchase or sales), and information analyzability and variety in the information exchanged between the dyad through the IOIS.

4.3. INTERORGANIZATIONAL COORDINATION MECHANISMS

In order to cope with these three types of interdependency, organizations employ a number of alternative interorganization coordination mechanisms which independently and collectively contribute to increasing the CTR performance of organizations. In the paragraphs

below, the roles of three types of mechanisms: structure, process, and technology are discussed. Figure 4 shows the interaction relationship among structure, process, and technology in organizations.

4.3.1. Structural Coordination Mechanisms

In the case of complex organizations, the internal differentiation and patterning of relationships are collectively referred to as structure (Thompson, 1967). Effectively controlling and channeling the interdependencies in and across organizations requires implementation of interorganizational systems (Barrett, 1987). Daft and Lengel (1986) argue for a hierarchy of structural mechanisms with different information processing capabilities: rules and procedures, direct contacts, liaison roles, integrator roles, task forces, and teams.

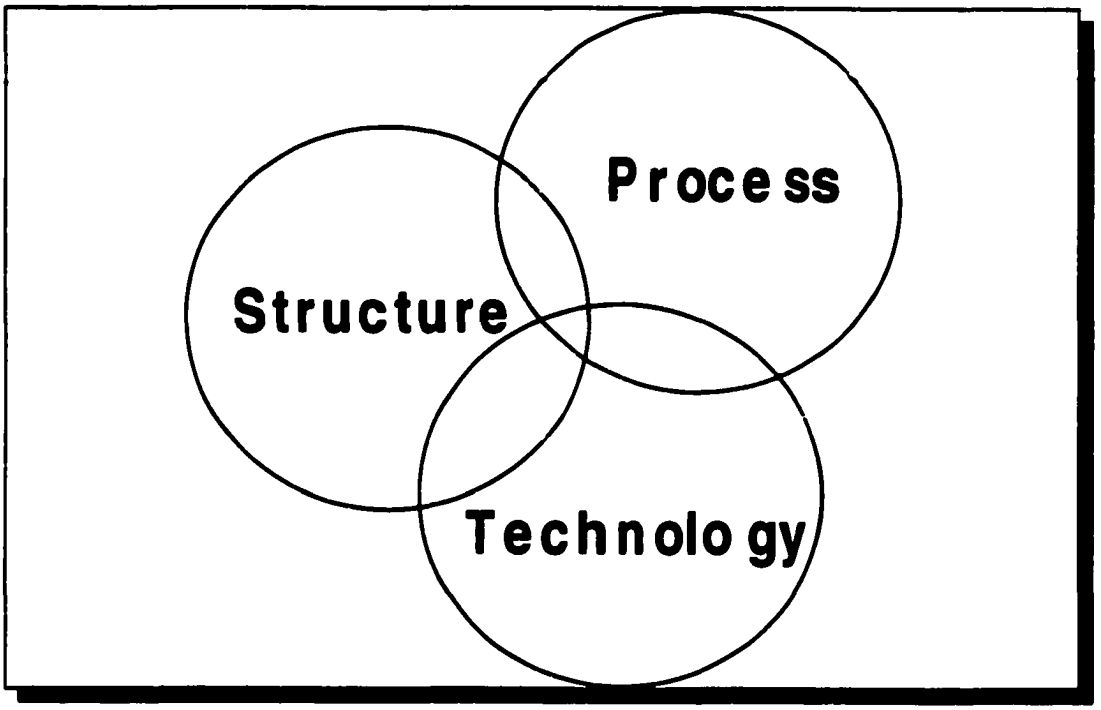


Figure 4. Interaction Among Interorganizational Coordination Components

These mechanisms establish a formal assignment of information roles among boundary spanners as well as a formal assignment of authority. Van de Ven (1976) argues that the level of formalization, reflecting either a control or a coordination emphasis, is a key characteristic of structural mechanisms in organizations. Similarly, the availability of multiple communication and coordination channels (Perrow, 1967), intensity and frequency of coordination mechanisms (such as email and group meetings), and asymmetry

(similarity/dissimilarity) of coordination mechanisms are other key characteristics of coordinated mechanisms (Benson, 1975; Thompson, 1967). Interorganizational capabilities are hypothesized to increase with higher intensity, higher multiplicity, and lower formalization and asymmetry of these structural mechanisms.

4.3.2. Process Coordination Mechanisms

Process coordination mechanisms represent the socio-political processes (Arndt, 1983; Benson, 1975) within which the previously defined structural mechanisms are embedded. They range along a cooperative-conflictual continuum, and directly affect the extent to which information is freely exchanged between the dyad members because or in spite of the nature of the structural mechanisms (Reve & Stern, 1984). For example, under the same dyad structure interorganizational coordination capabilities will tend to decrease in a negative, conflictual, and non-cooperative context. Process coordination mechanisms have been mainly explained along three distinct dimensions: ***conflict*** (Gaski, 1984; Lusch, 1976), ***Cooperation*** (Harry & McGrath, 1988; Robincheaux, & El-Ansary, 1976), and ***Commitment*** (Gardner & Cooper, 1988; Henderson, 1990). Coordination capabilities are hypothesized to increase with higher cooperation, higher commitment, lower conflict, and collaborative (as opposed to adversarial) conflict resolution.

4.3.3. Technology Coordination Mechanisms

These mechanisms represent the use of information systems and technology for facilitating interorganizational coordination as opposed to intra-organizational uses.

Interorganizational coordination mechanisms using information technology and systems can include electronic linkages between the two dyad members ranging from simple, asymmetric access to databases to a more integrated platform involving symmetric sharing a deeper set of information elements such as joint design, development, and knowledge sharing (Barrett & Konsynski, 1982; Konsynski, 1992). In addition, the nature of the technology, the structure of ownership, and access policies (Barrett & Konsynski, 1982; Konsynski & Warbelow, 1990) all contribute to different coordination capabilities. A range of variables that affect technology-enabled interorganizational coordination have been proposed. These include: ***intensity of use*** of electronic linkages (Riggins & Mukhopadhyay, 1994), ***asymmetry*** of database access (Konsynski, 1992), ***level of electronic integration*** of operational processes across the two firms (Henderson, 1990; Konsynski & Warbelow, 1990; Riggins & Mukhopadhyay, 1994), and ***scope of use*** across functions (Konsynski, 1992; Malone, et al. 1987). IOIS coordination capabilities are hypothesized to increase with intensity, symmetry, higher integration of processes, and scope of use.

4.4. CYCLE TIME PERFORMANCE

Cycle time performance can be measured by customer satisfaction, inventory levels, productivity performance, and quality ratings (Ehie & Stough, 1995). Moreover, since cycle time reduction often results in multiple effects across business functions (Wetherbe, 1995), a composite measure involving satisfaction, buffers, and internal ratings would better capture the cycle time performance in organizations.

Cycle time performance will be measured as a composite measure of three variables: manufacturer ratings (by the retailer), satisfaction, and buffer levels. It is important to note that these variables are measured only from the perspective of the apparel retailers.

Apparel manufacturer ratings will be evaluated by the internal retailer's team on seven dimensions. i.e., manufacturing time, delivery, and quality performance, price competitiveness, engineering/design capabilities. quality of relationship, and quality of management processes. Perceived satisfaction with the apparel manufacturer (i.e., supplier) will be measured based on seven criteria, i.e., quality, amount, and accuracy of information, level of cooperation, and satisfaction with delivery, quality, and performance of the product/apparel item. Buffer levels between the retailer and manufacturer will be measured by four indicators including average level of inventory carried by the retailer and by the manufacturer, shipments increments, and average quality levels.

The relevant theoretical anchors of the interdependencies and interorganizational coordination mechanisms are shown in Table 1 and Table 2.

4.5. OPERATIONAL RESEARCH MODEL

Since all the research concepts have been explicitly discussed and hypothetical relationships between them have been posited, an operational research model is proposed. Appendix A shows the operational research model which delineates the dimensions and the variables associated with them.

Table 1. Theoretical Anchors of the Research Model -I

Types of Interdependency

Interdependency Dimension	Organization Theory	Transaction Cost Economics	Political Economy
Environmental	-Homogeneity/Heterogenity -Stability/dynamism (Thompson, 1967; Dill, 1969; Duncan, 1972) -Concentration/capacity (Pfeffer & Salancik, 1978)	-Concentration/capacity (Williamson, 1975)	-External economy and polity (Benson, 1975)
Relationship	- Goal compatibility (Schmidt & Kochan, 1977; Stern & Reve, 1986) - power dependence (Pfeffer & Salancik, 1978; Frazier, 1983)	- Asset specificity (Williamson, 1975; Anderson, 1985; Heide & John, 1990)	
Internal	- Interdependent parts (Thompson, 1967) -Social/group interdependence (Lewin, 1948)		

Table 2. Theoretical Anchors of the Research Model -II

Interorganizational Coordination Mechanisms

Interorganization Coordination Dimension	Organization Theory	Transaction Cost Economics	Political Economy
Structure	- Formalization, centralization (Van de Ven, 1976)	-Market, hierarchy or hybrid governance structures (Williamson, 1975; 1990)	- Internal economy (Benson, 1975)
Process	- Cooperation, commitment, conflict (Gardner and Cooper, 1976)	- Trust (Ouchi, 1980; Williamson, 1985)	- Internal polity (Benson, 1975)
Technology	- Nature of technology, access policies (Barrett & Konsynski, 1982; Konsynski & Warbelow, 1990) - Information Systems(Galbraith, 1974; Daft & Lengel, 1986)	- IOIS could mitigate transaction cost determinants (Malone, T.W., Yates, J., and Benjamin, R.I., 1986)	

4.5.1. Operationalization of the Research Constructs

Operationalization of the research constructs and the design of the specific measures were derived in two complimentary methods: first, from previous empirical research that has tested measures and scales for constructs similar to those in the proposed research model and second, from interviews and discussions conducted with potential respondents and industry

experts both from academia and industry. The objective in doing this was to increase the content validity of the indicator (Churchill, 1979). Similarly, the design choices employed in the research contribute to increased validity and quality of the empirical findings. Tables 3 and 4 operationalize the research constructs.

Table 3: Operationalization of the Research Constructs

Interorganizational Interdependency

Construct	Dimensions	Variable	Number of indicators
Environmental Interdependency	Product Characteristics	Environmental complexity	1
		Environmental dynamism	3
	Market Characteristics	Environmental capacity	1
Relationship Interdependency	Climate of the relationship	Mutual trust	2
	Power-dependency	Retailer's asset specificity	4
		Manufacturer's asset specificity	4
Internal Interdependency	Task interdependency	Task Interdependency	2
	Information-interdependency	Information analyzability	4
		Information variety	2

Table 3 (continued)

Interorganizational Coordination Mechanisms

Construct	Variables	Number of Indicators
Structural Mechanisms	Multiplicity (of communication channels)	1
	Frequency of mutual visits	1
	Formalization (control/coordination)	1
Process Mechanisms	Conflict resolution	1
	Commitment	3
	Joint action and cooperation	7
Technological Mechanisms	Scope of the use of IOIS	1
	Intensity of IOIS use	1
	IOIS use in sales/mktg.	1
	IOIS use in purchasing	1
	Extent of IOIS integration	1

Table 4: Operationalization of CTR Performance

Construct	Variables	Number of Indicators
CTR Performance	Manufacturer ratings	7
	Satisfaction	7
	Buffer levels	1

4.5.2. Operationalization of Fit

The concept of fit has served as an important building block for theory construction in several areas of research (Aldrich, 1979; Barnard, 1949; Fry & Smith, 1987; Thompson, 1967; Van de Ven & Drazin, 1985), including strategic management (Miles & Snow, 1978; Snow & Miles, 1983; Venkatraman & Camillus, 1984). Venkatraman (1989) describes six perspectives of fit and argues that words such as congruence, fit, and alignment should be accompanied by descriptive guidelines that, at minimum, specify functional form(s). Examining multiple approaches of fit in contingency studies and relating the findings to unique sample characterisitcs can greatly aid the development of mid-range theories of what approach to fit applies where (Van de Ven & Drazin, 1985). However, as suggested by Venkatraman (1989) we consider the particular research context that is under investigation and use an exploratory perspective that is less precise in specifying the functional form of fit and can support many variables (i.e., fit as gestalt) because the study of the role of IOIS in CTR is still in its formative stages.

When fit is conceptualized and specified using two variables, it is possible for investigators to invoke alternate perspectives that have precise functional forms, but when many variables are used, the degree of precision must be relaxed (Venkatraman, 1989). One such multivariate perspective is the identification of gestalts, which is defined in terms of the degree of internal coherence among a set of theoretical constructs. In this perspective, instead of looking at a few variables or at linear associations among such variables frequently recurring clusters of attributes or gestalts are considered (Miller 1981). Along similar lines, Miller and Friesen (1977) noted that archetypes appear to represent a set of relationships

which are in a temporary state of balance and the situations seem to form a number of gestalts. These patterns of attributes or gestalts could provide useful insights into a powerful concept of equifinality or the feasible sets of internally consistent and equally effective configurations (Venkatraman, 1989). The development of gestalts logically extends the bivariate fit perspective through a multitiered taxonomical approach (Hambrick, 1984; Miller & Friesen, 1984).

There are two major analytical issues regarding fit as gestalts, the descriptive validity of the gestalts and the predicitive validity of the gestalts (Venkatraman, 1989). Descriptive validity requires that the gestalts be interpretable in terms of the theoretical positions implied by fit. Given that most analytical schemes available for developing gestalts (e.g., cluster analysis, *q*-factor analysis) are inductive, it is important to develop a formal criteria to judge the descriptive validity of gestalts. These criteria should include a) testing the number of gestalts using formal statistical procedures like the VRC index (Calinski & Harabasz, 1974), and b) describing the gestalts based on the theory that guided the selection of input variables for analysis (Venkatraman, 1989). The selection of the underlying variables for taxonomic inquiry is guided by the need to balance parsimony and exhaustiveness of coverage. Predictive validity is important for establishing the performance implications of fit and for demonstrating the existence of generic strategy types or multiple configurations of equally successful strategies (Venkatraman, 1989). One approach for assessing predictive validity is to follow Hambrick's (1980) suggestion of identifying subsamples of high- and low-performing businesses to identify profiles of fit within each subsample. This approach would help a researcher to develop distinct profiles of fit across the performance categories, and

to assess the possibility of discovering patterns of equifinality within low- and high-performing businesses. Such an approach enabled Hambrick (1983a, 1983b) and Miller and Friesen (1978) to isolate generic successful and unsuccessful gestalts in an exploratory fashion.

The conceptualization and operationalization of fit originates from the concept of fit as a gestalt (Drazin & Van de Ven, 1985; McKelvey, 1984; Miller & Friesen, 1984; Venkatraman, 1989). In the configurational view, organizations are treated as complex entities whose elements, such as structure, process, and technology have a natural tendency to coalesce into patterns or "configurations" (Bensaou, 1993). These configurations are composed of interdependent and mutually supportive elements such that the importance of each element can best be understood by making reference to the whole configuration.

In the context of the research setting, the use of IOIS by a retailer with an apparel manufacturer may be best understood within the whole context of the nature of its competitive environment (for that apparel item); its strategy toward the manufacturer(s), as well as the structures and processes used to coordinate with the manufacturer. Thus, in other words, dyadic structures, business processes (such as sales and purchase), interorganizational coordination mechanisms, strategies, and environments all tend to influence each other and give rise to many differentiable relationships and interorganizational information systems. However, a small number of configurations may be used to characterize a large fraction of these relationships and interorganizational information systems. Thus, the main objective of this research is to uncover the small number of dominant configurations within the sample of apparel retailer-manufacturer relationships studied.

4.6. LINKING THEORY BUILDING AND THEORY TESTING

The proposed research model is intended to serve as a basis to guide research into the area of CTR strategies that leverage IOIS. Specifically, the model argues that the three types of interdependency-environmental, relationship, and internal-give rise to a set of IOIS needs which are appropriately balanced by a set of interorganizational coordination mechanisms-structure, process, and information technology-that collectively reflect the total IOIS capabilities available to achieve CTR in the dyad. This model has three distinct roles or functions-descriptive, analytical, and prescriptive.

4.6.1. Role as a Descriptive Model

The research model allows researchers and managers to organize the complex set of factors that could potentially influence the nature of CTR performance. Thus, this model identifies a parsimonious set of sources of interdependency within a dyadic transaction as well as set of IOIS capabilities (through interorganizational coordination mechanisms) that can be used to resolve it. Using multiple criteria such as parsimony, internal consistency, and domain coverage it can be argued that the model serves a descriptive function.

4.6.2. Role as an Analytical Model

The model's role as an analytical tool can be assessed by its potential to guide empirical research. Since the model builds from diverse perspectives and offers an integrated view of IOIS-enabled CTR, this proposed model could serve as a framework to empirically examine several related research issues. According to Bagozzi (1980), the relevant constructs of interdependency and interorganizational coordination mechanisms need to be operationalized using observable and measurable indicators for the model to be an effective

analytical tool. As shown earlier, all the six major research constructs have been operationalized using observable indicators that satisfy the required measurement properties.

4.6.3. Role as a Prescriptive Model

Since MIS is an applied discipline, where researchers are concerned with the ability of studies to inform and guide management practice, it is important that the model has the inherent potential to offer normative insights. The proposed model can offer important insights into areas such as: relative importance of the various interorganizational coordination mechanisms under different conditions of interdependency; trade-offs among different interorganizational coordination mechanisms to achieve CTR; selection of partners for dyadic relationships under different conditions of interdependency; and the selection of IOIS mechanisms and their deployment under given market conditions.

4.7. HYPOTHESES GENERATION

Two distinct sets of hypothesis testing will be employed to validate the constructs and assess the relative contribution of each interdependency construct to explain the variations in the dependent CTR variables.

4.7.1 Interdependency and CTR: Bivariate Relationships

The following set of bivariate analyses represent the direct testing of the bivariate hypotheses underlying the dominant theoretical perspectives when employed separately. Multiple regressions were conducted on the total sample with each interorganizational coordination mechanism as the dependent variable, and successively each interdependency

construct as the independent variable. These analyses are not part of a traditional hypothesis-testing study, but rather constitute a test for nomological validity.

H1: The greater the environmental interdependency, the greater the capacity of structural coordination mechanisms impacting CTR performance.

H2: The greater the environmental interdependency, the greater the capacity of process coordination mechanisms impacting CTR performance.

H3: The greater the environmental interdependency, the greater the capacity of technology coordination mechanisms impacting CTR performance.

H4: The greater the relationship interdependency, the greater the capacity of structural coordination mechanisms impacting CTR performance.

H5: The greater the relationship interdependency, the greater the capacity of process coordination mechanisms impacting CTR performance.

H6: The greater the relationship interdependency, the greater the capacity of technology coordination mechanisms impacting CTR performance.

H7: The greater the internal interdependency, the greater the capacity of structure coordination mechanisms impacting CTR performance.

H8: The greater the internal interdependency, the greater the capacity of process coordination mechanisms impacting CTR performance.

H9: The greater the internal interdependency, the greater the capacity of technology coordination mechanisms impacting CTR performance.

4.7.2. Interdependency and CTR: Multivariate Relationships

The next set of analyses includes multiple independent variables into the multiple regression model. This analyses allows for comparison of the relative contribution of each interdependency construct to explaining the variations in the dependent CTR variables. Here, we focus on changes in R^2 values and their significance.

H1: The greater the environmental, relationship, and internal interdependency, the greater the capacity of structural coordination mechanisms impacting CTR performance.

H2: The greater the environmental, relationship, and internal interdependency, the greater the capacity of process coordination mechanisms impacting CTR performance.

H3: The greater the environmental, relationship, and internal interdependency, the greater the capacity of technology coordination mechanisms impacting CTR performance.

4.8. SUMMARY

The proposed conceptual model is intended to serve as a basis to guide research in the area of cycle time research. Specifically, it argues that the three types of interdependency-environmental, relationship, and internal-give rise to a set of IOIS needs which are appropriately balanced by a set of interorganizational coordination mechanisms-structure, process, and technology-that reflect the total available IOIS capabilities to achieve CTR in the dyad.

5. RESEARCH METHODOLOGY

In this chapter, the multi-method research design to answer the research questions is discussed. In addition, the logic behind adoption of the configurational approach to uncover IOIS configurations is explained. Finally, the research setting and the possible threats to validity are discussed.

5.1. RESEARCH DESIGN

To examine the research questions stated earlier, we apply the proposed research model to the specific context of the use of IOIS for CTR purposes in the U.S. apparel industry. In order to do this, we look into the apparel retailer-manufacturer relationships that exist in the U.S. apparel industry. These relationships have been described as undergoing major changes, fuelled by changes in technology and markets (Bailey, 1994; Christmas, 1994).

Traditionally, apparel retailers in the U.S. relied on a few manufacturers to supply all of their apparel needs (DeWitt, 1994). The trend now, however, is towards a retailer becoming the coordinator of an increasingly intricate production network, often comprising of many domestic and foreign manufacturers/suppliers, typically purchasing apparel items from different manufacturers, thus reducing its dependence on a few manufacturers and at the same time increasing the number and relative importance of good supplier relations.

However, the climate and governance of retailer-manufacturer relations seem to be changing, moving from the traditional model where a large number of manufacturers were competing for short-term contracts, on the primary basis of price. The current trend is for the apparel retailer to establish longer-term contracts and work more closely with manufacturers to ensure that problems of design, quality, delivery, and cost are tackled early on and resolved cooperatively. Facilitating this trend is the development in and wide deployment of networking technologies and interorganizational information systems. In order to carry out this study, the actual research was carried out in two phases and employed both qualitative and quantitative methodologies.

5.1.1. The Qualitative Method

In Phase-I of the research, a series of qualitative field studies was conducted at retailer as well as apparel manufacturer sites. This comprised of visits to retail stores, telephone conversation and discussions with retailer personnel and focus groups, interviews with supervisors, and various functional purchase and sales managers responsible for different apparel items. This phase of the research can be best described as an iterative process between the refining of conceptual model and the development of the questionnaire instrument in an effort to refine and validate the measures. It was instrumental in 1) identifying the best sampling methods, 2) identifying the most appropriate boundary spanning role to be a key informant, and 3) pilot testing the questionnaires.

5.1.2. The Survey Method

In Phase II, a cross-sectional quantitative field study was designed to collect questionnaire data from purchase managers at leading U.S. apparel retailers and sales managers at some of the leading U.S. apparel manufacturers. First, a stratified list of items was developed based on the use of IOIS for interorganizational coordination and the criticality of reducing cycle times. A purchasing manager at the retailer's central division was first asked to select a set of apparel items under his/her responsibility from this stratified list provided by the researcher (see Appendix E). Then for each item (apparel) these senior managers helped identify the apparel item and the appropriate sales manager of the apparel manufacturer to whom we could send the questionnaire. The final decision about which specific apparel manufacturer to choose was at the respondent's discretion. Then for the selected item, a similar questionnaire was mailed to the apparel manufacturer to capture the perceptions of the relationship from the other side of the dyad. Thus, each data point represents an unique item-dyad-information triplet, where the sampling of different apparel items (apparel) provides the variance along environmental interdependency, the ensuing sampling of different apparel manufacturer dyads provide variance along relationship interdependency, and finally the sampling of different key informants dealing with different items and apparel manufacturers is likely to give variance along internal interdependencies arising our of different tasks. The data collected represents a wide sampling of relationships between a retailer and one of its apparel manufacturers. Figure 5. depicts the data point variances. In sum, the proposed conceptual model was tested on the basis of a sample of about 320 independent data points.

The survey questionnaire was developed, pretested, and checked for internal, external, convergent, construct, and statistical validity. A copy of the questionnaire is enclosed in Appendix B .

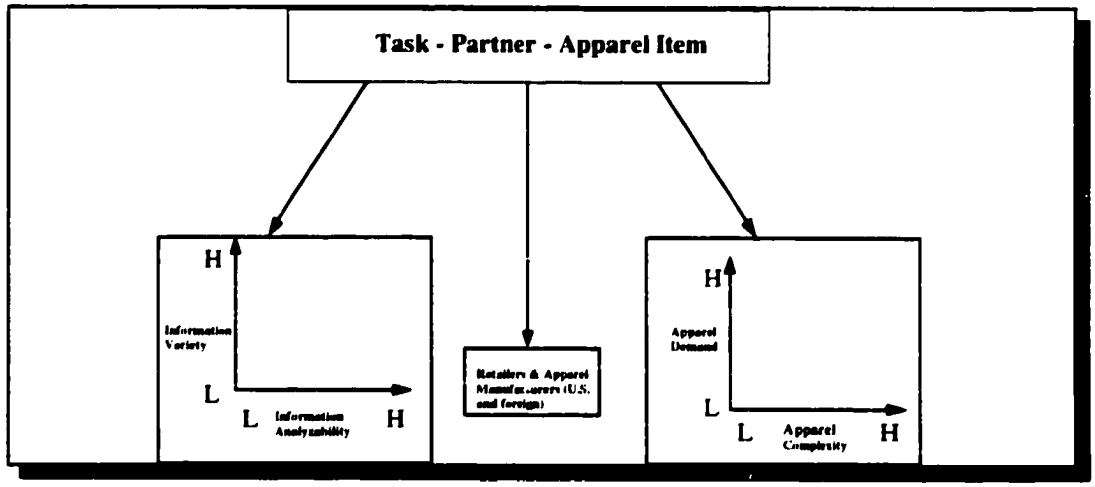


Figure 5. Variances in the sample data points

In Cook and Campbell's (1979) terminology, this research design is a post-test design with nonequivalent groups. The unit of analysis is the apparel retailer-manufacturer relationship, but the unit of measurement is the individual level of the key informants (sales manager or purchase manager).

Multiple regression tests was employed to test both bivariate and multivariate relationships. Cluster analysis was used to capture the complexity of CTR situations in real industrial settings - the objective being to uncover the various configurations of fit between

interorganizational interdependency and coordination within the data set, and to identify the specific roles that IOIS can play in increasing CTR.

5.2. A CONFIGURATIONAL APPROACH

The power of the proposed model could be increased by using it to uncover configurations or gestalts of the alignment between types of interdependency and interorganizational coordination mechanisms. In the configurational approach, instead of looking at a few variables or at linear associations among such variables, the researcher should look for frequently recurring clusters of attributes or gestalts (McKelvey, 1978; Miller, 1981). Such identified configurations or patterns in the U.S. apparel industry provide useful insights into powerful concepts of equifinality or the feasible sets of internally consistent and equally effective configurations (Venkatraman, 1989).

This configurational approach employed here is different from a theoretically-derived typology of possible combinations (Bensaou, 1993) among the interdependency types and interorganizational coordination mechanisms since empirical delineations of configurations point to actually occurring, feasible patterns in any given real situation. This research strategy is a powerful way to link theory and practice and can yield a set of managerially relevant guidelines for the deployment of different IOIS to achieve CTR in critical business processes.

The configurational approach compared to other approaches, is a strong approach in the early stages of theory construction since a larger set of constructs are studied simultaneously in order to yield a detailed, holistic, and integrated image of reality (Miller

& Friesen, 1984). Subsequent data analysis and theory building are typically geared to finding common natural clusters among the research constructs studied.

5.2.1. Data Analysis Methods

Multiple regression analysis helped validate the operational model (nomological validity) & identify the variables to include into the next procedure. The variables that were used in the cluster analysis was selected on theoretical basis underlying the conceptual model and the empirical results from the LISREL analyses of the variables measurement and from the multiple regression.

Cluster analysis involved two stages in uncovering configurations. In stage 1, underlying configurations reflecting the information processing needs was uncovered for every U.S. apparel retailer and apparel manufacturer separately as well as for the total sample. In stage 2, dominant configurations reflecting the information processing capabilities within each configuration obtained in stage 1 were uncovered. In both the stages, the 'best' solution was selected based on the Calinksi and Harabasz (1974) VRC index. The assessment of descriptive validity of the configurations was based on a oneway ANOVA analysis across 22 variables identified in the operational research model. Similarly, the assessment of predictive validity of the configurations was based on oneway ANOVA across the set of dependent variables. Three criteria that were used to distinguish across configurations include:

1. Differences across clusters are significant ($P < 0.05$) but multiple comparisons across clusters are also significant.

2. Significant difference only across configurations (fails Scheffe's test).

3. Insignificant differences across the 22 variables.

5.3. THREATS TO VALIDITY

Cook and Campbell (1979) identified four important threats to the validity of research: Statistical conclusion validity, Internal validity, External validity, and Construct validity. Each of the above threats and the measures taken to reduce those threats are discussed in more detail below.

5.3.1 Threats to Statistical Conclusion Validity

These are threats to drawing valid inferences about the covariance of two variables. In order to avoid low statistical power, which increases the risk of making incorrect conclusions, a large sample size and measurement of variables using multiple indicators (items) were employed. Violations of the assumptions underlying the statistical procedures used for data analysis significantly reduce the meaningfulness of the interpretation of the results (Cook & Campbell, 1979). To reduce this risk, the operational research model was tested using structural equation models with latent variables or LISREL models. The advantage of using multivariate techniques such as these over traditional statistical procedures is that the tests can be carried out under less restrictive assumptions (Joreskog & Sorbom, 1990).

5.3.2. Threats to Internal Validity

Internal validity refers to the extent to which conclusions can be drawn about the causal effects of one variable on another (Cook and Campbell, 1979). In a single post-test design such as this, the main concern is whether there are alternate explanations for the

measured effects other than those proposed by the research model. To reduce the possibility of unmeasured explanations causing the measured effects, data from 15 different companies (controlled for the selection of individual apparel items) was independently collected. Threats due to historical events were not observed as the questionnaires were administered concurrently and quickly.

5.3.3. Threats to External Validity

This is the threat of not being able to generalize conclusions about research constructs to specific firms, contexts, and industries and across types of firms, contexts, and industries. The immediate outcome of this research is that the findings can be generalized to all the retailer-manufacturer dyadic relationships in the U.S. apparel industry. To ensure this, care was taken to in the sampling and selection of key informants. The selected sample is representative of the population of all retailer-manufacturer relationships in the U.S. apparel industry. To ensure true representativeness of the sample, the individual apparel items were selected first and independently before identifying the respondents.

5.3.4. Threats to Construct Validity

Threats to construct validity refers to the extent to which the research constructs are successfully operationalized and measured in the study. Threats to the validity of measurement in turn relate to three sets of concerns. First is the choice of key informants (motivational barrier, perceptual and cognitive limitations, and lack of information are all concerns here). To safeguard against this threat, the key informants were carefully chosen based on the direct interaction with the particular apparel retailer and manufacturer for the given apparel item. Further, the items in the questionnaire were related to specific, daily tasks

performed by the purchase and sales managers and they measured the respondent's perception of each other in the apparel retailer-manufacturer dyad. In addition, complete confidentiality at both the individual level and firm level was guaranteed throughout the study.

Second, is the concern regarding some of the important issues surrounding the measurement scheme and the instrument. Bagozzi (1980) refers to these as critical components of construct validity. These include: theoretical meaningfulness of concepts, observational meaningfulness of concepts, internal consistency of operationalizations, convergent validity, discriminant validity, and nomological validity. These components will be discussed shortly.

Third, is the concern with measurement being treated as merely a process of assigning numerical values to objects according to a specified set of rules (Bensaou, 1993). However, there is a growing acceptance of an alternate view of measurement as the "intellectual and empirical activity of giving meaning to the theoretical variables in one's theory" (Bagozzi, 1980). In this research, we subscribe to such a view.

In order to understand real-world phenomena, researchers examine the relationships between a set of research constructs (Blalock, 1969). These research constructs, however, are typically not directly observable, but are considered to be latent variables. To test a proposed theory, researchers then measure these theoretical constructs (i.e., latent variables) using surrogate operationalizations and observable indicators. Thus, relationships between the research constructs are examined by analyzing the relationships between their observed indicators. A critical aspect in the method of theory testing then is developing and gathering valid indicators of the research constructs and testing the relationships between these

indicators. Hence, an important objective of measurement validation or construct validation is to increase the level of confidence in the results. Anyone assuming that the theoretical constructs are measured perfectly without error (or ignores construct validity) runs the risk of generating unreliable and inappropriate results (Bagozzi & Phillips, 1982; Lee, 1989). Bagozzi (1980) refers to the explicit testing of the properties of the measures and indicators as a "holistic construct of measurement" and identifies six components of construct validity. We shall present briefly how each of these components has been addressed in this study.

The ***theoretical meaningfulness of concepts*** refers to the nature and internal consistency of the language used to represent the concepts (Bagozzi, 1980). A construct, like relationship interdependency, is considered meaningful if it reflects the characteristics and language used to represent the theory. Thus, in the case of relationship interdependency, the concepts from which this construct originated are well grounded in the organizational theory literature (Pfeffer & Salancik, 1978; Schmidt & Kochan, 1977) and transactional economics literature (Anderson, 1985; Willamson, 1975). This grounding also ensures that the research constructs included in the research model and their relationships are consistent with prior research. This also justifies inclusion of appropriate, previously tested indicators and scales while designing the questionnaire in this study. To strengthen the theoretical meaningfulness of research concepts further, during the pilot test of the questionnaire the terminology used to describe the various constructs was discussed at length with purchase and sales managers in the respondent firms.

The ***observational meaningfulness of concepts*** refers to the relationship between the theoretical variables and their operationalization (Bagozzi, 1980). This was ensured in the study during the pilot testing of the questionnaire when the questions measuring various constructs were tested for clarity, perception, and appropriateness. Feedback obtained in this phase of data collection was incorporated in the final version in order to refine the instrument further.

The ***internal consistency of operationalizations*** is concerned with the homogeneity (or single factoredness) of the indicators (Bagozzi, 1980). This component involves two related issues: unidimensionality and reliability. While ***unidimensionality*** ensures that all the indicators (for example, mutual trust, retailer asset specificity and manufacturer's asset specificity) indeed measure the underlying construct of interest (relationship interdependency, in this example), ***reliability*** is concerned with the consistency of measurement or the extent to which repeated measures of the same construct (for example, relationship interdependency) lead to the same result. In terms of statistical interpretation, any measurement can be conceived as including two variances: variance that is free of random error, and variance that is entirely composed of random error. Reliability of the underlying research construct can then be viewed as the proportion of two variances. A typical summary statistic that is used to measure reliability is the Cronbach Alpha coefficient (Cronbach, 1951), which represents a lower bound of reliability (Lord & Novick, 1968). The results are discussed in the next chapter.

Convergent validity refers to the degree to which two or more measures of the same theoretical construct are in agreement (Cook & Campbell, 1979). ***Discriminant validity*** refers to the degree to which one theoretical construct differs from another (Cook & Campbell, 1979). These two key validity issues have been tested using Joreskog's (1971) formal and systematic treatment which uses confirmatory factor analysis. Since these tests constitute an important part of the study, they have been treated in section 6.2 in the following chapter.

5.4. SUMMARY

In this research study, an integrative stepwise approach is adopted in order to establish the validity of the proposed research model in the specific research setting of the U.S. apparel industry. The initial phase consists of a deductive process, a theoretically-based quest for the parsimonious set of generic dimensions for IOIS-enabled CTR (specifically, the interdependency and interorganizational coordination mechanisms). In the second phase of the research, an inductive one, actual IOIS configurations for CTR in the retailer-manufacturer relationships in the U.S. apparel industry are uncovered systematically. The objective of this phase is not to identify unidirectional "structural" causation between pairs of research constructs or multiple forms of causation. On the contrary, the inductive process searches for "systems of causation" (or gestalts) where each IOIS configuration (for CTR) is considered as a system in which each construct can influence many of the others by being an indispensable part of an integrated whole.

6. DATA ANALYSIS AND INTERPRETATION OF RESULTS

The data analysis takes place in several logical steps eventually leading upto the uncovering of the dominant configurations of interdependency-interorganization coordination fit existent in the U.S. apparel industry. First, we examine the differences across the U.S. apparel retailers and U.S. apparel manufacturers at an aggregate level. The analysis that is undertaken in this stage will only reveal general tendencies in the underlying logics for retailer-manufacturer relationships that gives rise to specific IOIS for achieving CTR for both retailers and manufacturers. It does not inform on the relationship between the six research constructs of the proposed model. Second, two sets of multivariate analyses based on multiple regression between the interorganizational coordination constructs (as dependent variables) and interdependency constructs (as independent variables) are carried out. Third, a configurational approach contrasting the multivariate approach is adopted to shed more light into the various IOIS-enabled CTR mechanisms that exist in the U.S. apparel industry. The objective in this stage of analysis is to explore the holistic and interaction view of IOIS-enabled CTR.

6.1. RESEARCH SAMPLE CHARACTERISTICS

From a possible sample population of 320 questionnaires that were mailed to 25 organizations located across North America, usable surveys (i.e., questionnaires were received from both the retailer and manufacturer for a given apparel item) were received from 104 respondents (please refer to Appendix B for copies of the survey instrument and

invitation letters to potential participants) accounting for a response rate of 32.5%. In order for the returned surveys to be considered usable, responses were required from both the apparel retailer and manufacturer for the same apparel item. Table 5 below gives a breakdown of response rates.

Table 5. Survey Response Rate Statistics

Sample Population Category	Possible Sample Population	Usable Surveys Returned	% Response Rate
Apparel Retailers	160	52	32.50%
Apparel Manufacturers	160	52	32.50%
Total	**320**	**104**	**32.50%**

6.2. RELIABILITY, CONVERGENT, AND DIVERGENT VALIDITY

The typical summary statistic of reliability is the Cronbach alpha coefficient. The reliability statistics (Cronbach α ranging from 0.65 to 0.91) provide strong support that the measures used are reliable and can be used for deriving the configurations (see Table 6). However, the Cronbach alpha model makes a few restrictive assumptions. First, α applies to a sum of measures presumed to indicate an unidimensional construct. However, if α is used to measure two or more different constructs, then the α coefficient may represent the proportion of variance shared by these measures across the constructs, thus resulting in a misleading measure. Second, another assumption that α makes is that it applies to measures that have either equal true score variances or both equal true score variances and equal error

Table 6: Survey Reliability Results

Construct	Variables	Cronbach's α
Environmental Interdependency	Environmental dynamism	0.78
	Environmental complexity	na
	Environmental capacity	na
Relationship Interdependency	Mutual trust	0.76
	Retailer's asset specificity	0.81
	Manufacturer's asset specificity	0.92
Internal Interdependency	Task interdependency	0.73
	Information analyzability	0.71
	Information variety	0.77
Structural Mechanisms	Multiplicity of channels	na
	Frequency of visits	na
	Formalization	na
Process Mechanisms	Conflict resolution	na
	Commitment	0.72
	Joint action	0.86
Technology Mechanisms	Scope of IOIS use	na
	Intensity of IOIS use	na
	IOIS use in sales	na
	IOIS use in purchase	na
CTR Performance	Apparel Manufacturer ratings	0.91
	Satisfaction	0.87
	Buffer levels	na

na: Not applicable since a single indicator was used.

variances (Bagozzi, 1981). Finally, α is defined only when there are two or more measures available for a construct.

In order to overcome the aforementioned drawbacks of the reliability measure, a detailed comprehensive model to assess measurement validity (i.e., reliability, convergent validity, divergent validity, and unidimensionality) of the constructs is constructed. The

procedure adopted in two representative cases, one for an unidimensional construct (single-factor model) and another for a two-dimensional construct (multiple-factor model), are detailed below.

6.2.1. Single-Factor Model

Four indicators (items in the questionnaire) were used to capture the perceptions of purchasing and sales managers about the level of asset specificity (Williamson, 1979) associated with the particular apparel item for which they selected to answer the questionnaire. In terms of structural equation modeling, the relationships between the measures and the hypothesized construct (i.e., asset specificity) can be expressed by these four equations:

$$y_1 = \beta_1 \epsilon + \eta_1 \quad \ldots\ldots\ldots (1)$$
$$y_2 = \beta_2 \epsilon + \eta_2 \quad \ldots\ldots\ldots (2)$$
$$y_3 = \beta_3 \epsilon + \eta_3 \quad \ldots\ldots\ldots (3)$$
$$y_4 = \beta_4 \epsilon + \eta_4 \quad \ldots\ldots\ldots (4)$$

where y_i is measure i, ϵ represents the hypothesized asset specificity construct, β_i is a parameter relating measure y_i to the construct ϵ, and η_i is an error residual in the measurement. In equations (2) through (4), η_i's are assumed to have zero means, are uncorrelated with ϵ, and are mutually uncorrelated among themselves. The path diagram summarizing the relationships among the asset specificity measures in this single-factor model is shown in Figure 6 and is referred to as the congeneric measurement model (Joreskog, 1971).

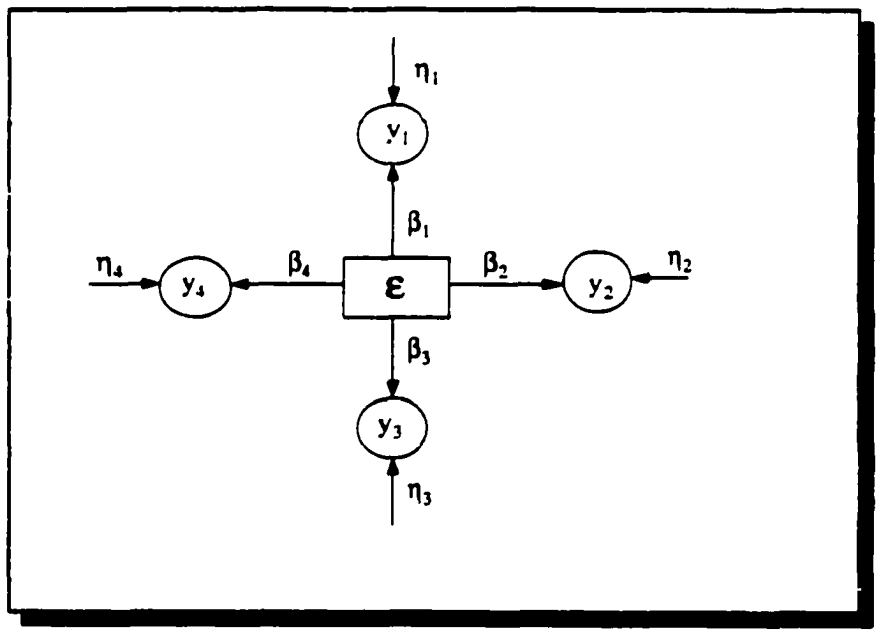


Figure 6. Congeneric Single-Factor Model for Asset Specificity

Next, we compute a chi-square measure of goodness-of-fit and estimates of the β_i's and the variances of the η_i's (referred to as θ_{ii} in LISREL terminology). These parameter estimates, in turn, are used to compute an index of individual reliability measure and a composite reliability measure. An index of reliability of an individual (ρ_i) measure is calculated with the help of the following equation

$$\rho_i = (\beta_i^2) / (\Sigma\beta_i^2 + \theta_{ii}) \quad \ldots\ldots\ldots (5)$$

Similarly, an index of reliability (ρ_c) of the composite measure is calculated by adding up the four measures in the following equation

$$\rho_c = (\Sigma\beta_i^2) / ((\Sigma\beta_i)^2 + \Sigma\theta_{ii}) \text{ ..... (6)}$$

Both the indices of reliability can range from 0 to 1, with higher values indicating greater reliability. The chi-square goodness-of-fit index provides a test of the hypothesis that the four items in the questionnaire that measure asset specificity can indeed be explained by a single underlying factor (i.e., asset specificity) and a random error. A larger chi-square index relative to its corresponding degrees of freedom suggest rejection of the unidimensionality hypothesis. Moreover, a *p*-value equal to or greater than 0.05 for the computed chi-square index indicates a satisfactory fit of the proposed single-factor model to the data.

The proposed congeneric single-factor measurement model tests the unidimensionality and reliability of the research construct under less restrictive assumptions than the traditional Alpha test. The congeneric model's superiority can be established by directly comparing with two other more restrictive models: the tau-equivalent model and the parallel forms model. The tau-equivalent model is generated when the condition $\beta_1=\beta_2=\beta_3=\beta_4$ is evoked and the assumption that each measure y_i relates to the true score ϵ in an equal way. The parallel forms model is obtained when all measures are assumed to have equal true-scores ($\beta_1=\beta_2=\beta_3=\beta_4$) and equal error variances ($\theta_{11}=\theta_{22}=\theta_{33}=\theta_{44}$).

Using LISREL 7 (Joreskog & Sorsbom, 1990), this congeneric single-factor model represented by equations (1) through (4) is applied to the data collected in the U.S. apparel industry. The β_i and θ_{ii} parameter estimates are all significant (t-values are significant). The individual item reliabilities for the first, second, and fourth measures in the congeneric model are high, but the values for the third measure are not significant. However, the composite reliability is high ($\rho_c = 0.91$). Hence, we can conclude that the four indicators used to measure asset specificity are indeed unidimensional. The goodness-of-fit indices suggest that the single-factor congeneric model cannot be rejected. On the other hand, the tau-equivalent and parallel forms models are rejected. Thus, the congeneric single-factor model is the best model that describes the asset specificity data. Tables 7, 8, and 9 summarize the results of this data analysis.

Table 7. Goodness-of-fit Measures for Asset Specificity

Hypothesis/Model	χ^2	Degrees of freedom	p-value
Congeneric	5.28	2	0.062
Tau-equivalent	39.38	5	0.001
Parallel form	51.22	8	0.000

Table 8. Reliability Estimates for Asset Specificity

Model	y_1	y_2	y_3	y_4	Composite ϵ
Congeneric	**0.72**	**0.78**	**0.47**	**0.77**	**0.93**
Tau-equivalent	0.75	0.77	0.48	0.76	0.90
Parallel form	0.74	0.75	0.73	0.75	0.87

Table 9. Parameter Estimates for Asset Specificity

Parameter	Congeneric Model	Tau-equivalent Model	Parallel forms Model
β_1	0.86	0.87	0.87
β_2	0.88	0.85	0.86
β_3	0.62	0.73	0.82
β_4	0.88	0.86	0.83
θ_{11}	0.22	0.24	0.24
θ_{22}	0.21	0.23	0.23
θ_{33}	0.23	0.24	0.23
θ_{44}	0.51	0.55	0.24

6.2.2. Multiple-Factor Model

We will now use structural equation models to assess the reliability of information interdependency, a multidimensional construct. Thompson (1967) identified two information dimensions associated with a task: information analyzability and information variety. Information analyzability is assessed by four items whereas information variety in measured

by two items in the questionnaire. Thus we have measures y_1 through y_4 related to construct ϵ_1 (i.e., information analyzability) and measures y_5 and y_6 are related to construct ϵ_2 (i.e., information variety). The structural equations representing the relationships are shown in equations (1) through (6), while the multiple-factor model is shown in Figure 7.

$$y_1 = \beta_1 \epsilon_1 + \eta_1 \quad \ldots\ldots\ldots (1)$$

$$y_2 = \beta_2 \epsilon_1 + \eta_2 \quad \ldots\ldots\ldots (2)$$

$$y_3 = \beta_3 \epsilon_1 + \eta_3 \quad \ldots\ldots\ldots (3)$$

$$y_4 = \beta_4 \epsilon_1 + \eta_4 \quad \ldots\ldots\ldots (4)$$

$$y_5 = \beta_4 \epsilon_2 + \eta_5 \quad \ldots\ldots\ldots (5)$$

$$y_6 = \beta_4 \epsilon_2 + \eta_6 \quad \ldots\ldots\ldots (6)$$

Figure 7 shows the congeneric measurement model for the two factor information interdependency construct.

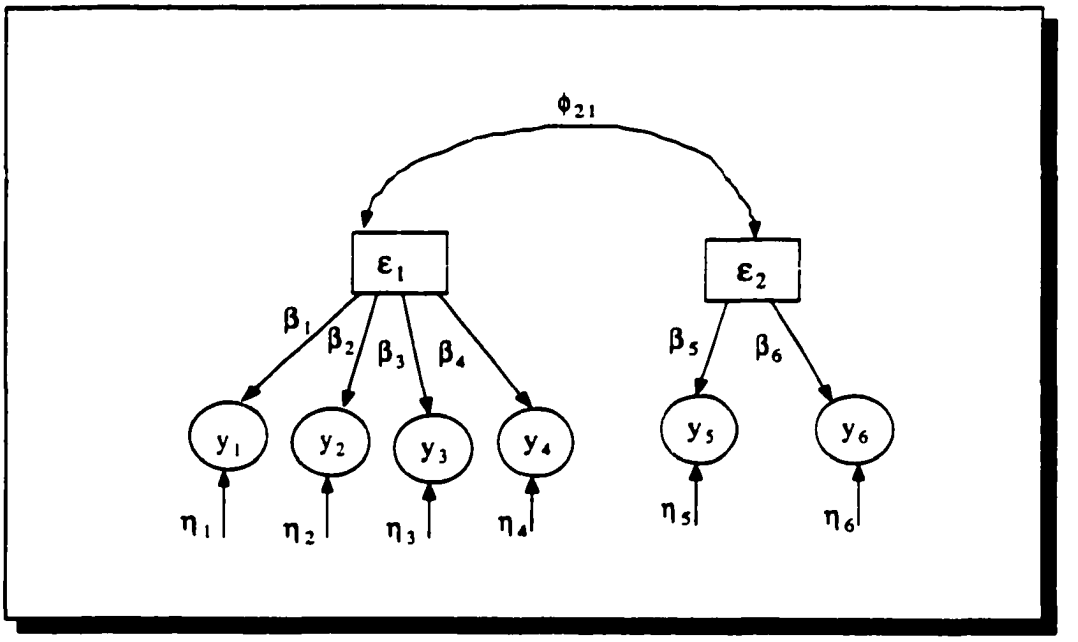


Figure 7. Congeneric Multiple-Factor Model for Information Interdependency

The assumptions here are similar to the one that were made in the case of a single-factor model (i.e., η_i's are assumed to have zero means, are uncorrelated with ϵ_i's, and are mutually uncorrelated among themselves). Though six hypotheses can be generated from the proposed two-factor model, we shall consider only four in order to establish the validity of the proposed multiple-factor model.

$\mathbf{H_1}$: β_1, β_2, β_3, β_4, β_5, β_6, θ_{11}, θ_{22}, θ_{33}, θ_{44}, θ_{55}, θ_{66}, and ϕ_{21} are free and unconstrained
$\mathbf{H_2}$: β_1, β_2, β_3, β_4, β_5, β_6, θ_{11}, θ_{22}, θ_{33}, θ_{44}, θ_{55}, θ_{66}, are free and unconstrained and $\phi_{21} = 1$
$\mathbf{H_3}$: $\beta_1 = \beta_2$, $\beta_3 = \beta_4$, $\beta_5 = \beta_6$, $\theta_{11} = \theta_{22}$, $\theta_{33} = \theta_{44}$, $\theta_{55} = \theta_{66}$, and $\phi_{21} = 1$
$\mathbf{H_4}$: $\beta_1 = \beta_2$, $\beta_3 = \beta_4$, $\beta_5 = \beta_6$, $\theta_{11} = \theta_{22}$, $\theta_{33} = \theta_{44}$, $\theta_{55} = \theta_{66}$, and ϕ_{21} free and unconstrained

The hypothesis $\mathbf{H_1}$ is the null hypothesis for the unconstrained congeneric model represented in Figure 7 above. Hypothesis $\mathbf{H_2}$ is the same as $\mathbf{H_1}$ but in addition, invokes the condition that the correlation between the constructs information analyzability (ϵ_1) and information variety (ϵ_2) is 1 (i.e., $\phi_{21} = 1$). Hypothesis $\mathbf{H_3}$, in addition to resembling hypothesis $\mathbf{H_2}$, introduces the constraints that factor loadings (β_i's) and error variances (θ_{ii}'s) are equal for measures of the same construct. Thus, hypothesis $\mathbf{H_3}$ is a version of the parallel forms model. And, hypothesis $\mathbf{H_4}$ is similar to hypothesis $\mathbf{H_3}$ except that there are no constraints on ϕ_{21}.

In order to examine whether the two information interdependency constructs, task analyzability ϵ_1 and information variety ϵ_2 are distinct, we compare hypothesis $\mathbf{H_1}$ to $\mathbf{H_2}$ and $\mathbf{H_3}$ to $\mathbf{H_4}$. A comparison of hypothesis $\mathbf{H_1}$ and $\mathbf{H_2}$ tests if $\phi_{21} = 1$ under the assumption that the measures are congeneric, while a comparison of hypothesis $\mathbf{H_3}$ to $\mathbf{H_4}$ tests if $\phi_{21} = 1$ under the assumption that the measures are parallel. These two comparisons in turn provide the basis for testing discriminant validity. However, to test the parallel forms model we compare hypothesis $\mathbf{H_1}$ to $\mathbf{H_4}$ and $\mathbf{H_2}$ to $\mathbf{H_3}$. A comparison of hypothesis $\mathbf{H_1}$ and $\mathbf{H_4}$ is done under the assumption that the constructs are distinct, while a comparison of hypothesis $\mathbf{H_2}$ to $\mathbf{H_3}$ is done under the assumption that the constructs are similar. Thus all the above comparisons involving each of these four hypotheses can be examined with a chi-square goodness-of-fit test in order to assess the validity of each model.

In order to test the multiple-factor model represented by equations (1) through (6), we apply the data collected for the four items measuring information interdependency. Specifically, we compare goodness-of-fit indices and use chi-square difference tests to draw our conclusions. The goodness-of-fit results show that the congeneric and parallel form models with ϕ_{21} free and unconstrained cannot be rejected, but both the models with ϕ_{21} = 1 must be rejected. In order to test whether the measures for the two constructs can be considered parallel, given the assumption that ϕ_{21} is a free parameter we compare hypothesis $\mathbf{H_1}$ and $\mathbf{H_4}$. This comparison yields a chi-square index of 1.45 for degrees of freedom of 4 (represented by χ^2 (4) = 1.45), which indicates that the hypothesis cannot be rejected. Similarly, a comparison of hypothesis $\mathbf{H_2}$ and $\mathbf{H_3}$ tests whether the measures for the two constructs are parallel under the constraint ϕ_{21} = 1. This comparison yields a chi-square index of 1.24 for degrees of freedom of 4 (represented by χ^2 (4) = 1.24) at p=0.01 indicates that the hypothesis of parallel forms model cannot be rejected. Thus these two comparisons validate the proposed congeneric model as the hypothesis of parallel forms could not be rejected under both assumptions about ϕ_{21}. The individual item reliabilities appear to be low for some items; however, the composite reliabilities are high (i.e., significant).

Now, we will measure the convergent and discriminant validity of the information dimensions that measure the information interdependency construct. In this context, convergent validity refers to the degree to which the measures for each of the two information interdependency constructs are in agreement. The results reveal that the factor loadings β_1, β_2, β_3, and β_4 on construct ϵ_1 (information analyzability) and β_5 and β_6 on construct ϵ_2 (information variety) are all statistically significant. Thus, each indicator is

strongly related to its underlying research construct. Discriminant validity, on the other hand, refers to the degree to which one research construct (i.e., information analyzability) differs from another (i.e., information variety) construct. It can be measured by testing whether the correlation between the two research constructs (i.e., ϕ_{21}) is significantly different than unity. The measure of ϕ_{21} is 0.67 with a standard error of 0.06. At a 95% confidence interval, the value for ϕ_{21} falls in the range $0.54 < \phi_{21} < 0.79$, which does not include 1.00. Hence, the two dimensions of information interdependency, information analyzability and information variety are distinct and separate. Another formal test of discriminant validity can be carried out by comparing hypothesis H_2 and H_3. This comparison tests whether ϕ_{21} is equal to 1 (i.e., they are perfectly correlated) under the assumption that the measures are congeneric. At $p = 0.01$ we have $\chi^2(4) = 1.34$, which justifies rejection of the hypothesis that information analyzability (ϵ_1) and information variety (ϵ_2) are perfectly correlated. Similarly, a comparison of hypothesis H_3 and H_4 testing $\phi_{21} = 1$ under the assumption that the measures are parallel yields a value of 1.42 for χ^2 at $p = 0.01$, which indicates that the hypothesis should be rejected. The results of this data analysis are shown in Tables 10, 11, and 12.

The results of this multiple-factor model analysis suggest that information interdependency is a multidimensional construct, comprising of information analyzability and information variety. In addition, the results also show that the indicators used to measure these two dimensions of the research construct are highly reliable, and have both convergent and divergent validity.

Table 10. Goodness-of-fit Measures for Information Interdependency

Hypothesis	χ^2	Degrees of freedom	p-value
H_1	4.36	1	0.039
H_2	159.57	2	0.001
H_3	165.83	6	0.000
H_4	5.95	5	0.354

Table 11. Reliability Estimates for Information Interdependency

Model	y_1	y_2	y_3	y_4	Composite ϵ_1	Composite ϵ_2
Congeneric with ϕ_{21} free	0.73	0.75	0.67	0.47	0.94	0.92
Parallel forms with ϕ_{21} free	0.75	0.77	0.48	0.76	0.93	0.92

Table 12. Parameter Estimates for Information Interdependency

Parameter	Congeneric Model with ϕ_{21} free	Parallel forms Model with ϕ_{21} free
β_1	0.77 (.05)	0.78 (.04)
β_2	0.89 (.07)	0.81 (.05)
β_3	0.86 (.06)	0.82 (.04)
β_4	0.78 (.05)	0.84 (.05)
θ_{11}	0.43 (.08)	0.41 (.02)
θ_{22}	0.31(.09)	0.38 (.03)
θ_{33}	0.23 (.07)	0.35 (.03)
θ_{44}	0.48 (.08)	0.34 (.02)
ϕ_{21}	0.67 (.06)	0.67 (.06)

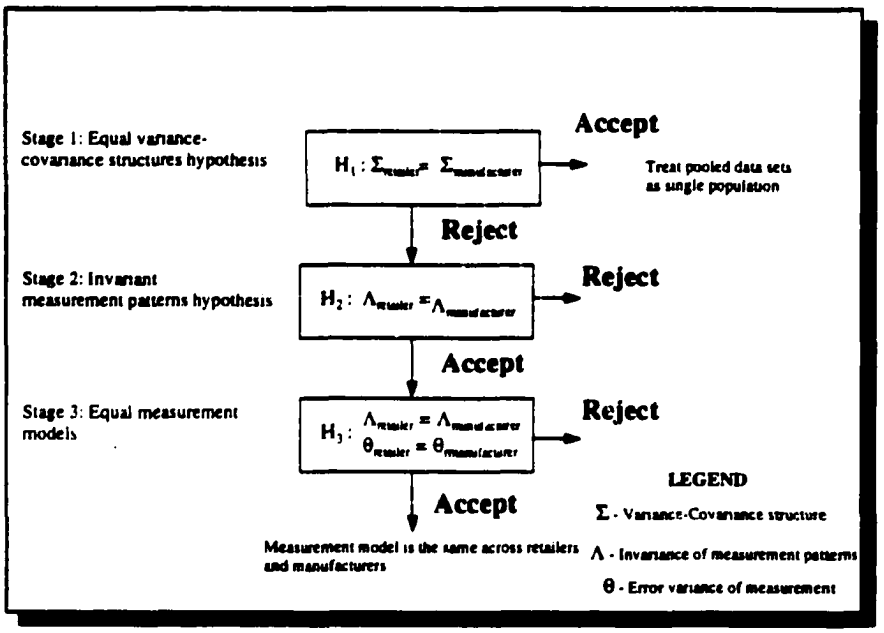
Note: Figures in parenthesis indicate standard errors in measurement.

6.3. A LISREL GROUP ANALYSIS OF DATA

Though apparel retailers and manufacturers are two distinct players in the supply chain (Bailey, 1994), the underlying research constructs measure similar phenomena on either side of the retailer-manufacturer dyad. However, in order to confirm this we devise a hypothesis testing plan (see Table 13). This plan will be carried out in three stages. In stage 1, the two data sets (viz., apparel retailer and manufacturer) are tested for equal variance-covariance structures. Acceptance of this hypothesis implies that these two sets can be pooled together and treated as a single population. However, if this hypothesis is rejected in stage 2 then the measurement patterns in the apparel retailers and manufacturers are tested for

invariance (i.e., whether factors load onto the construct in a similar way). If the hypothesis is accepted (i.e., the patterns are invariant), then the two measurement models (for retailers and manufacturers) are treated as same across both sets of data.

Table 13. Hypothesis Testing for Measurement Differences Across Retailers and Manufacturers



Bagozzi (1980) suggests a testing plan along the lines shown in Table 13 above. The first hypothesis proposes equality of variance-covariance matrices across the two groups (i.e., retailers and manufacturers). A failure to reject this hypothesis suggests that the research constructs do not differ across retailers and manufacturers and therefore may be pooled for further analysis. On the other hand, a rejection of the hypothesis suggests the constructs are different across the two groups.

In this research context, we compare the χ^2 values for hypotheses at two consecutive stages, with degree of freedom equal to the difference in degrees of freedom between the two stages (refer the table above). For example, given that H_1 has been rejected we test H_2 in stage II by comparing the χ^2 value with the difference in χ^2 values for H_1 and H_2. A failure to reject this hypothesis, however, might lead to stage 3 where the measurement models for both sets of data are tested. In summary, we have hypothesized three models

H_1: $\Sigma_{retailer} = \Sigma_{manufacturer}$
H_2: $\Sigma_{retailer} = \Sigma_{manufacturer}$, and $\Lambda_{retailer} = \Lambda_{manufacturer}$
H_3: $\Sigma_{retailer} = \Sigma_{manufacturer}$, and $\Lambda_{retailer} = \Lambda_{manufacturer}$, and $\Phi_{retailer} = \Phi_{manufacturer}$

In order to demonstrate the application of these tests, we select a range of research constructs: an unidimensional construct for asset specificity, a two-factor construct for information interdependency (viz., information analyzability and information variety), and a three-factor construct for relationship interdependency (viz., mutual interdependence, manufacturer investments, and mutual trust). The results (see Tables 14, 15, and 16) reveal that testing hypotheses involving all the three research constructs (viz., asset specificity, information interdependency, and relationship interdependency) can be done using the total sample as a single population.

Table 14. Goodness-of-Fit Test For a Single-Factor Construct: Asset Specificity

Hypothesis	χ^2	Degrees of freedom	p-value
H_1	1.06	6	0.839

Table 15. Goodness-of-Fit Test For a Two-Factor Construct: Information Interdependency

Hypothesis	χ^2	Degrees of freedom	p-value
H_1	34.36	10	0.001
H_2	4.57	4	0.514
H_3	31.83	8	0.000

Table 16. Goodness-of-Fit Test For a Three-Factor Construct: Relationship Interdependency

Hypothesis	χ^2	Degrees of freedom	p-value
H_1	54.36	36	0.032
H_2	51.57	39	0.081
H_3	65.81	47	0.078
H_4	72.65	53	0.034

6.4. MODELS OF INTERORGANIZATIONAL COORDINATION

In this stage of our data analysis, we examine differences across apparel retailers and manufacturers at an aggregate level in order to identify the existence of two general modes of interorganizational coordination mechanisms to achieve cycle time reduction. Specifically, a series of t-tests of mean differences across the two samples (viz., retailers and manufacturers) conducted for each proposed research construct and variable in the operational research model, allows a specification of the "average" retailer-manufacturer relationship in the U.S. apparel industry, and highlight the internal consistency of each model within the unique characteristics of the market.

It is important to note that these series of analyses and results are useful only in revealing general tendencies in the underlying concept of interorganizational coordination in the retailer-manufacturer dyad. Despite poor theoretical meaningfulness these analyses and comparisons at an aggregate level provide interesting managerial insights into the various interorganization coordination arrangements that are existent in the retailer and manufacturer markets. The analyses proceeds in two steps.

The first step in our analysis is an examination of the differences between apparel retailers and manufacturers in the context of cycle time reduction taking into consideration the general characteristics of the respective environments, the general characteristics and climate of retailer-manufacturer relations in the apparel industry, and the general characteristics of internal interdependency in the boundary spanning roles such as purchase and sales. In the second step, we present the results for the differences in the use of the three

interorganizational coordination mechanisms (viz., structure, process, and technology) in order to achieve cycle time reduction.

6.4.1. Interorganizational Interdependencies

The environmental interdependencies are reflected in the ***characteristics of the market and product*** (i.e., apparel item) and for the same apparel items they dramatically differ across retailers and manufacturers. For any given apparel item the retailer's market exhibits *lower stability* and *lower market concentration*, while the apparel manufacturer's market for the same apparel item exhibits *higher stability* and *greater market concentration*. In other words, apparel retailers in the U.S. operate under traditional market-like mechanisms, where retailers tend to purchase apparel items from a large pool of potential suppliers (i.e., apparel manufacturers) and consequently, the number of similar apparel items ordered from a given apparel manufacturer is less (i.e., lower market concentration or fewer items per manufacturer). On the other hand, apparel manufacturers tend to compete in the same market segments (i.e., greater market stability), and deliver a much broader range of items to the apparel retailers (i.e., greater market concentration). Inspite of their larger number of suppliers (i.e., apparel manufacturers) and purchasing staff U.S. apparel retailers are purchasing a greater portion of their total purchase from a select few suppliers, while apparel manufacturers strategy is to concentrate on their core competencies, internalize the design and manufacture of certain key, fast-moving apparel items, technologies, and systems that distinguish them from their competitors, thereby achieving greater *product penetration*. Figure 8 below summarizes the results of the data analysis.

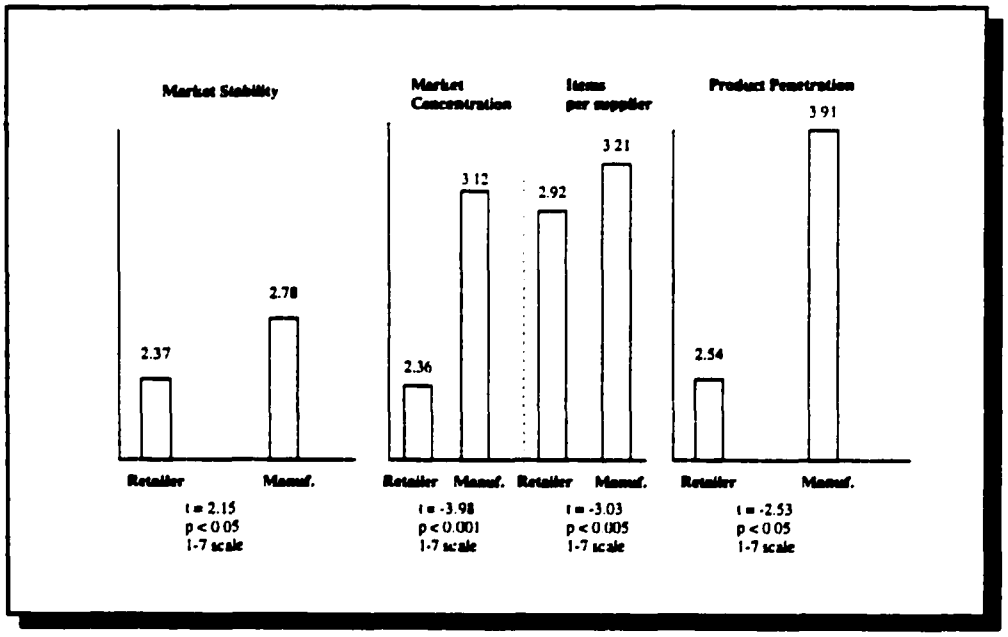


Figure 8. Market and Product Characteristics for Retailers and Manufacturers

The characteristics of the apparel retailer-manufacturer relationship capture the inherent interdependencies existent in a dyadic arrangement and reflect the differences in the market and product characteristics discussed above. Managers of apparel retailers feel they are making higher investments specific to their relationship with an apparel manufacturer (i.e., supplier) in terms of information systems, and technology deployment. On the other hand, apparel manufacturers report a lower score on their investment specific to their relationship with the other member of the dyad. The perceived interdependence is higher on the retailer side of the retailer-manufacturer relationship and is reflected in a higher mutual

trust and a stronger predisposition to continue the relationship in the future. Figure 9. below shows the results of the data analysis.

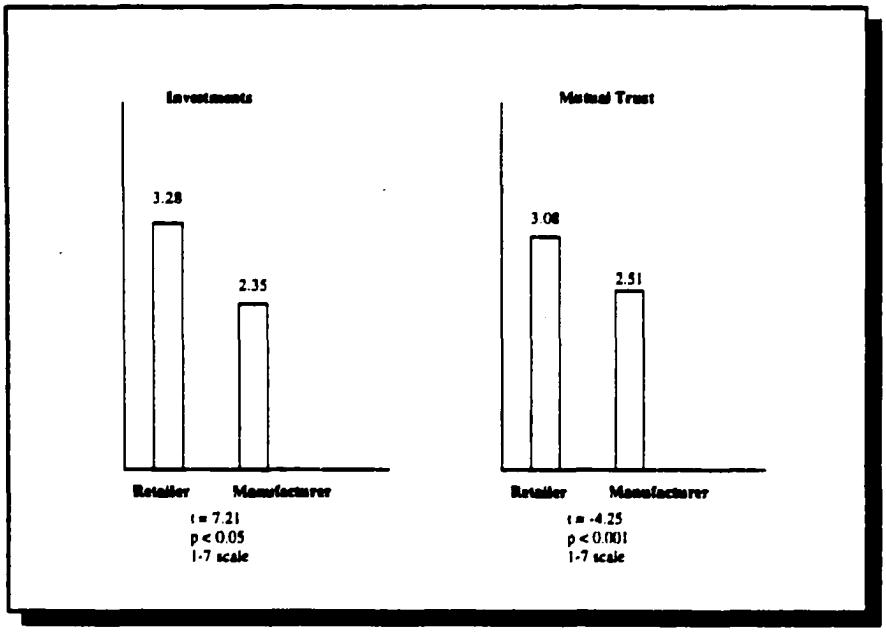


Figure 9. Relationship Characteristics for Retailers and Manufacturers

Internal interdependencies present in business tasks and information sharing in boundary roles such as purchase and sales differ across apparel retailers and manufacturers. Task interdependency or the extent to which the manager spends his/her time working with a given supplier (i.e., apparel manufacturer) is significantly higher in the apparel retailer sample. The sales managers of apparel manufacturers, on the other hand, perceive task interdependency to be less important. Also, the boundary spanning role (i.e., the sales function) in case of apparel manufacturers involve more structured, modularized and routine

tasks than they do in the case of apparel retailers. Apparel retailers, on the other hand, have to plan for market and demand contingencies and hence, have to deal with more unstructured and less repetitive tasks in their relationship with manufacturers. Figure 10 below summarizes the results of this analysis.

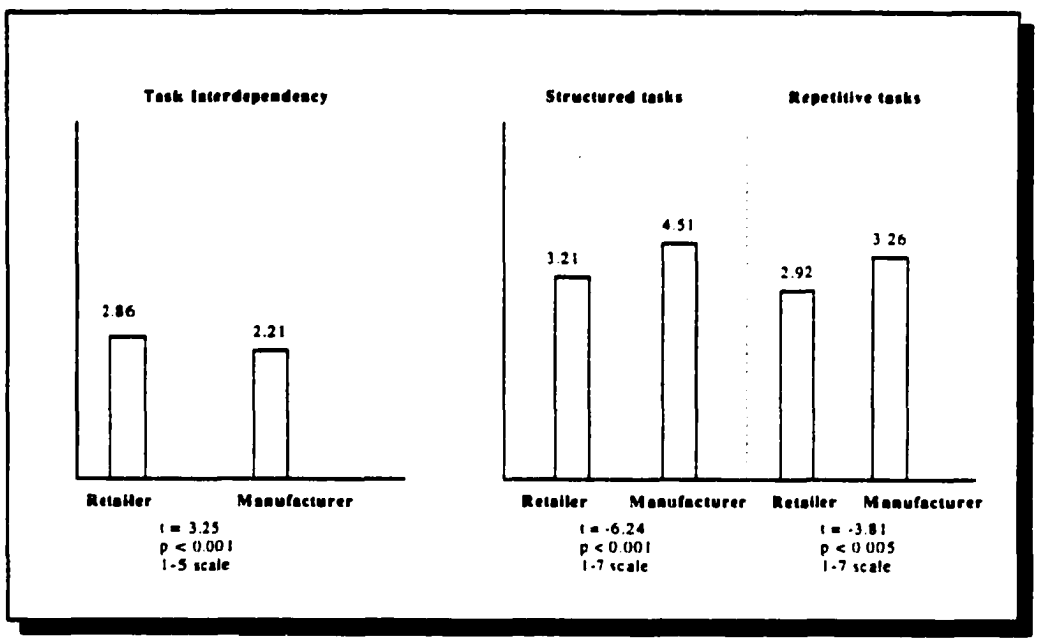


Figure 10. Task and Information Characteristics for Retailers and Manufacturers

In sum, retailer-manufacturer relationships in the U.S. apparel industry operate under different sets of conditions. Markets for apparel items are structured and regulated under different environmental mechanisms, relationships reflect different assumptions about the

logic for effective governance, and the tasks that regulate the relationship are configured differently.

6.4.2. Interorganizational Coordination

Interorganizational coordination through structure in the retailer-manufacturer relationship was measured along several dimensions including frequency of visits to each other's location, the degree to which the firms work together in certain business functions, and the importance of control and coordination tasks. Purchase managers at the retailers end report more exchange of visits between them and their supplier (i..e, apparel manufacturer), while managers of apparel manufacturers report working together with a greater number of different functional areas from the retailer. Retail managers spend a great part of their time monitoring the performance of the supplier (i.e., apparel manufacturer) and resolving urgent problems related to delivery, quality, and ordering issues. Managers at the manufacturers end, however, spend relatively more time in the early stages of the relationship such as negotiating price terms and conditions for orders placed, negotiation of design and quality parameters with the retailer. Figure 11 summarizes the findings.

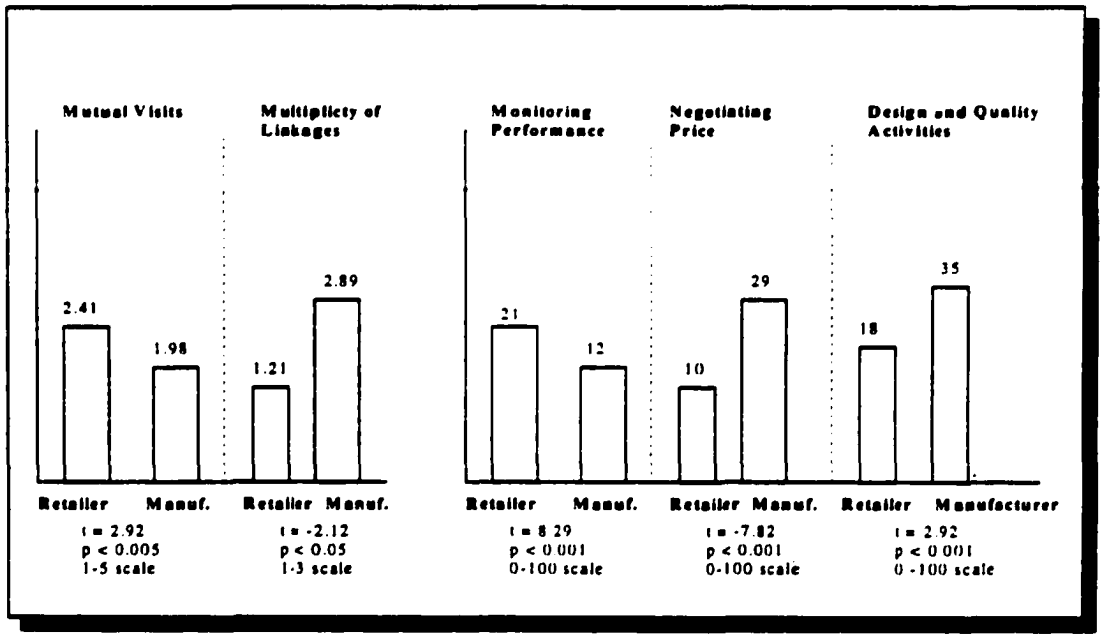


Figure 11. Structure for Interorganizational Coordination

Interorganizational coordination through process mechanisms represents the activities and processes prevalent in the relationship, which can either foster or inhibit information exchange between retailer and manufacturer. Surprisingly, apparel manufacturers perceive that there is a relatively higher level of conflict or stress in their relationships with the retailer. In addition, there is more cooperation from the apparel manufacturer, particularly in the areas of order scheduling, technical assistance, and long range planning together with more commitment (sharing of burdens, risks, and benefits) in their relationships with retailers. Figure 12 shows the results of data analysis.

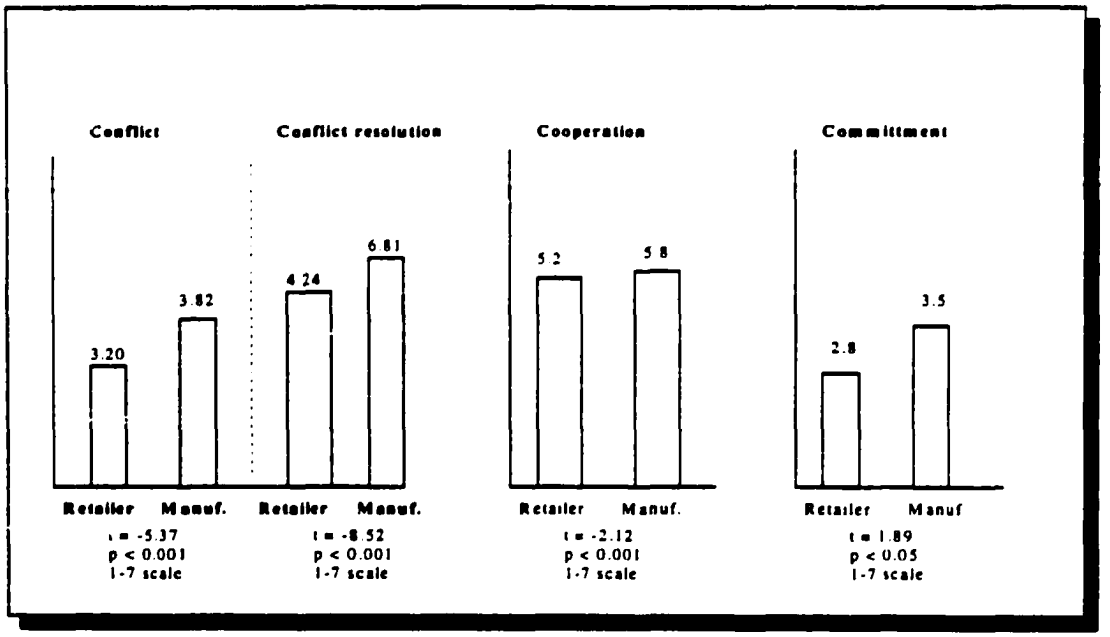


Figure 12. Process for Interorganizational Coordination

The use of information technology to facilitate interorganizational coordination in the retailer-manufacturer relationship offers a contrasting and interesting pattern across the supply chain dyad. First, apparel manufacturers are making greater use of information technology (specifically, IOIS) to coordinate with the retailers than is usually expected. Their pattern and scope of use, however, dramatically differ from apparel retailers in the U.S. While apparel manufacturers are making more investments in a few critical operational areas such as quality and production control, apparel retailers not only rely more on technology altogether, but also tend to apply it to a wider scope of functions such as purchasing, sales, quality, delivery, payment, and ordering. However, despite the relatively higher investments

made by the manufacturers, the level of data and process integration across the organizational boundary with the retailers is lower than that of the retailers. Retail managers feel that technologies such as electronic data interchange (EDI) should be used as a strategic weapon that will allow them to retrieve information from manufacturers faster, with less errors and at a lesser cost. In the area of standards, there is greater awareness of and conformance to industry standards for EDI communication from apparel retailers than manufacturers. Figure 13 summarizes the findings along the information technology dimension of interorganizational coordination.

To summarize, the results from this phase of quantitative study reported here seem to suggest a different pattern of response to the contextual factors affecting retailer-manufacturer relationships across the supply chain dyad. However, without further analysis of bivariate and multivariate relationships between the dimensions discussed above and their effect on the performance of the relationship, it is impossible to make valid assessments about the quality and level of interorganizational coordination and its impact on cycle time performance.

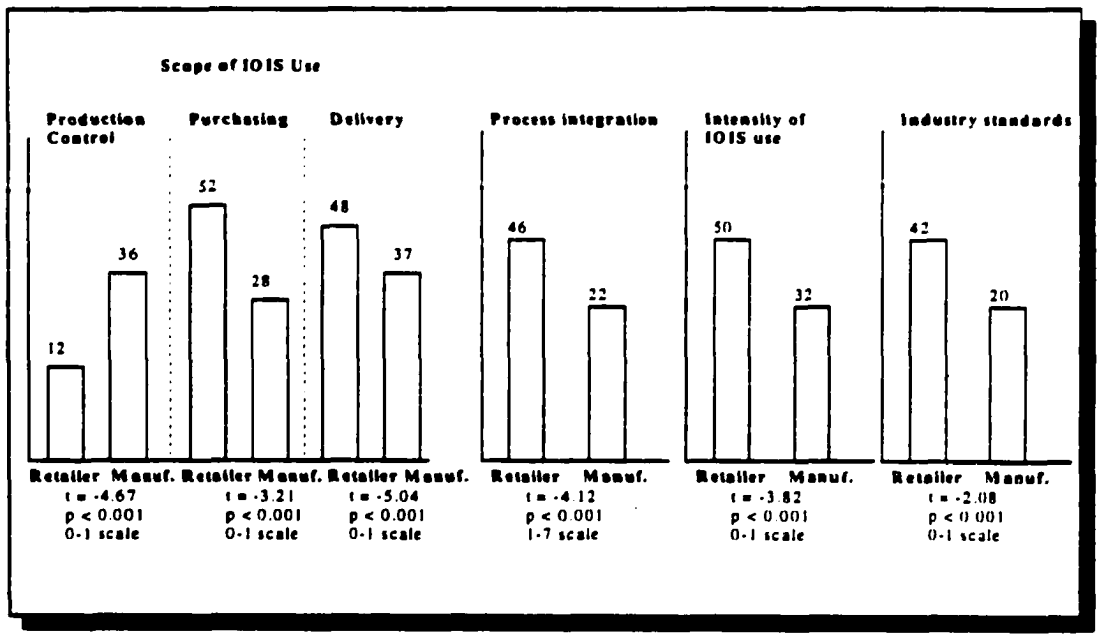


Figure 13. Information Technology for Interorganizational Coordination

6.5. MULTIVARIATE ANALYSIS OF CTR PERFORMANCE

This multivariate analysis is based on multiple regression between interorganizational coordination constructs (as dependent variables) and interorganizational interdependency constructs (as independent variables). The first set of multiple regressions consists of multiple regression between one interorganizational coordination construct and one interorganizational interdependency construct and tests for the individual effect of each type of interdependency on each type of interorganizational coordination mechanism. The second set of analysis consists of multiple regression with one interorganizational coordination

construct as the dependent variable and three interorganizational interdependencies as independent variables, and thus provide a test for the comparative and collective effect of the three generic sources of interorganizational interdependency on each interorganizational coordination mechanism.

6.5.1. Interorganizational Interdependency and Coordination: Bivariate Relationships

The following set of bivariate analyses represent the direct testing of the bivariate hypotheses underlying the dominant theoretical perspectives when employed separately. Multiple regressions were conducted on the total sample and the retailer and manufacturer samples with each interorganizational coordination mechanisms as the dependent variable, and successively each interorganizational interdependency construct as the independent variable.

The possible combinations between environmental interdependency and each of the interorganizational coordination mechanisms is reproduced below.

H1: The greater the environmental interdependency, the greater the capacity of structural coordination mechanisms impacting CTR performance.

H2: The greater the environmental interdependency, the greater the capacity of process coordination mechanisms impacting CTR performance.

H3: The greater the environmental interdependency, the greater the capacity of technology coordination mechanisms impacting CTR performance.

Figure 14 displays the beta values, F ratio and R^2 values for the multiple regressions that confirms the above three hypotheses. These analyses are not part of a traditional hypothesis-testing study, but rather constitute a test for nomological validity. These findings

demonstrate consistency with other empirical work in other organizational literature (Duncan, 1972; Pfeffer & Salancik, 1978).

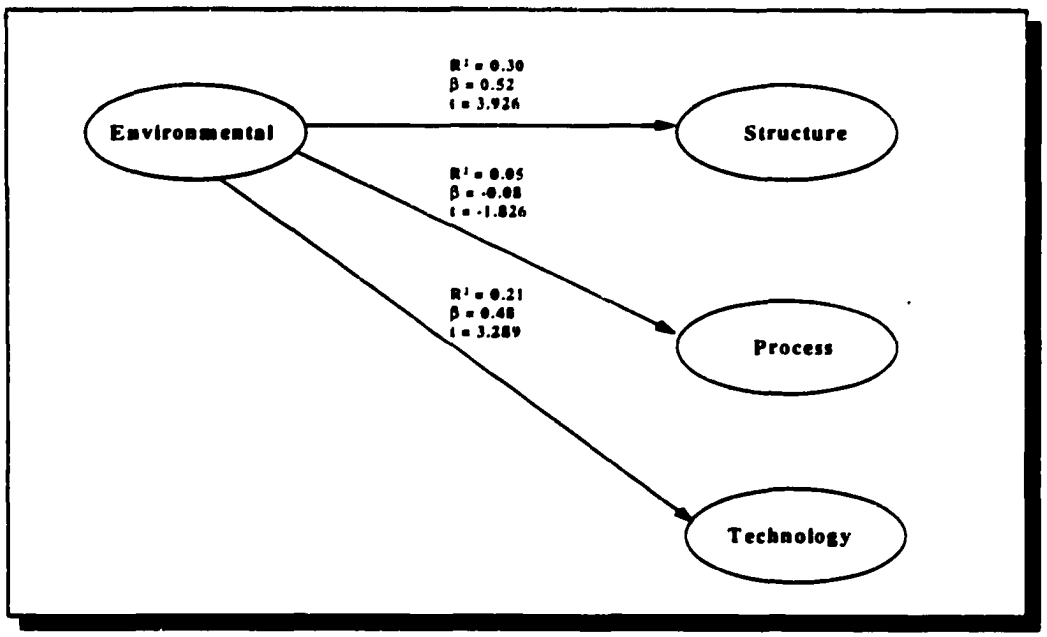


Figure 14. Bivariate Relationships: Environmental Interdependency and Interorganizational Coordination

The possible combinations between relationship interdependency and each of the interorganizational coordination mechanisms is reproduced below.

H4: The greater the relationship interdependency, the greater the capacity of structural coordination mechanisms impacting CTR performance.

H5: The greater the relationship interdependency, the greater the capacity of process coordination mechanisms impacting CTR performance.

H6: The greater the relationship interdependency, the greater the capacity of technology coordination mechanisms impacting CTR performance.

Figure 15 displays the beta values, F ratio, and R^2 values for the multiple regressions that confirms the above three hypotheses. Despite low R^2 values, inspection of the sign for beta and the level of significance (t-value) demonstrate consistency with other empirical work in related MIS (Cooprider, 1990) and marketing (Anderson & Weitz, 1989; Gardner & Cooper, 1988).

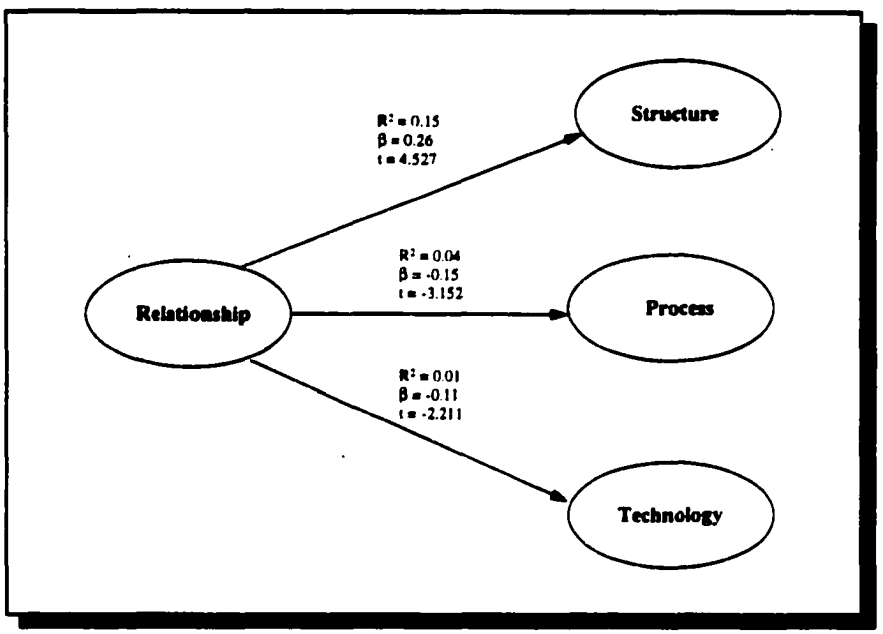


Figure 15. Bivariate Relationships: Relationship Interdependency and Interorganizational Coordination

The possible combinations between internal interdependency and each of the interorganizational coordination mechanisms is reproduced below.

H7: The greater the internal interdependency, the greater the capacity of structure coordination mechanisms impacting CTR performance.

H8: The greater the internal interdependency, the greater the capacity of process coordination mechanisms impacting CTR performance.

H9: The greater the internal interdependency, the greater the capacity of technology coordination mechanisms impacting CTR performance.

Figure 16 displays the beta values, F ratio, and R^2 values for the multiple regressions that confirms the above three hypotheses.

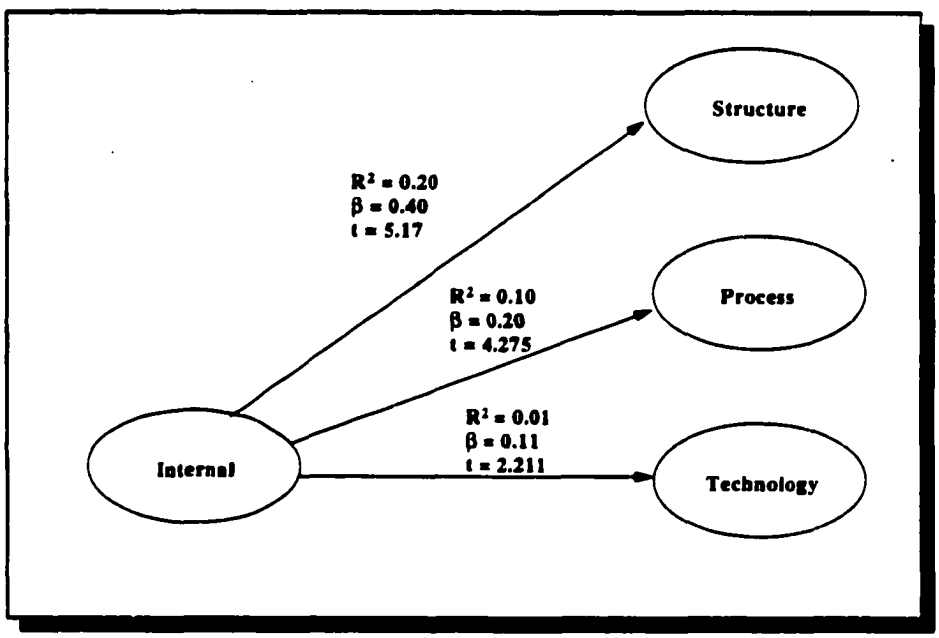


Figure 16. Bivariate Relationships: Internal Interdependency and Interorganizational Coordination

6.5.2. Interorganizational Interdependency and Interorganizational Coordination: Multivariate Relationships

This set of analyses includes multiple independent variables into the multiple regression. This analyses allows a comparison of the relative contribution of each interorganizational interdependency constructs in explaining the variations in the dependent interorganization coordination variables. In order to interpret the results in this set of analyses we focus on changes in R^2 values and their significance.

The possible combination of multivariate relationships between interorganization interdependency construct and the structure dimension of interorganizational coordination is hypothesized below.

H1: The greater the environmental, relationship, and internal interdependency, the greater the capacity of structural coordination mechanisms impacting CTR performance.

Figure 17 displays the results of this analyses which confirm the above stated hypothesis. In addition, the value of R^2 change for environmental interdependency emphasizes the greater importance of environmental related interdependency in explaining interorganizational coordination. Hence, this finding supports the contingency logic and also suggests that relationship interdependency is a second order determinant of interorganizational coordination.

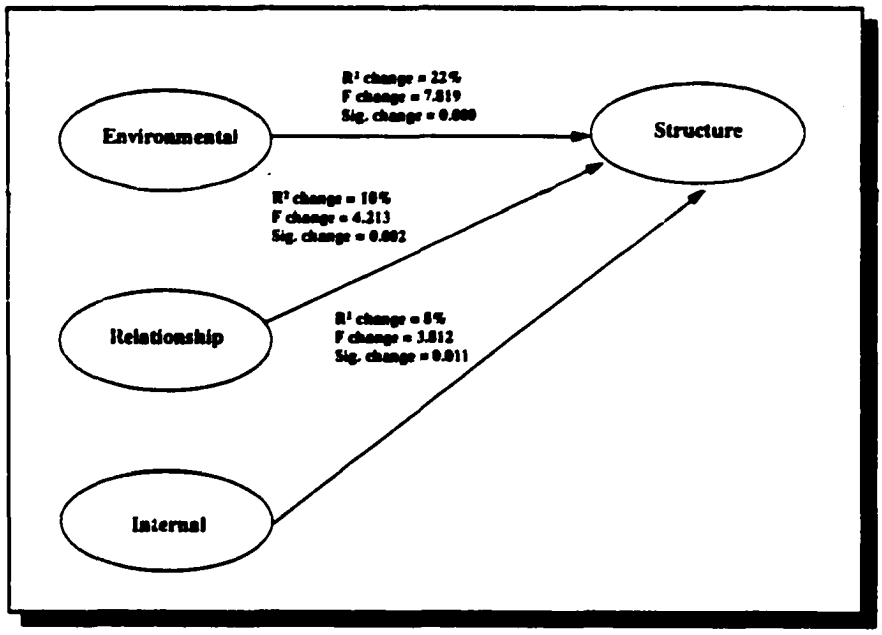


Figure 17. Multivariate Relationships: Interorganizational Interdependency and Structural Coordination

The possible combination of multivariate relationships between interorganization interdependency construct and the process dimension of interorganizational coordination is hypothesized below.

H2: The greater the environmental, relationship, and internal interdependency, the greater the capacity of process coordination mechanisms impacting CTR performance.

Figure 18 displays the results of this analyses which confirms the above stated hypothesis.

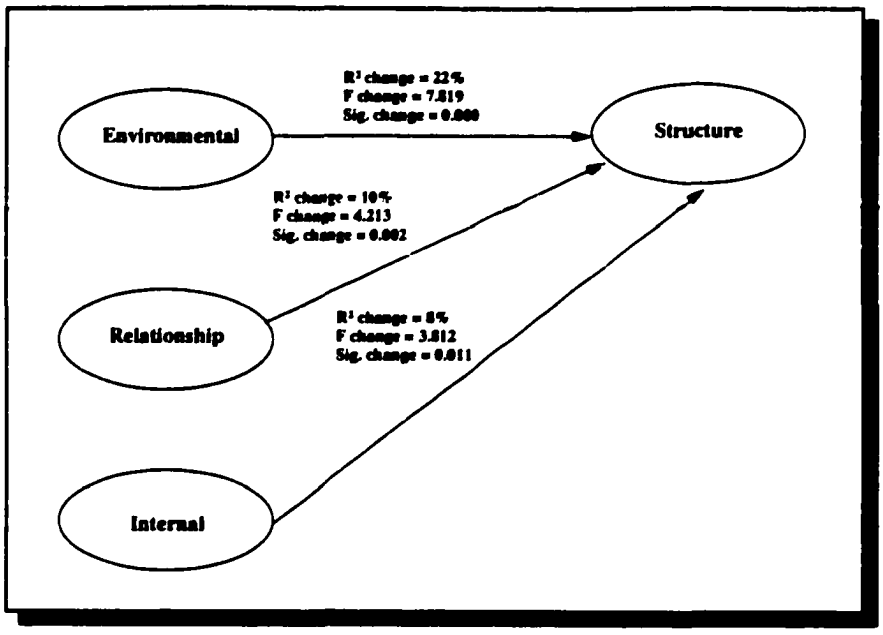


Figure 17. Multivariate Relationships: Interorganizational Interdependency and Structural Coordination

The possible combination of multivariate relationships between interorganization interdependency construct and the process dimension of interorganizational coordination is hypothesized below.

H2: The greater the environmental, relationship, and internal interdependency, the greater the capacity of process coordination mechanisms impacting CTR performance.

Figure 18 displays the results of this analyses which confirms the above stated hypothesis.

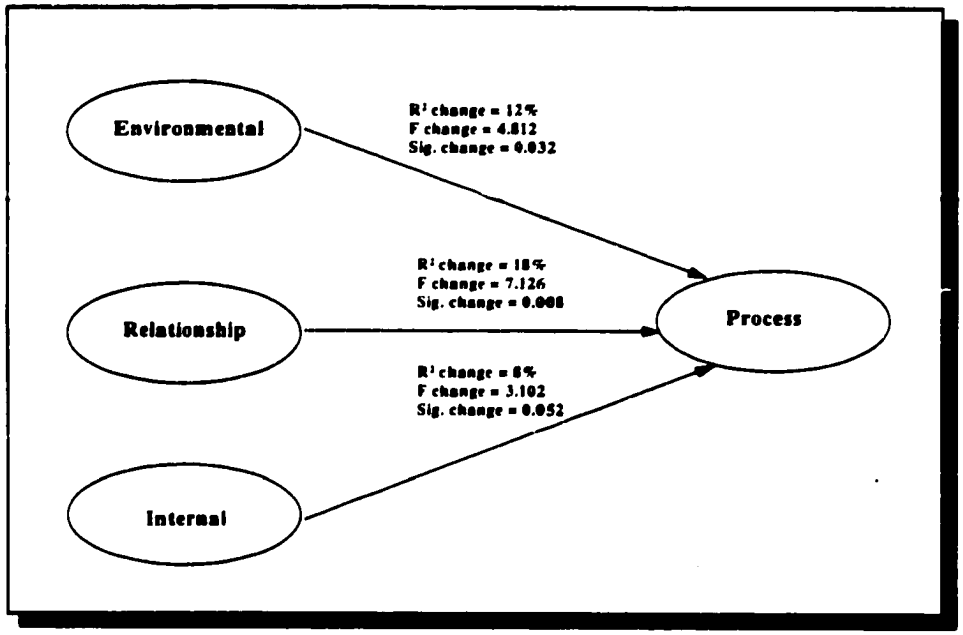


Figure 18. Multivariate Relationships: Interorganizational Interdependency and Process Coordination

The possible combination of multivariate relationships between interorganization interdependency construct and the technology dimension of interorganizational coordination is hypothesized below.

H3: The greater the environmental, relationship, and internal interdependency, the greater the capacity of technology coordination mechanisms impacting CTR performance.

Figure 19 displays the results of this analyses which confirms the above stated hypothesis.

a supply chain. The immediate normative derivation from these multiple regressions would argue for higher investments in all the three interorganizational coordination mechanisms under high interorganizational interdependency. However, in reality such prescriptions are not feasible given the severe resource constraints confronting management. Hence, what is required is multivariate analyses that can include more than one dependent variable.

Inspite of these drawbacks, multiple regression analyses helped validate the measurement model (i.e., nomological validity) and also identify the variables to include in the next stage of our data analysis to uncover the dominant configurations of interorganizational interdependency and the dominant patterns of combining structure, process, and technology dimensions of interorganizational coordination in order to achieve greater CTR performance.

6.6. UNCOVERING CONFIGURATION GESTALTS

As stated earlier, a configurational perspective more appropriately reflects the underlying concept of fit in the proposed research model and should provide greater insight into how two firms coordinate across their organizational boundaries in order to achieve CTR in their business processes and also specifically identify the role of technology (in the form of interorganizational information systems) in the CTR performance of the organizations. In addition, a configurational approach contrasts with the previous multivariate approach as it captures the coexistence and interaction between the three interorganizational coordination mechanisms.

Cluster analysis is used to explore the holistic and interaction view of interorganizational coordination. The analysis proceeds in two stages which gradually build up to the identification of generic configurations of interorganizational interdependency - interorganizational coordination fit. In the first stage, we uncover separately for the retailers and manufacturer samples and then for the pooled sample the interorganizational interdependency configurations present in the data set. Next, these interorganizational interdependency configurations defined along 10 variables (4 for environment interdependency, and 3 each for relationship and internal interdependency) are tested for significant differences (oneway analysis of variance with Scheffe ranges of 0.05) in interorganization coordination and CTR performance. In the second stage of analysis, configurations of fit between interorganizational interdependency and coordination within U.S. apparel retailers and manufacturers are uncovered and their probability of occurrence is examined along with their characteristics and performance properties.

First, a brief discussion about cluster analysis as a technique for arriving at naturally occurring clusters in the data set is presented. Next, the basis for the selection of a procedure to identify the clusters is formulated. Finally, the procedure that is used in uncovering the configuration gestalts is described.

6.6.1. Cluster Analysis: A Basis for Analyzing Data Sets

Cluster analysis technique is used for developing empirical groupings of cases or variables which may serve as the basis for further analysis. Despite its frequent uses, little is known of the characteristics of available clustering methods and how these methods should be employed (Bensaou 1993). Punj and Stewart (1983) discuss some of the problems

plaguing the empirical use of the technique and build on recent work on clustering algorithms to conclude with some recommendations for an appropriate use of cluster analysis.

A wider variety of clustering methodologies have been developed primarily outside of a single dominant discipline. While factor analysis and other scaling methods can be associated to the discipline of psychology, and regression to econometrics, no single discipline has independently developed and retained clustering methodology (Punk and Stewart, 1983). On the other hand, numerous disciplines such as econometrics, psychology, biology, and engineering have independently approached the clustering problem. Punj and Stewart (1983) offer a critically important exception to this lack of common language and formal guidelines for the use of cluster analysis by suggesting specific methods.

Punj and Stewart (1983) reviewed these methodologies, and evaluated most commonly used algorithms. They applied each of these methods to the same data sets and compared their relative performance. The authors propose to distinguish four hierarchical methods (such as single linkage, complete linkage, average linkage, and Ward's minimum variance method) from other non-hierarchical methods. These nonhierarchical methods are iterative partitioning methods which begin by dividing the sample into some predetermined number of clusters; then observations are reassigned to clusters until some decision rule terminates the process. Thus, these nonhierarchical methods may differ with respect to 1) the starting partition, 2) the type of reassignment process, 3) the decision rule used for terminating clustering, and 4) the frequency with which the cluster centroids are updated during the reassignment process (Punj & Stewart, 1983).

It follows from Punj and Stewart's (1983) analysis that three procedures outperform all other methods and they are: Ward's minimum variance methods, average linkage, and variants of the iterative partitioning method. According to Punj and Stewart (1983), the selection of a similarity/dissimilarity or distance measure is not critical while the selection of clustering algorithms is more important for determining the outcome of a clustering solution. Hence, based on this analysis it turns out that Ward's minimum variance method is the preferred method.

Cluster analysis when used for classification is typically an inductive technique or a purely empirical method of classification. On the other hand, most techniques developed are concerned with the identification of discrete, naturally occurring categories such as taxonomies, configurations, clusters, and patterns within a data set, and make no prior assumptions about important differences in the population. Clusters resulting from the use of this technique should exhibit two key properties, external isolation and internal cohesion (Cormack, 1971). External isolation requires that cases in one cluster be separated from cases in another cluster by fairly empty space. Internal cohesion requires that cases within the same cluster be similar to each other.

6.6.2. Applying Cluster Analysis

Following Punj and Stewart's (1983) recommendation for a rational or theoretical basis for selecting the variables we use the conceptual model and its theoretical grounding as the basis for the selection of a first set of candidate variables defining the six key research constructs in the model. Next, we build upon the previous analysis of bivariate relationships

and other multiple regression results and further narrow the final set to 10 variables for interorganizational interdependency clustering and 18 variables for interorganizational coordination clustering.

In arriving at the clusters, the lack of a rigorous and objective procedure to identify the number of clusters in the final solution has been acknowledged in literature (Everitt, 1979; Sneath & Sokal, 1973). Hierarchical procedures used to identify clusters typically require the researcher to specify the "best number" of clusters before running the clustering program, while in non-hierarchical procedures the program offers the full range of solutions from one cluster solution to the *n*-clusters solution; here the determination of the final solution is left to the subjective judgment of the researcher.

In addition to the above methods for determining the number of clusters, recent efforts to design reliable and valid procedures for the determination of the number of clusters in a data set have yielded interesting results (Dubes & Jain, 1979; Milligan, 1981; Perruchet, 1983). Milligan and Cooper (1985) conducted a Monte Carlo evaluation of 30 such procedures applied to artificial data sets containing either 2, 3, 4, or 5 distinct non-overlapping clusters. They also compared the 30 different stopping rules across four hierarchical clustering methods, including the Ward's minimum variance procedure. The results of their simulation revealed high variability in the procedures ability to determine the correct number of clusters in the data. But inspite of this variability, the Calinski and Harabasz (1974) index procedure scored consistently high on the performance and validity criteria. Hence, based on these considerations we choose the Calinski and Harabasz index

procedure to uncover interorganizational coordination and interorganizational interdependency configurations in the data set.

To summarize, the uncovering of the interorganizational interdependency and coordination configurations in this study is based on the following decisions:

- data is standardized.
- squared euclidean distance is the preferred similarity measure.
- the selection of the variables to include in the clustering algorithms is based on the theoretical considerations underlying the conceptual model and previous analysis of bivariate and multivariate relationships.
- the Ward's minimum variance method is the preferred method for cluster formation.
- the optimal number of clusters is objectively determined by the Calinski and Harabasz index.

6.6.3. Calinski and Harabasz Variance Ratio Criterion: Determining the Optimum Number of Clusters

The Calinski and Harabasz (1974) index procedure is based on a shortest dendrite method (or minimum spanning tree) for identifying the clusters of points in a multidimensional Euclidean space. Points within a cluster are close together, while clusters are themselves are apart (Rao, 1964). The objective is then to find some minimum variance clusters. The formal index proposed by Calinski and Harabasz (1974) is based on two familiar objective functions: the within group (cluster) sum of squares (WGSS) and the

between groups (clusters) sum of squares (BGSS). Thus, the index referred to as the variance ratio criterion index or VRC index, can be defined as:

$$VRC = \frac{BGSS}{k-1} / \frac{WGSS}{n-k} \quad \ldots\ldots (1)$$

where n is the total sample size and k is the number of clusters in the data set. VRC is first computed for a $k = 2$ cluster solution, then $k = 3$, and so on. For each clustering solution we calculate WGSS, BGSS, and VRC. Calinksi and Harabasz (1974) concluded that the final number of clusters will be that number k for which the VRC, variance ratio criterion, has an absolute or a first local maximum. This conclusion has been validated by Milligan and Cooper's (1985) Monte Carlo simulation study.

WGSS, being the within group squared euclidean distances (i.e., sum of squares), is defined by the function

$$WGSS = 1/2 \left((n_1 - 1)\, d^2_1 + (n_2 - 1)\, d^2_2 + \ldots. + (n_k - 1)\, d^2_k\right.$$

where d^2_g denotes the general mean of all $n_g (n_g - 1) / 2$ squared distances between data points within the g-th group and $g = 1, 2, \ldots, k$.

The between groups sum of squares, BGSS, can be derived from the total sum of squares (TSS) since we know that TSS = WGSS + BGSS and that TSS is the general mean of all $n (n - 1) / 2$ squared distances d^2_{ij}.

6.7. INTERORGANIZATIONAL INTERDEPENDENCY CONFIGURATIONS

The best number of clusters that represent interorganizational interdependency in retailers is arrived at in two phases. In phase I, cluster analysis was conducted along 5 environmental interdependency variables (4 variables for product characteristics and 1 for market characteristics) and 4 internal interdependency variables (2 for task interdependency and 2 for information interdependency). In phase II, each of the derived clusters was then treated as a separate data set and a cluster analysis was conducted along 10 relationship interdependency variables (2 for climate of the relationship and 8 for power-dependency). Now, we will systematically uncover the optimum number of interorganizational interdependency configurations in the retailer sample, manufacturer sample, and the pooled sample separately.

6.7.1. Interorganizational Interdependency Configurations in Apparel Retailers

The total sum of all pairwise squared distances between the 52 data points in the apparel retailers sample is TSS = 472. There are 52 x (52 - 1) / 2 such distances. A $k = 2$ clusters solution gives 2 interorganizational interdependency clusters C_1 and C_2 with $n_1 = 26$ and $n_2 = 26$. The sum of squared distances between the cases in cluster C_1 is 156, and the sum of squared distances between those in cluster C_2 is 264. Consequently, WGSS is given by:

$$WGSS = 156 + 264 = 420.$$

and since, BGSS = TSS - WGSS, we have

$$BGSS = 472 - 420 = 52.$$

Hence, VRC is then derived by equation (1)

$$VRC = \frac{52}{(2-1)} \Big/ \frac{420}{(52-2)} = 6.19 \ldots . (2)$$

A $k = 3$ cluster solution gives three configurations with the following characteristics:

$n_1 = 18$, $n_2 = 8$, and $n_3 = 26$ with respective within-cluster sum of squared distances

$WGSS_1 = 1/2\,(18-1)\,d^2_1 = 132$,

$WGSS_2 = 1/2\,(8-1)\,d^2_2 = 42$, and

$WGSS_3 = 1/2\,(26-1)\,d^2_3 = 212$

Hence, WGSS = 132 + 42 + 212 = 386 and BGSS = 472 - 386 = 86.

VRC is then derived by equation (1)

$$VRC = \frac{86}{(3-1)} \Big/ \frac{386}{(52-3)} = 5.46 \ldots . (3)$$

Comparing (2) and (3) following Calinksi and Harabasz variance ratio rule (i.e., select k for which VRC has a general or local maximum as the "best number" of clusters in the data set), we conclude that $k = 2$ is the best number of clusters at this stage of data analyses. Table 17 and Figure 20 below depict the results for the same VRC procedure conducted upto $k = 10$.

Table 17. Results of the VRC Procedure: Phase I

Number of clusters, *k*	2	3	4	5	6	7	8	9	10
BGSS	52	86	116	131	155	171	189	196	212
WGSS	420	386	356	341	317	301	283	276	260
VRC	**6.19**	5.46	5.21	4.60	4.49	4.26	4.19	3.82	3.80

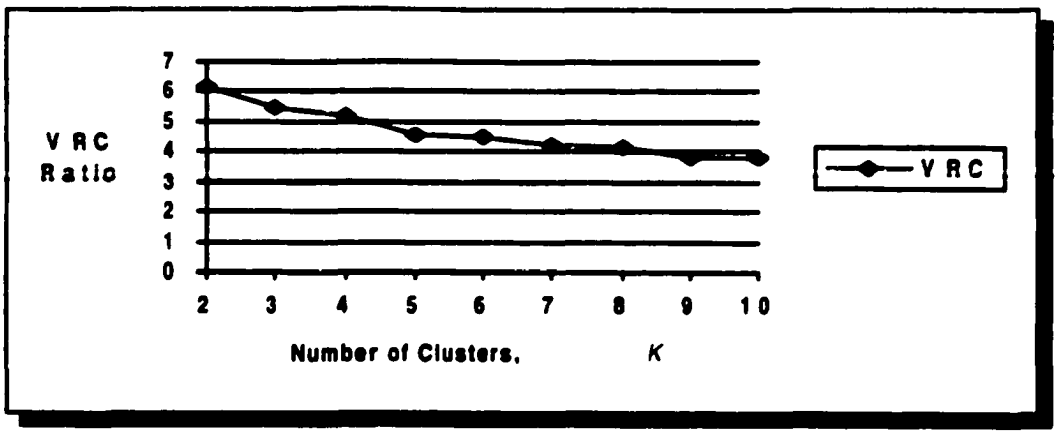


Figure 20. VRC Ratio and *k* : Phase I

In phase II, for each of these clusters C_1 and C_2 , this procedure is repeated. Cluster C_1, with 26 cases, gives a best solution with 4-cluster, while cluster C_2, with 26 cases, gives a 3-cluster solution. Tables 18 and 19 summarize the results of VRC tests on cluster C_1 and cluster C_2 respectively. Figures 21 and 22 depict the results graphically.

Table 18. Summary Results (phase II) for Cluster C_1 and k = 2 to 10

Number of clusters, *k*	2	3	4	5	6	7	8	9	10
BGSS	82	164	238	251	273	289	309	324	342
WGSS	408	326	252	239	217	201	181	166	148
VRC	4.82	5.78	**6.93**	5.51	5.03	4.55	4.39	4.14	4.10

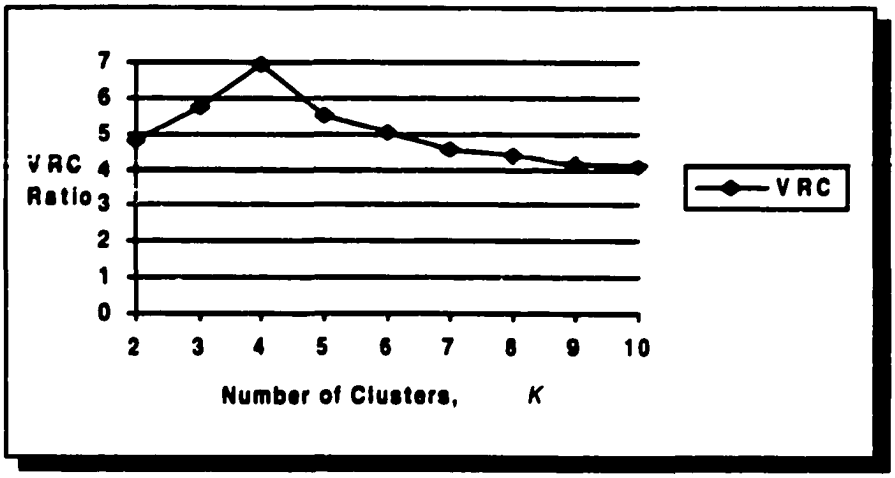


Figure 21. VRC Ratio and k for Cluster C_1: Phase II

Table 19. Summary Results for Cluster C_2 and k = 2 to 10

Number of clusters, k	2	3	4	5	6	7	8	9	10
BGSS	88	174	188	198	223	239	242	234	225
WGSS	412	326	312	302	277	261	268	246	275
VRC	5.13	**6.13**	4.41	3.44	3.22	2.90	2.32	2.02	1.45

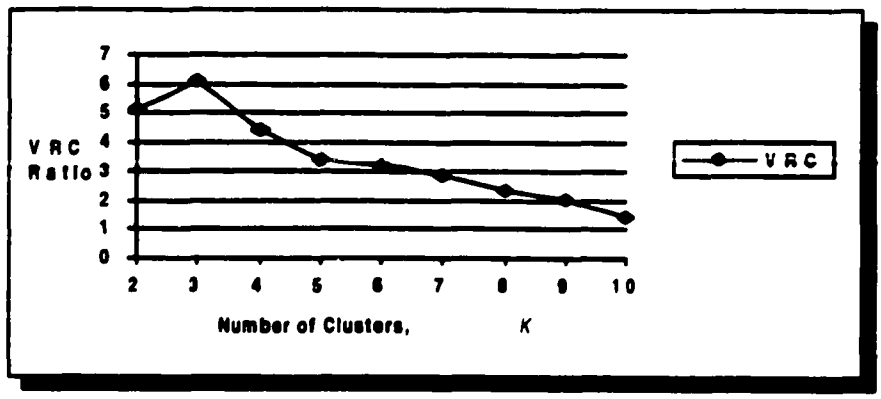


Figure 22. VRC Ratio and *k* for Cluster C_2: Phase II

Thus the above set of analyses reveals that there are 7 dominant interorganizational interdependency patterns in the U.S. apparel retailer sample. The findings provides the highest precision and truly underscores the practice and behavior in the apparel retailer industry.

6.7.2. Interorganizational Interdependency Configurations in Apparel Manufacturers

The total sum of all pairwise squared distances between the 52 data points in the apparel manufacturers sample is TSS = 494. There are 52 x (52 - 1) / 2 such distances. A $k = 2$ clusters solution gives 2 interorganizational interdependency clusters C_1 and C_2 with $n_1 = 26$ and $n_2 = 26$. The sum of squared distances between the cases in cluster C_1 is 156, and the sum of squared distances between those in cluster C_2 is 264. Consequently, WGSS is given by:

WGSS = 156 + 264 = 420.

and since, BGSS = TSS - WGSS, we have

BGSS = 494 - 420 = 74.

Hence, VRC is then derived by equation (1)

$$VRC = \frac{74}{(2\text{-}1)} \Big/ \frac{420}{(52\text{-}2)} = \mathbf{8.80} \ldots . \mathbf{(2)}$$

A $k = 3$ cluster solution gives three configurations with the following characteristics:

$n_1 = 18$, $n_2 = 8$, and $n_3 = 26$ with respective within-cluster sum of squared distances

$WGSS_1 = 1/2\ (18\text{-}1)\ d^2_1 = 132$,

$WGSS_2 = 1/2\ (8\text{-}1)\ d^2_2 = 42$, and

$WGSS_3 = 1/2\ (26\text{-}1)\ d^2_3 = 212$

Hence, WGSS = 132 + 42 + 212 = 386 and BGSS = 494 - 386 = 108.

VRC is then derived by equation (1)

$$VRC = \frac{108}{(3\text{-}1)} \Big/ \frac{3\,86}{(52\text{-}3)} = \mathbf{6.85} \ldots . \mathbf{(3)}$$

Comparing (2) and (3) following Calinksi and Harabasz variance ratio rule (i.e., select k for which VRC has a general or local maximum as the "best number" of clusters in the data set), we conclude that $k = 2$ is the best number of clusters at this stage of analyses. Table 20 and Figure 22 below depict the results for the same VRC procedure conducted upto $k = 10$.

Table 20. Results of the VRC Procedure: Phase I

Number of clusters, *k*	2	3	4	5	6	7	8	9	10
BGSS	74	108	178	193	225	241	259	276	282
WGSS	420	386	316	301	269	253	235	218	212
VRC	8.80	6.85	4.13	3.36	3.35	3.01	2.83	2.69	2.36

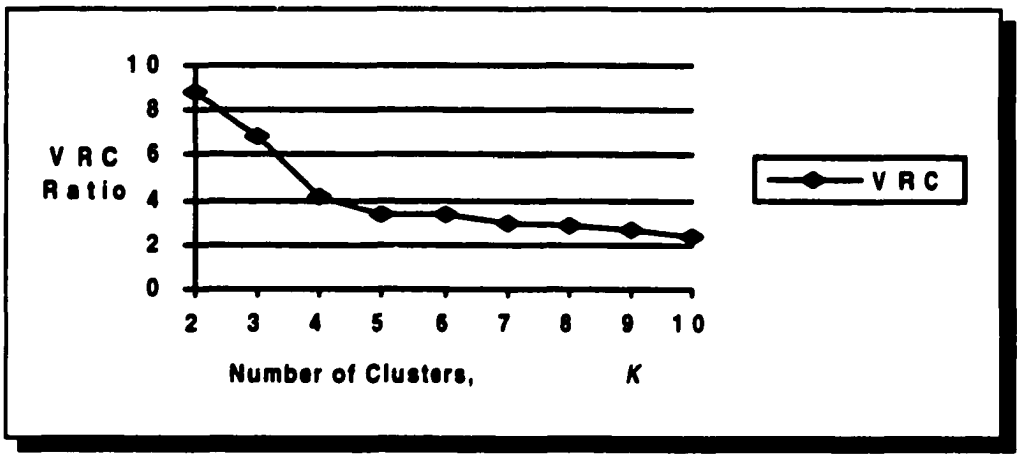


Figure 23. VRC Ratio and *k* : Phase I

In phase II, for each of these clusters C_1 and C_2 , this procedure is repeated. Cluster C_1, with 26 cases, gives a best solution with 2-cluster, while cluster C_2, with 26 cases, gives a 2-cluster solution. Tables 21 and 22 summarize the results of VRC tests on cluster C_1 and cluster C_2 respectively. Figures 24 and 25 depict the results graphically.

Table 21. Summary Results (phase II) for Cluster C_1 and k = 2 to 10

Number of clusters, k	2	3	4	5	6	7	8	9	10
BGSS	84	138	178	210	240	259	280	300	320
WGSS	410	356	316	284	254	235	214	194	174
VRC	4.92	4.46	4.13	3.88	3.78	3.49	3.36	3.28	3.26

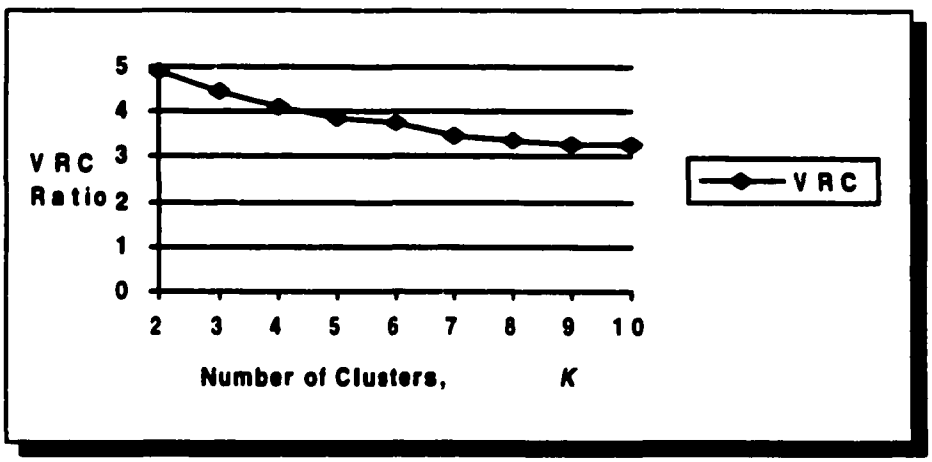


Figure 24. VRC Ratio and k for Cluster C_1: Phase II

Table 22. Summary Results (phase II) for Cluster C_2 and k = 2 to 10

Number of clusters, k	2	3	4	5	6	7	8	9	10
BGSS	82	134	178	209	233	254	272	294	322
WGSS	412	360	316	285	261	240	222	200	272
VRC	4.77	4.28	4.13	3.85	3.57	3.35	3.15	3.12	2.10

Thus the above set of analyses reveals that there are 4 dominant interorganizational interdependency patterns in the U.S. apparel manufacturer sample. The findings provides the highest precision and truly underscores the practice and behavior in the apparel manufacturer industry.

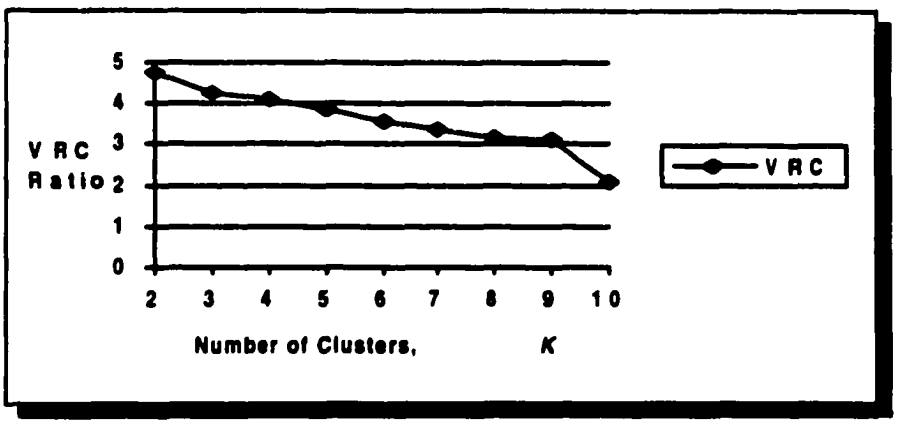


Figure 25. VRC Ratio and k for Cluster C_2: Phase II

6.7.3. Interorganizational Interdependency Configurations in the Pooled Sample (Apparel Retailers and Manufacturers)

The total sum of all pairwise squared distances between the 52 data points in the pooled sample is TSS = 498. There are 52 x (52 - 1) / 2 such distances. A $k = 2$ clusters solution gives 2 interorganizational interdependency clusters C_1 and C_2 with $n_1 = 26$ and $n_2 = 26$. The sum of squared distances between the cases in cluster C_1 is 156, and the sum of squared distances between those in cluster C_2 is 264. Consequently, WGSS is given by:

$$WGSS = 156 + 264 = 420.$$

and since, BGSS = TSS - WGSS, we have

$$BGSS = 498 - 420 = 78.$$

Hence, VRC is then derived by equation (1)

$$VRC = \frac{78}{(2-1)} \Big/ \frac{420}{(52-2)} = \mathbf{9.28} \text{ .... (2)}$$

A $k = 3$ cluster solution gives three configurations with the following characteristics:

$n_1 = 18$, $n_2 = 8$, and $n_3 = 26$ with respective within-cluster sum of squared distances

$$WGSS_1 = 1/2\,(18-1)\,d^2_1 = 132,$$

$$WGSS_2 = 1/2\,(8-1)\,d^2_2 = 42, \text{ and}$$

$$WGSS_3 = 1/2\,(26-1)\,d^2_3 = 212$$

Hence, WGSS = 132 + 42 + 212 = 386 and BGSS = 498 - 386 = 112.

VRC is then derived by equation (1)

$$VRC = \frac{112}{(3-1)} \Big/ \frac{386}{(52-3)} = \mathbf{7.10} \text{ .... (3)}$$

Comparing (2) and (3) following Calinksi and Harabasz variance ratio rule (i.e., select k for which VRC has a general or local maximum as the "best number" of clusters in the data set), we conclude that $k = 2$ is the best number of clusters at this stage of analyses. Table 23 and Figure 26 below depict the results for the same VRC procedure conducted upto $k = 10$.

Table 23. Results of the VRC Procedure: Phase I

Number of clusters, k	2	3	4	5	6	7	8	9	10
BGSS	78	112	138	163	185	204	219	236	242
WGSS	420	386	360	335	313	294	279	263	252
VRC	9.28	7.10	6.13	5.71	5.43	5.08	4.93	4.82	4.48

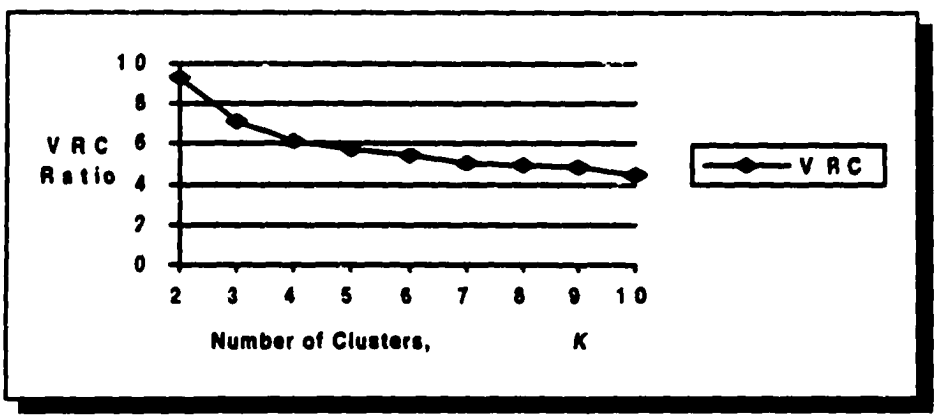


Figure 26. VRC Ratio and k : Phase I

In phase II, for each of these clusters C_1 and C_2 , this procedure is repeated. Cluster C_1, with 26 cases, gives a best solution with 2-cluster, while cluster C_2, with 26 cases, gives a 2-cluster solution. Tables 24 and 25 summarize the results of VRC tests on cluster C_1 and cluster C_2 respectively. Figures 27 and 28 depict the results graphically.

Table 24. Summary Results (phase II) for Cluster C_1 and k = 2 to 10

Number of clusters, k	2	3	4	5	6	7	8	9	10
BGSS	84	138	178	210	240	259	280	300	320
WGSS	414	360	320	288	258	239	218	198	178
VRC	4.86	4.40	4.08	3.82	3.72	3.43	3.30	3.21	3.19

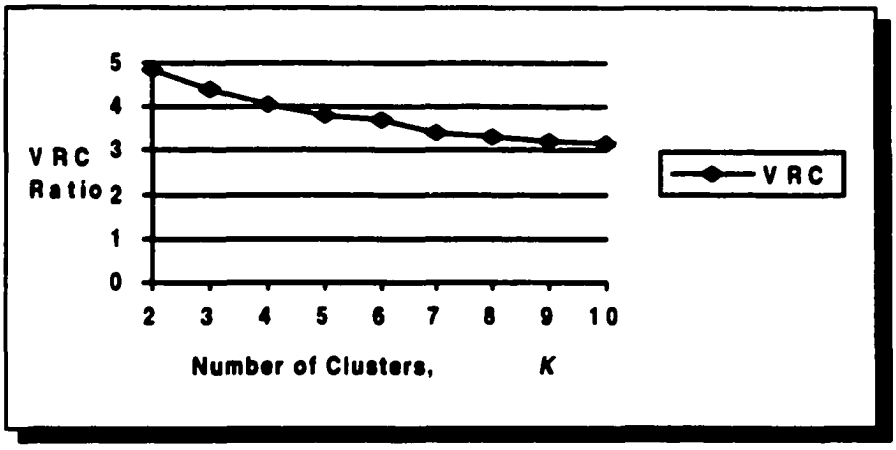


Figure 27. VRC Ratio and k for Cluster C_1: Phase II

Table 25. Summary Results (phase II) for Cluster C_2 and k = 2 to 10

Number of clusters, k	2	3	4	5	6	7	8	9	10
BGSS	82	134	178	209	233	254	272	294	322
WGSS	416	364	320	289	265	244	226	204	276
VRC	4.73	4.23	4.08	3.79	3.51	3.29	3.09	3.06	2.07

Thus the above set of analyses reveals that there are 4 dominant interorganizational interdependency patterns in the pooled (U.S. apparel retailers and manufacturers) sample.

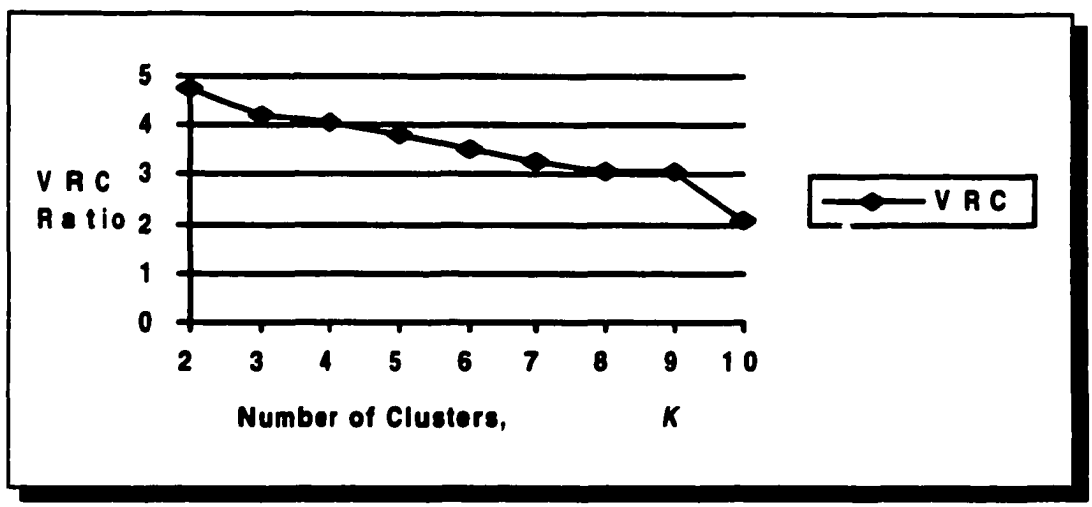


Figure 28. VRC Ratio and k for Cluster C_2: Phase II

6.8. SUMMARY

The results for the first set of analysis reveal 7 interorganizational interdependency configurations in the retailer sample, but only 4 in the manufacturer and the pooled samples. The results demonstrate that for retailers and manufacturers there are only a limited number of dominant patterns of interorganizational interdependency. Further in the case of both the retailers and manufacturers these interdependency patterns exhibit differences in interorganizational coordination and cycle time performance. Thus this finding supports a contingency view of CTR through interorganizational interdependency-coordination fit. However, we need to explore further the total pattern along the six research interorganizational interdependency and coordination constructs and identify the configurations of fit between interorganizational interdependency and coordination that help organizations achieve CTR.

7.0. DISCUSSION

The following section will conclude by discussing the key research findings of this dissertation research by uncovering the dominant configurations of interorganizational interdependency-coordination fit that facilitate cycle time reduction in key business processes. In addition, the limitations of the research will be presented along with specific contributions this study has made to field. Finally, directions for future research will be provided.

7.1. EMPIRICAL RESULTS

The mean values for each of the 25 standardized variables (5 for environmental interdependency, 3 for relationship interdependency, 3 for internal interdependency, 3 each for structural and process mechanisms, 5 for technology mechanisms, and 3 for CTR performance) of the operational research model are used to uncover the configurations, examine the interorganizational coordination and performance variables, and provide greater detail and insight into each configuration. The first important finding is that only eight patterns of fit emerged as valid based on significant F ratio, *p* value, and Scheffe ranges. Of these eight configurations. four configurations are common to both the apparel retailers and manufacturers, two configurations are unique to apparel retailers, and two configurations are unique to apparel manufacturers. Table 26 profiles the 25 variables across the eight configurations of interorganizational interdependency and coordination fit. It can be seen

Table 26. Summary of the Eight Interorganizational Interdependency-Coordination Configurations in the U.S. Apparel Industry

Variables	F(p)	Scheffe Differences **
Technical complexity	22.34 (0.000)	(8; 3,6,1); (4; 2,1,5)
Maturity of technology	10.42 (0.000)	(5; 4,2,7); (8; 3,6,1,5)
Engineering content	12.37 (0.000)	(3; 2,5,1); (5; 1,7,4,8)
Product customization	23.20 (0.000)	(2; 4,1,8); (7; 3,6,5)
Market growth	26.00 (0.000)	(6; 4,2,1); (8; 3,5,7)
Mutual trust	15.23 (0.000)	(5; 2,4,6); (3; 6,1,7,8)
Retailer's asset specificity	13.21 (0.000)	(4; 1,3,6); (2; 5,8,4,1)
Manufacturer's asset specificity	15.62 (0.000)	(3; 5,1,7); (2; 6,8,6)
Task interdependency	22.38 (0.000)	(4; 6,2,1,8); (7; 3,5)
Information analyzability	0.35 (0.7) NS*	NS*
Information variety	3.29 (0.01)	NS*
Multiplicity	12.00 (0.000)	(1; 4,6,2,8); (6; 5,7)
Frequency of visits	14.23 (0.000)	(2; 5,8,1); (5; 3,7,2,4)
Formalization	4.21 (0.000)	(3; 6,2,7); (7; 1,3,8)
Conflict resolution	8.62 (0.000)	(4; 5,1,7,8); (8; 3,2,6)
Commitment	11.05 (0.000)	(2; 3,1,6); (7; 5,8,2)
Joint action	17.65 (0.000)	(2; 1,6,7); (6; 2,4,8,5)
Scope of IOIS use	76.34 (0.000)	(7; 2,5,1); (8; 4,5); (5; 1,4)
Intensity of IOIS use	32.02 (0.000)	(3; 4,6,8); (5; 1,4,7)
IOIS use in sales	31.24 (0.000)	(1; 5,3,7); (4; 2,6,3,1)
IOIS use in purchase	75.64 (0.000)	(3; 2,1,7,4,5); (8; 3,6,1,7)
Extent of IOIS integration	32.22 (0.000)	(4; 1,5,7,3,8); (2; 3,5,8,1)

Table 26 (continued)

Variables	F(p)	Scheffe Differences **
Manufacturer ratings	12.43 (0.000)	(5; 4,1,6,8); (2; 5,3,6)
Satisfaction	10.24 (0.000)	(8; 2,6,1,7); (1; 3,5)
Buffer levels	8.92 (0.000)	(4; 2,6,3); (7; 1,5,8)

***: NS - not significant at 0.05 level**
****: (x; a,b,c) means that the following pairs were significantly different (x,a); (x,b); and (x,c).**

from these summary results of the analysis in Table 26 that all the variables except one variable (i.e., information analyzability) exhibit significant *p*-values and strongly discriminate the configurations as demonstrated by the multiple comparison tests (Scheffe contrasts) significant at $p < 0.05$. In order to reduce the complexity associated with looking at all 25 variables to represent each configuration, each configuration is assigned an aggregate score coded as High, Moderate, or Low based on the individual score and their significance along the six research constructs. High, moderate, and low scores are assigned on the basis of the data from the oneway analysis of variance using the severe test of multiple comparisons with 0.05 Scheffe ranges. The apparel retailer and manufacturer samples are treated separately. A hierarchy of three criteria is used to distinguish across configurations. The first criteria operates along those variables for which not only differences across clusters are significant (F ratio and *p*-value < 0.05), but also multiple comparisons across clusters are significant with 0.05 Scheffe ranges. The second criteria operates along those variables that display only significant differences across configurations (i.e., they fail the Scheffe test). The

third criteria deals with recognizing pattern of differences that will add anecdotal richness to the definition and description of each configuration. The configurations are classified into two domains of lower interdependency (i.e., a low score for at least two of the three interdependency constructs) and higher interdependency (i.e., a low score for at least two of the three interdependency constructs) conditions, uncovering only four completely homogenous configurations (i.e., structural linkage relationship appears in a systematically high environmental, relationship, and internal interdependency context, while interorganizational relationship through virtual, pure, and control linkages develop in a context low on all three sources of interdependency). The other four configurations exhibit a composite and mixed fabric for interorganizational interdependency.

The total number of possible configurations of all the six research constructs along the three levels (i.e., high, moderate, and low) is $3^6 = 729$. In other words, there are 729 theoretically possible configurations of interorganizational interdependency-coordination fit, out of which there are only eight dominant configurations in the total retailer and manufacturer sample. Appendix C shows the labeled eight configurations of interorganizational interdependency -coordination fit that result in greater CTR performance.

Table 27 displays the scores across the 22 variables for all the eight configurations uncovered in the above analysis. From the results, it is apparent that except

Table 27. Cluster Analysis Results For Configurations in the Apparel Industry

Variables	Structural Linkage	Integral Linkage	Virtual Linkage	Pure Linkage	Formal Linkage	Intensive Linkage	Quasi Linkage	Control Linkage	F (*p*)
Technical complexity	-.52	-.43	-.71	-.32	-.45	.34	.38	-.31	22.34 (.000)
Maturity of technology	.23	.31	-.42	-.65	.21	-.34	-.43	-.26	10.42 (.000)
Engineering content	.25	.33	-.35	-.62	.53	.33	-.13	-.32	12.37 (.000)
Product customization	.42	.22	-.23	.12	-.24	-.43	.24	.21	23.20 (.000)
Market growth	-.45	-.32	-.42	-.21	-.42	-.56	.42	-.34	26 (.000)
Mutual trust	-.30	.02	-.53	.33	-.54	-.07	-.53	-.41	15.23 (.000)
Retailer's asset specificity	-.32	-.41	.32	-.32	.33	.21	-.34	.39	13.21 (.000)
Manufacturer's asset specificity	.21	-.21	.22	-.21	.52	.33	.22	.32	15.62 (.000)
Task interdep-endency	-.09	.22	-.03	.05	-.06	-.18	-.31	-.21	22.38 (.000)
Information analyzability	.12	-.31	.21	.23	.05	-.54	.22	-.35	NS* .35 (0.7)
Information variety	-.03	-.24	-.42	-.34	.21	-.23	-.23	-.42	3.29 (.01)
Multiplicity	-.61	.11	-.54	.16	-.21	.11	-.21	.23	12 (.000)
Frequency of visits	.21	-.20	-.31	-.31	-.41	.23	.15	-.34	14.23 (.000)
Formalization	-.31	-.45	-.43	.12	-.07	.23	-.32	-.41	4.21 (.000)
Conflict resolution	.32	-.31	-.05	-.32	-.23	.45	.33	-.65	8.62 (.000)

Table 27(Continued)

Variables	Structural Linkage	Integral Linkage	Virtual Linkage	Pure Linkage	Formal Linkage	Intensive Linkage	Quasi Linkage	Control Linkage	F (*p*)
Commitment	.47	-.31	.23	-.22	.24	-.37	-.42	.45	11.05 (.000)
Joint action	-.11	.42	.43	.12	.41	-.33	.45	.32	17.65 (.000)
Scope of IOIS use	.22	-.32	-.52	.52	-.62	-.45	-.52	-.32	76.34 (.000)
Intensity of IOIS use	-.31	.44	.34	-.35	-.33	.32	.38	.33	32.02 (.000)
IOIS use in sales	-.35	.62	-.16	-.31	-.32	.46	.41	-.31	31.24 (.000)
IOIS use in purchase	-.45	-.23	-.04	.22	.08	-.52	-.42	-.42	75.64 (.000)
Extent of IOIS integration	.32	.33	.28	-.34	.52	-.07	.33	.32	32.22 (.000)

for information analyzability all the variables show significant F(*p*) values in spite of negative values for some of the configurations.

7.1.1. Configurations Common to Apparel Retailers and Manufacturers

Control through structural, integral, virtual, and pure linkages are the four dominant configurations which exist in both the retailers and manufacturers.

Pure Linkage

Control through pure linkage comes about in the extreme contextual setting represented by L-L-L, where the environment, relationship, and the internal interdependency between the two firms give rise to limited degree of interorganizational interdependency. The

mix of interorganizational coordination mechanisms, represented by L-H-L, reflects a focus on control activities combined with a strong commitment to nurturing an initially trusting relationship. Invariably this configuration displays higher CTR performance in both the retailer and manufacturer samples providing strong support for the axiom underlying the proposed conceptual model. Lower interdependency gives rise to low interorganizational coordination requirements easily matched by low structural and technology mechanisms, the coordination effectiveness of which is sustained by way of high collaborative processes (such as meetings, frequent visits, mutual contacts, and trust).

We attempt a more detailed and precise definition of control through pure-linkage in the retailer-manufacturer context by examining the mean score for each of the 22 variables defining the eight configurations. Technical complexity data (which satisfied the first criteria, that is highly significant F = 22.34 and *p*-value = 0.0001 and passed the 0.05 Scheffe ranges test) shows that the apparel items involved are standard products (such as men's briefs) with a very low level of customization. Technically very simple they are typically based on a mature technology and require very low engineering efforts and expertise. In addition, no major innovations (such as functionality improvements, apparel or manufacturing innovations, price/performance improvements) are likely to occur in the next five years in this type of apparel items. Key informants involved in such "control through pure linkage" relationships also indicate that volume requirements for the items involved are typically predictable and testify that the volume forecasts established by their firms are reliable (i.e., product customization variable satisfied the second criteria of highly significant F (= 23.30) and *p*-value (= 0.0001). The boundary agents (i.e., purchase and sales managers) estimate

that the work they do with the manufacturer/retailer in question is well structured. They tend to follow a clearly known way to execute their tasks, as specified in the contract or the job description order. Hence, for these standard apparel items negotiation of the contract, regulation of delivery, inventory, and monitoring of quality are be executed following established and proven practices and procedures. Also, these tasks tend to be highly repetitive, where the same tasks are done in the same way most of the time.

By looking at the results of the relationship interdependency variables, we can also conclude that this common configuration emerges when the apparel retailer perceives little risk and interdependency about the apparel manufacturer supplying the apparel item(s). Neither member of the retailer-manufacturer dyad has made any investments specifically for this relationship (i.e., low retailer and manufacturer asset specificity). The retailer (and the manufacturer) could easily switch to an alternative source of supply (i.e., a different apparel manufacturer) if necessary. However, they describe their relationship as a highly trusting one (i.e., high mutual trust) and strongly expect the business relationship with this supplier (i.e., apparel manufacturer) to last a long time (i.e., high continuity). Thus in this contextual setting where the apparel items are standard, well understood and controlled on both sides and are unlikely to undergo major, unexpected technical transformations, and where boundary spanning tasks are highly structured and repetitive, the interorganizational coordination capacity of the structural and technology mechanisms in place is consistently low (i.e., low mutual visits). The use of information technology is non-existent. The scope of IOIS use reveals no use across multiple functional areas (such as purchasing, engineering, and quality control).

The distinctive characteristic of control through pure-linkage stems from the significantly high investments made by the apparel retailer in what the conceptual model designates as process mechanisms. There is minimal disagreement between the two firms about the apparel item price and design, quality, inventory levels, and delivery schedules (i.e., low conflict). The apparel retailer reports a strong commitment to the interorganizational relationship with the manufacturer where they equally share the burden, risks, and benefits of the relationship. This configuration is characterized by the synergy created by low relationship interdependency and investment in process coordination mechanisms which gives rise to a "pure linkage" setting and hence, is labeled "pure-linkage".

CTR performance measures for the retailer-manufacturer relationships that make up this configuration strongly testify to the virtues of a control relationship embedded within a close and nurtured partnership. The relationship is perceived as productive, worthwhile and the boundary agents are satisfied with the level and quality of the information exchange, given their needs (i.e., high customer satisfaction). The apparel retailer's internal supplier rating also manifest appropriate delivery, quality, or price levels (i.e., high performance composite). Buffer levels, measured as inventory levels at the retailer and manufacturer sites, delivery frequency, and quality levels are also maintained at an extremely low level.

Structural Linkage

At the opposite end of the interdependency spectrum, we uncovered a configuration for interorganizational relationships operating under high interorganizational interdependency conditions. In this setting, on one hand it is difficult to understand and

predict the behavior of competitors, the future trends in technology, products and process innovations, and to establish a clear set of goals, procedures, and assessment measures around which boundary agents can organize their tasks and activities; on the other hand, the partners available in the marketplace typically present a high risk, primarily because the focal firm (i.e., the retailer) depends on their products and at the same time little mutual trust has been built in the dyad. Despite the poor quality of the climate of the relationship, the focal firm overlooks or decides not to invest in better processes, such as engaging in more joint planning, involving the manufacturer in order scheduling and apparel customization, offering training and education to its personnel and developing conflict resolution processes based on problem-solving rather than confrontation.

The core of the interorganizational coordination needs that has to be established within the dyad are extremely high and is primarily implemented in the form of structural mechanisms, and limited use of information technology capabilities. Structural relationships tend to be low performing ones, as structural coordination capabilities alone are insufficient to cope with the overwhelming set of sources of interdependency between two firms in the supply chain dyad. In an environment where product (i.e., apparel item) and market interdependencies turn high, a focal firm (i.e., apparel retailer) needs to choose a partner (i.e., apparel manufacturer) which presents lower risks or invest in developing and maintaining through cooperative processes a close partnership with a select group of partners.

The U.S. apparel retailer and manufacturer data samples show that the apparel items transacted through structural relationships are generally specialized apparel items such as fashion-sensitive, high-priced design wear which demands a high level of customization

from manufacturers. They tend to be complex products to manufacture, for which the technology is currently well known, but industry expectations are toward major innovations in functionality, manufacturing process, and design enhancements within the next five years. In other words, the nature of the apparel items gives rise to long term interdependency with the manufacturers about the core competencies required to remain a strong competitor in the particular market segment represented by the apparel items. Also, because of the fashion-sensitive element in the apparel items, product unpredictable data suggest that even short-term design changes are difficult to predict.

Reflecting the above factors, boundary spanners rated their tasks as highly ill-structured, with no objective procedure to follow when problems arise. Moreover, the high frequency of unexpected or novel events (i.e., low information variety) makes it difficult for purchasing managers to plan in advance and analyze their task in terms of ex-ante established courses of action, costs, benefits, and desired outcomes. This turbulent environment also gives little opportunity for that apparel manufacturer to choose a low risk and interdependent retailer as partner. From an economic perspective, the two firms are tied to each other (i.e., high mutual interdependency); the apparel manufacturer's business is economically important to the retailer, and vice versa. In addition, if the retailer or the manufacturer decided to terminate the current contract it would be extremely difficult and costly to switch to another business partner for the particular apparel item(s). The apparel manufacturer made investments in manufacturing these items which were dedicated to this relationship with this apparel retailer and the retailer has made commitments to its customers based on this

arrangement with the apparel manufacturer. Also, considerable time and effort has been invested on both the sides to maintain communication between them.

Structural linkage relationships typically have a short history, and there is a strong likelihood that it will be re-negotiated or terminated at the end of the current contract (i.e., low continuity). Thus doing business with a partner with whom a firm is highly dependent becomes even more risky and uncertain given the climate of the relationship is poor. These structural linkage coordination mechanisms are in moderate use in the case of apparel retailers while they are extensively used by apparel manufacturers. The extensive use of rich media such as group or team meetings testifies to the extent and importance of information exchange between the two firms in the dyad. However, boundary agents allocate much of their time to coordination activity dealing with very urgent operational problems (such as delivery schedule aspects and customization details). There is virtually no use of any type of IOIS to exchange information between the two firms (i.e., extremely low scope of IOIS use and intensity of IOIS use). Finally, the processes within which the transactions are accomplished are very unlikely to foster the exchange of information between the retailer and the manufacturer. The key informants at the manufacturer reported extreme levels of disagreement with the retailer about apparel item price, its design specifications, the quality levels of the shipments, as well as the level of stock to be carried by the manufacturer (i.e., high conflict). These disagreements are usually resolved in an adversarial climate through confrontation, which consequently has a negative effect on the interorganizational relationship. There also is little joint effort and cooperation between the two firms.

The proposed model of fit predicts that structural-linkage relationships are plagued with low CTR performance. The apparel retailer's ratings of the manufacturer mirror complaints about the manufacturer development time, its delivery and quality performance, while the key informants subjective assessment of the relationship shows dissatisfaction with the exchange of information and the overall virtue of this relationship. The results about the level of slack or buffers granted to the manufacturer also indicate low productivity. Excessive stock has to be maintained, delivery increments are too far apart and the average level of apparel items that the retailer has to scrap or return to the manufacturer is below standard expectations.

Virtual Linkage

Both the apparel retailers and manufacturers also have in common another low performing configuration of fit between interorganizational interdependency and coordination, where minimal coordination capacity (low levels of structure, process, and technological coordination mechanisms), does not constitute an appropriate match for a relationship plagued by relationship interdependency, despite the fact that the focal firm (i.e., the retailer) can find other partners (i.e., apparel manufacturers) to do business with, and that the nature of interface coordination between the firms allows for "virtual linkage" of transactions by means of a "complete" contract, standard practices and procedures.

Apparel items are typically simple standard products (such as dress material) which require little engineering efforts and expertise, which makes it possible for a large number of "clothing stores" to compete in this market (i.e., low product complexity). These stores

are small independent firms and generally enjoy a short lived relationship with the apparel manufacturer, which implies a high turnover among similar manufacturers. Examination of additional variables about the characteristics of the manufacturer, also point to a extremely narrow portfolio of apparel items submitted to the manufacturer, and a low content of manufacturer proprietary technology in the design and manufacture of these apparel items. Negotiation of the contract, the price for the apparel item, as well as the coordination of ordering, scheduling, and delivery processes can be done through the terms of the standard contract governing the relationship, and a set of rules and procedures used for a wide range of such products (i.e., high information analyzability and low information variety). Other task characteristics such as task interdependency, also mirror an extremely low level of internal interdependency.

We found two distinct, separate mechanism that seem to contribute to the apparel retailer's concern about the manufacturer it is currently doing business with. The first type of virtual-linkage relationship operates in a negative climate with a strong distrust of one another, under the assumption by the retailers that the relationship will be terminated at the end of the current contract and is found in both the retailer and manufacturer data sets. In this scenario, in spite of its size and power, the retailer can potentially be held "hostage" by the manufacturer for at least the duration of the current contract and confronts serious short-term dependency upon this manufacturer/supplier. The second type of virtual-linkage relationship (found only in the apparel retailer sample) offers a brighter picture of the manufacturer and the dynamics of its relationship with the customer, though relationship interdependency is still significant. These relationships perpetuate a long tradition of doing business together

(i.e., a high history score) and still operate under mutually shared belief that the relationship is a long-term partnership (i.e., high continuity). Nevertheless, inasmuchas the two firms have along the years invested a lot of time and effort learning about each others products, manufacturing and management processes, a long history represents for the retailer a set of investments highly specific to this relationship with the manufacturer, though the manufacturer and its apparel items can be easily replaced at low costs and adverse consequences to its production process.

The unique and distinctive properties of the "virtual-linkage" configuration not only include its unusual L-M-L interorganizational interdependency patterns, but also includes a L-L-L combination of interorganizational coordination mechanisms, individually and collectively accounting for the poor coordination capacity in the retailer-manufacturer dyad. The purchasing managers who responded to the questionnaires reported spending little time coordination tasks such as coordinating with this manufacturer for continuous improvements, exchanging ideas and future plans, or keeping in touch with this manufacturer. Control tasks such as negotiating contracts, monitoring manufacturer performance, or resolving very urgent operational problems with the manufacturer constitute the core of their job. The media most often used for information exchange is highly formal and impersonal, while richer media such as face-to-face encounter (i.e., group or team meetings or visits) to each other's offices are seldom used. Much of the interorganizational coordination is accomplished along the terms of the contract, with the support of standard procedures such as requests for quote, purchase order, and delivery notices. The processes within which the interorganizational relationship is embedded also contribute very little to a coordination strategy focused solely

on controlling operational transactions from a distance without direct, physical involvement of the retailer. Conflict is extremely high, and according to the respondents from retailer side disagreements are usually resolved in an highly adversarial and confrontational way. The retailer also displays no desire to share burdens and benefits with the less powerful manufacturer (i.e., low commitment), or help the manufacturer improve through joint efforts and training/education (i.e., low joint action). This lack of investment by the retailer into constructive and cooperative processes indicates its lack of interest in transforming the relationships (i.e., both the market-like relationship as well as the mediated relationship) into a sustained partnership. Process coordination mechanisms reflect no desire on the part of the retailer to try to match and eventually decrease the initial high level of relationship interdependency between the members of the dyad.

Taking into account the above descriptions, one could argue that virtual linkage relationship represents a "vicious cycle" where conflict, lack of cooperation and commitment to the relationship feeds into distrust and a view of the relationship as a bundle of short-term standard transactions. Apparel retailers and manufacturers which resort to this configuration may enjoy low interorganizational coordination investments and costs, but clearly collect little benefits from it. Indeed, both the types of virtual-linkage relationships display poor CTR performance. The constrains and costs of larger buffers, such as poor quality of the manufacturer's output, or lack of just in time delivery to the retailer's store, all move upstream and become a major burden the retailer has to bear. The explicit consideration of all the multiple sources of interorganizational interdependency faced by a relationship, especially relationship interdependency, provide an explanation for the poor CTR

performance of these relationships. Indeed, the interorganizational coordination capacity of a L-L-L combination of structure, process, and technology mechanisms, does not suffice to make up for the poor climate of the relationship. Thus, this finding provides strong support for the proposed model and its underlying argument for a fit conception of the relationship between interorganizational interdependency and coordination, and the integration of multiple theoretical perspectives.

Integral Linkage

Integral linkage emerges as an alternative configuration in the high interorganizational interdependency domain, and exhibits a heterogenous H-L-H composite of sources of interdependency, contrasting with the homogenous H-H-H interdependency context for structural linkage. Integral linkage is the configuration of fit reserved for high-risk and interdependency apparel items or market segments, and for those partners (i.e., apparel manufacturers) whose future behavior presents low risk. The data collected in the U.S. apparel industry indicates that under these contingencies retailers select to internalize or take a majority control over the activity. The associated level of interorganizational coordination capacity is extremely high along three mechanisms of structure, process, and information technology. The apparel items involved in these type of relationships are typically the ones close to the fast moving, flagship products of the retailer. Their level of complexity transpires from the design process, through the development and manufacturing process at the manufacturer's design plant to the harmonization of production and delivery schedules. These integrated subsystems require high levels of technology and engineering

capabilities apparel manufacturers usually keep close to themselves (high content of proprietary manufacturing technology) and frequently undergo major innovations.

The rapid change in the technology and product design of these apparel items renders the task of purchasing managers and sales managers alike difficult to structure and program delivery schedules. Demand forecasting and pre-planning for these complex apparel items is not only a high interdependency task, but the results and recommendations can quickly become obsolete and irrelevant (i.e., very high information variety) because of the time-sensitive nature of the products. The boundary agents function in a world of high ambiguity, confusion and lack of understanding of what constitutes the best direction for the future (i.e., very low information analyzability). The two dyad members are highly interdependent on each other; the extent of the apparel retailer's specific investments and assets tied to this relationship illustrates the potential risk and damage to the retailer if the manufacturer becomes opportunistic and suddenly exits the relationship or moves to a competitor or simply starts leveraging such threats. The level of apparel retailer ownership of these suppliers indicate that apparel manufacturers governed through integral linkage are internal or allied divisions completely owned by the retailers. Additional measures of manufacturer size, the number of distinct products supplied by the manufacturer, and the ration of internal sourcing support this conclusion. These relationships are the product of a long history of doing business together, a rich climate of mutual trust, and long-term partnership (i.e., high continuity).

A distinctive feature of integral linkages such as these exhibited by firms is that their interorganizational strategy consists of the concurrent and extensive use of structure, process, and technology. Additionally, this configuration is unique because it reflects no implicit trade-off among the three generic sources of interorganizational coordination. The extensive reliance of impersonal media such as written mail suggest an exchange of large amounts of data and information, while the amount of time key informants reported spending in visits, group, and teams meetings reflect the use of rich media to deal with ambiguity and lack of mutua understanding. Similarly, the task allocation among boundary agents reflects a prevalent coordination focus.

The use of interorganizational information systems across the two firm boundaries represents some of the best practice in the use of technology mechanisms to efficiently and effectively coordinate tasks between members of the dyad. IOIS such as EDI is practiced across multiple functional areas including purchase, engineering, quality, payment, delivery, and order processing through electronic fund transfer (i.e., high scope of IOIS use). In addition, purchasing managers at the retailer's end reported a frequent and consistent use of EDI (i.e., high intensity of IOIS use). While purchasing managers at retailers emphasize the electronic exchange of purchase order related documents (i.e., purchase orders, acknowledgments, order changes, and change acknowledgments) apparel manufacturers concentrate their use around negotiation related documents and quotation documentation (i.e., request for quotes, response for requests for quote, etc.). The high level of process integration implies that there is little or no need to manually reenter the data into the

manufacturers' internal information systems, and in some instances data is automatically and directly used by the manufacturer's systems.

In addition to use of technological mechanisms and systems to enhance interorganizational coordination between the members of the dyad, process coordination is typically high. However, there are areas of disagreement between retailer and manufacturer. For instance, apparel item pricing, cost structure, apparel design, quality levels targeted, as well as inventory levels and delivery policies all constitute causes for frequent disagreements and tensions (i.e., high conflict). But owing to the high process coordination mechanisms in place, these disagreements are resolved invariably in a highly collaborative, and constructive way, based upon problem-solving and negotiation rather than on confrontation. The apparel retailer also involves the manufacturer in the early stages of apparel customization and forecasting and engages in joint action and cooperation in long range planning, advanced research, and training/education. Thus these processes and actions induce greater information exchange between the individuals involved in a structure-based (i.e., during a visit, or meetings) or IT-mediated (i.e., use of IOIS such as EDI) coordination effort.

CTR performance measures testify to the high performance of integral linkage configuration existing in retailers and manufacturers. Key informants indicate that they are highly satisfied with the relationship itself and the level of information exchange with the manufacturer. The manufacturer ratings conducted by the retailer also show short development times (i.e., reduced cycle times), strong technology and engineering capabilities, and high quality of equipment. Delivery of apparel items is typically done on a just-in-time basis, with minimal inventory levels at the retailer site. The average proportion

of apparel items scrapped or returned to the manufacturer is extremely low, attesting to high quality standards.

7.1.2. Configurations Unique to Apparel Retailers

Two configurations appeared only in the apparel retailer sample. Intensive linkage presents not only an unique interorganizational interdependency pattern, but also an unique interorganizational coordination strategy, while formal linkage can be seen as an alternative coordination strategy dealing with the same H-L-H interdependency contingency as the common integral linkage discussed above.

Intensive Linkage

The distinctive characteristics of this configuration is the seemingly rich interorganizational coordination mix, somewhat of an over-design, given the low interorganizational interdependency contingency. Firms engaged in intensive linkage type of relationships appear to not only implement rich structural mechanisms and highly sophisticated IT applications, but also make important investments into nurturing the relationship with the particular manufacturer, inspite of a low level of relationship and internal interdependency, and a moderate environmental interdependency.

The level of technical complexity and product customization, involved in these apparel items transacted through intensive linkage is typically moderate. The degree of product (i.e., apparel item) complexity, innovation, and unpredictability in these apparel items allows for some structure and routinization for boundary tasks. Information analyzability displays a significantly high score, suggesting that despite the relative

complexity and customization of these apparel items, the operational coordination relationship between the members in the dyad can be analyzed and broken down into manageable, clearly understood, and well-structured steps and procedures. In other words, it is possible to analyze and define the set of intrinsic cause-effect relationships underlying boundary spanning tasks which will allow purchase and sales managers on either side to delineate and control the boundaries for related activities such as ordering, scheduling, and delivery, introducing standardization and routiness in their jobs (i.e., low task variety).

A high level of mutual interdependency between the retailer and the manufacturer determines the selection of the manufacturer in the retailer's sourcing decisions. Given the high level of asset specificity both for the retailer and manufacturer, neither of them can switch to another business partner. This perception of sharing a mutual fate, however, is also associated with a highly positive climate contributing to lesser anxiety about any possible shirking of contractual obligations or other opportunistic behavior by the apparel manufacturer. In this kind of relationship ambience, trust and readiness to share sensitive information is strong. Respondents also agreed that the relationship is more likely to last a long time (i.e., high continuity).

It follows from the above discussions that the logic underlying the conceptual research model would however predict and prescribe a mix of coordination mechanisms with collective lower interorganizational coordination capabilities. In reality, the apparel retailer data reflects important investments in all three generic mechanisms for interorganizational coordination. Purchasing managers and sales managers reported a high frequency of visits from both the manufacturer and retailer personnel. Multiplicity of channels in the

relationship reveals that purchasing managers work together with multiple functions from the manufacturer such as sales, apparel designers, and manufacturing or quality personnel. Information exchange through interpersonal media (i.e., low use of snail mail) is significantly lower in this configuration than in others. Boundary agents' time allocation does not reflect a control focus, in spite of the low interorganizational interdependency context.

The use of IT in these relationships represent an unique pattern. Information technology is not widely applied in a range of functional areas, as in the case of integral linkage, but rather concentrated in and focused on certain key functions such as purchasing (for the retailer) and production control (for the manufacturer). However, the intensity of use of IOIS in these targeted functional areas is high (i.e., intensity of IOIS use). For instance, a large number of the purchase related documents such as requests for quote, purchase orders, and shipment schedules are sent over EDI linkages. This combination of rich structural mechanisms and highly focused use of IT operates within a set of collaborative and supportive processes.

Conflict is measured by the extent of disagreements between the two firms in areas such as apparel item pricing, apparel design, quality levels, and delivery schedules and is extremely low. However, when disagreements do arise they are resolved in a highly collaborative and problem-solving atmosphere. The apparel retailer is also willing to commit itself to the relationship and share the risks, burdens, and benefits of the relationships with the manufacturer. This configuration also displays the highest level of joint action. Mutual cooperation between the two firms in the dyad extends beyond joint delivery scheduling of apparel items and includes long range planning, training/education, and technical assistance.

In terms of CTR performance, these arguably over-designed intensive linkage relationships between the members of the dyad exhibit the highest level of CTR performance across the configurations making up the sample of apparel retailers in the U.S. Retailers' manufacturer ratings assess very highly the relationship in terms of the time required to manufacture the apparel item, the timeliness of delivery of ordered apparel items to the retailer's store, and the quality of the items supplied. The respondents to the questionnaire also express the highest satisfaction with these relationships.

Formal Linkage

This configuration presents a H-L-H set of interorganizational interdependency conditions similar to the one characterizing integral linkage, but a distinct interorganizational coordination strategy. There is no significantly high investment in either condition mechanisms, when compared to the other configurations. In these type of relationships, investments are primarily made in structural mechanisms and processes to cultivate the good climate of the relationship. Information technology is not considered as an alternative coordination mechanism.

Formal linkage relationships involve highly complex apparel items with a high level of customization. The technology required to manufacture these apparel items is new, requires great engineering efforts and expertise and quickly changing (i.e., high product innovation). Short-term unpredictability in terms of specification changes and volume demand estimates and interdependency are rated high. Agents involved in the management

and coordination of such apparel items perceived their tasks as highly ambiguous and unstructured.

Though both intensive linkage and formal linkage exhibit low relationship interdependency, the factors underlying this result are slightly different. In this set of relationships, what contributes to lower interdependency about the manufacturer is the combination of low mutual interdependency (contrasting with a high level of interdependency for integral linkage), low manufacturer's investment in the relationship (contrasting with a high level of interdependency for integral linkage), and an extremely high level of trust. In addition, this configuration exhibits a shorter history when compared to integral linkage.

Low frequency of visits, and a moderate use of rich media such as face-to-face meetings attribute for a moderate structural coordination mechanism between the firms. A highly formal and impersonal media, such as written mail, is used extensively for information exchange with the manufacturer. Moreover, the time allocated to coordinative tasks with manufacturers such as continuous improvement, exchange of ideas and future plans is extremely high. The use of information technology is low (i.e., low scope and intensity of IOIS).

The processes surrounding the relationship reflect a supportive context, though a moderate conflict level results in some tension between the members of the dyad which is resolved in a semi-collaborative manner. The retailer is committed in its relationship with the manufacturer, willing to share the risks, burdens, and benefits involved. These processes

contribute to nurturing the relationship with a business partner about which the level of interdependency is typically low to start with.

CTR performance level in this formal linkage relationships is positive, but is not high because the structural and process mechanisms do not exhibit the highest scores across configurations across apparel retailers. Retailer's ratings of the manufacturer were favorable on dimensions of development time, item pricing, quality, and delivery performance. Similarly, the respondents considered the relationship constructive, worthwhile and expressed satisfaction with the quantity and quality of information exchange with them and the manufacturer. Retailers also expressed satisfaction with objective measures of the buffers levels in terms of inventory levels at both the retailer and manufacturer sites, defect levels of the delivered products, and frequency of shipments to the retailer store.

7.1.3. Configurations Unique to Apparel Manufacturers

Similar to the number of configurations in the retailer sample, we also found two unique configurations, control linkage and quasi linkage, in the apparel manufacturer sample in the U.S. These configurations present an unique interorganizational interdependency pattern in the low interdependency domain, and an alternative interorganizational coordination response to the H-L-H interdependency pattern of integral linkage.

Control Linkage

This configuration stands out primarily by its high investment in information technology applications across the two firms boundaries in the context of a close and strong relationship.

The apparel items involved are very standard and low technology products (i.e., low technical complexity) and are unlikely to experience any major technical innovations in the next five years. In order to manage the interface with the manufacturer, boundary roles typically rely on a set of rules and standard procedures around which they structure their daily activities (i.e., high information analyzability). However, new and unexpected problems in apparel design and production control functions disrupt the inherent built-in routine in the information flow across the boundaries (i.e., low information variety).

The relationship with the apparel manufacturer does not give rise to high relationship interdependency. Mutual trust between the retailer and the manufacturer is high and the respondents strongly believe that their relationship will last a long time and is unlikely to be terminated at the end of the current order. The apparel retailer was not required to order customized apparel items from the manufacturer in these relationships. Though the retailer has not made substantial investments into developing and nurturing a close relationship with the manufacturer, it is aware of the high level of specificity of the manufacturer skills and assets to this relationship in the form of facilities, manufacturing skills, and capabilities. This awareness results in a strong perception of mutual interdependency on each others business and the belief that it would be difficult for either firm to look for another partner.

In this relationship, the use of structural mechanisms for interorganizational coordination emphasizes control activities. Respondents typically reported spending a large portion of their time monitoring the manufacturer's performance or resolving issues. Thus, high frequency of visits and the use of rich face-to-face or group meetings do not themselves create coordination capacity as they are tools for controlling the behavior of the manufacturer

in the relationship. In contrast, integral relationships displayed similarly high frequency of visits and group meetings that contributed to high coordinative tasks such as exchange of ideas and future plans with the manufacturer, coordination with the manufacturer for continuous improvements or keeping in touch.

The use of information technology is important not only in its wide scope of use across multiple functions, but also in the intensity of its use by the various key informants. For instance, functions such as purchase and engineering exhibit greater frequency of use (i.e., intensity of IOIS use) of IT for exchanging data electronically with the other member of the dyad. The context surrounding IT mediated control is characterized by a highly supportive set of processes and actions. In these relationships, conflict or disagreements about fundamental terms and conditions of the transaction with the manufacturer remains extremely low. Whenever such tension emerges in the relationship, it is dealt with in a collaborative and constructive problem-solving mode. The extent of joint action is important with cooperation in the long-range planning phases, apparel design as well as operational phases of the life cycle of the interorganizational relationship. The apparel retailer also provides training and education to support the relationship. These processes are also consistent with the reported strong commitment by the retailer to the relationship, in the form of sharing burden, benefits and risks with the manufacturer.

CTR performance measures reflect a design of the relationship which is strong in its interorganizational coordination capacity given the low level of interorganizational interdependency. Apparel retailer's manufacturer's rating points to control linkage relationship as the most performing relationship of the configurations in the apparel

manufacturer sample. The key informants were satisfied with the relationship and the nature of information exchange with the manufacturer is also rated the highest for this configuration. This suggests that under low interorganizational interdependency an extensive use of information technology combined with supportive processes can be very efficient.

Quasi-Linkage

This configuration offers an alterative interorganizational coordination strategy associated with the H-L-H interdependency context already covered in the integral linkage relationship. A major difference between the two configurations of fit stem from the extent to which they leverage information technology capabilities in the relationship. In quasi-linkage, the level of IT use is non-existent (i.e., low intensity and scope of IOIS use), while in integral linkage IT is used in a wide range of functions to coordinate across interorganizational boundaries. Another key distinction resides in the level of vertical integration, where integral linkage represents an IT-mediated hierarchy. Quasi linkage, on the other hand, reflects a strong and active partnership in a high interorganizational interdependency context.

The apparel items involved in this kind of configuration are critical to the apparel retailer and are typically high in technical complexity (i.e., the items are complex to design and manufacture, requiring great engineering efforts and expertise, and based on new technologies). Moreover, the underlying apparel item(s) and manufacturing technologies are not stable, but likely to undergo major innovations in the near future. For instance, a better apparel design may emerge improving the apparel item's functionality, price/performance

ratio, and market demand. The nature of these apparel items are such that it is extremely unpredictable and hence, little pre-planning and forecasting of competition can be done reflecting the high environmental interdependency inherent in the relationship. Even short-term unpredictability further adds to the instability of the relationship environment as design specification changes and volume requirements are difficult to predict.

The job of boundary spanning agents responsible for coordinating key transactions such as purchasing and sales is rated as highly ill-structured and non-routine. New problems may arise at multiple stages in the order execution life cycle. However, in spite of the high risk environment, some retailers have developed and nurtured a set of partnership relationship with some manufacturers. The mutual trust they achieve in these relationships constitutes the safeguard against any potential opportunistic behavior from this manufacturer. These relationships exhibit significant mutual trust and perception of continuity. In addition, the manufacturer has typically has highly invested in this relationship with the retailer (i.e., high manufacturer's asset specificity).

The interorganizational coordination practice in quasi linkage reflects a strong structural linkage with a high frequency of reciprocal visits. These frequent visits on either side represent regular efforts to coordinate production, scheduling, and delivery between the manufacturer's production factory and the retailer's store. This is also confirmed by the results for boundary agents time allocation. Coordination, as opposed to control, is the focus of their activities and is reflected in the greater time spent on activities such as coordinating with manufacturer for continuous improvement, exchanging ideas and future plans, keeping in touch, or jointly planning and scheduling delivery shipments with the manufacturer. Group

or team meetings also appear to be the preferred way of exchanging information with the manufacturer.

Regarding the use of IT mechanisms, the scope and intensity of information technology (in the form of IOIS) are both significantly low, indicating no desire to substitute this rich set of structural mechanisms and leverage IT capabilities.

Process mechanisms, on the other hand, represent a key component of the interorganizational coordination strategy for quasi-linkage. However, there are disagreements between the two firms in the dyad as respondents reported a high level of conflict around issues central to the operational efficiency of the multiple transactions involved such as apparel item pricing, design tolerances, inventory policies and delivery quantities and frequencies. But these conflicts are resolved in a highly collaborative manner, which indicates a constructive and intense level of information exchange between the two firms. A distinctive characteristics of quasi-linkage is the high level of commitment reflected by sharing of risks, burdens, and benefits with the manufacturer, but not necessarily a high level of effective cooperation and joint action.

In terms of CTR performance, quasi-linkage appears as a moderately performing configuration as compared to other configurations in the sample.

7.1.4. Assessing Predictive Validity of Configurations of Fit

We assess predictive validity by examining whether the distinction between the eight configurations in the total sample is useful in predicting differences along other "dependent" variables reflecting the CTR performance of the relations. Table 28 reports a set of variables

which exhibit significant differences across these configurations (i..e, oneway differences highly significant $p < 0.01$ with Scheffe ranges of 0.05).

For this purpose, we consider three dimensions of CTR performance: a) apparel manufacturer rating index assessed by a team of purchase personnel during visits to the manufacturer sites along seven criteria (Cronbach $\alpha = 0.91$) which assesses the attributes of the interorganizational relationship rather than the manufacturer itself. The criteria include manufacturing time, delivery performance, quality performance, price competitiveness, engineering/design capabilities, quality of the relationship, and quality of management processes; b) perceived satisfaction with the relationship along seven criteria (7-item scale, Cronbach $\alpha = 0.94$), such as the quality of information exchanged, amount of information exchanged, accuracy of information at all levels, satisfaction with the delivery, quality of the apparel items delivered, and performance of the apparel item; and c) buffer levels between the two firms which includes average level of inventory carried by the retailer and manufacturer, shipment increments for the apparel item, and average quality levels for the apparel item delivered (Cronbach $\alpha = 0.90$).

We found highly significant differences ($F_{perf} = 9.67$; $F_{satisfy} = 6.52$; and $F_{buffer} = 6.81$, all at levels of p-value < 0.001) across the eight configurations of fit between interorganizational information processing needs and interorganizational coordination needs. In terms of CTR performance measures, three configurations -Structural Linkage, Virtual Linkage, and Pure Linkage relationships - stand out as low performers. On the other hand, four configurations- Intensive Linkage, Integral Linkage, Control Linkage, and Quasi Linkage- all turn out to be high performing relationships between the members of the dyad.

Table 28. Predictive Validity Matrix for Configurations of Fit in the U.S. Apparel Industry

	Structural Linkage	Virtual Linkage	Pure Linkage	Formal Linkage	Intensive Linkage	Integral Linkage	Control Linkage	Quasi Linkage
Structural Linkage		low buffers relative to virtual linkage	greater CTR performa-nce relative to pure linkage	not much difference in CTR performance relative to formal linkage	lower degree of IT utilization relative to intensive linkage	lower CTR performance and satisfaction relative to integral linkage	low buffers and satisfaction relative to control linkage	higher IT utilization relative to quasi linkage
Virtual Linkage	lower CTR performance & satisfaction relative to structural linkage		similar CTR performance but lower IT utilization relative to pure linkage	lower buffer levels and CTR performance relative to formal linkage	lower satisfaction & IT utilization relative to intensive linkage	much lower levels of CTR performance & satisfaction relative to integral linkage	higher buffer levels and lower satisfaction relative to control linkage	lower CTR performance for the same level of IT relative to quasi linkage
Pure Linkage	higher IT utilization with lower CTR performance relative to structural linkage	modestly greater CTR performance and satisfaction relative to virtual linkage		lower satisfaction and CTR performa-nce relative to formal linkage	greater CTR performa-nce and satisfaction relative to intensive linkage	lower satisfaction and CTR performa-nce relative to integral linkage	similar levels of IT utilization, but lower CTR perform-ance relative to control linkage	higher IT utilzation;lower CTR perform-ance relative to quasi linkage

Table 28 (Continued)

	Structural Linkage	Virtual Linkage	Pure Linkage	Formal Linkage	Intensive Linkage	Integral Linkage	Control Linkage	Quasi Linkage
Formal Linkage	higher buffer levels and lower CTR performance relative to formal linkage	greater CTR performance and higher IT utilization relative to virtual linkage	similar CTR performance with lower IT utilization relative to pure linkage		lower CTR performance & satisfaction relative to intensive linkage	lower IT utilization and CTR performance relative to integral linkage	higher buffer levels & lower CTR performance relative to control linkage	greater satisfaction and CTR performance relative to quasi linkage
Intensive Linkage	about the same CTR performance with high IT utilization relative to formal	lower bufffer levels and greater CTR performance relative to virtual linkage	for the same level of IT utilization, higher CTR perform-ance relative to pure linkage	greater satisfaction relative to formal linkage		lower CTR performance relative to integral linkage	lower satisfaction levels and higher IT utilization relative to control	higher buffer levels and lower satisfaction relative to quasi linkage
Integral Linkage	lower buffer levels and higher satisfaction relative to structural linkage	greater IT utilization and CTR performance relative to virtual linkage	greater satisfaction relative to pure linkage	much lower buffer levels relative to formal linkage	higher CTR performance and satisfaction relative to intensive linkage		slightly lower levels of satisfaction relative to control linkage	slightly higher level of satisfaction relative to quasi linkage

Table 28 (Continued)

	Structural Linkage	**Virtual Linkage**	**Pure Linkage**	**Formal Linkage**	**Intensive Linkage**	**Integral Linkage**	**Control Linkage**	**Quasi Linkage**
Control Linkage	lower buffer levels relative to structural linkage	greater CTR perform-ance relative to virtual linkage	higher CTR perfo-rmance levels for same IT utilization relative to pure linkage	higher IT utilization and satisfaction relative to formal linkage	lower IT utilization and higher satisfaction relative to intensive linkage	lower satisfaction levels relative to integral linkage		similar performa-nce outputs with higher IT utilization relative to quasi linkage
Quasi Linkage	lower buffer levels relative to structural linkage	similar level of IT utilization with higher satisfaction level relative to virtual	much lower IT utilization with greater CTR perfo-rmance relative to pure linkage	higher satisfaction levels relative to formal linkage	lower IT utilization, greater CTR performa-nce relative to intensive linkage	lower perf-ormance and IT utilization relative to integral linkage	similar CTR performance and satisfaction relative to control linkage	

Formal linkage relationships are classified moderate in terms of CTR performance. It is important to note that dimensions of interorganizational information processing needs by themselves do not predict CTR performance as can be seen by the fact that both low performing configurations (e.g., virtual linkage and pure linkage) as well as high performing configurations (i.e., intensive linkage and control linkage) operating under low interorganizational interdependency needs, and on the other hand, both low performing (e.g., structural linkage) configurations and high performing configurations (e.g., integral linkage and quasi linkage) operating under high interorganizational interdependency processing needs.

The above results (see Table 28) reinforce the underlying logic and concept of fit as operationalized in the proposed research model and confirms the importance of fit between interorganizational information processing needs and capabilities than either dimension alone. For instance, structural linkage relationships operate in a high interorganizational interdependency context (i.e., customized apparel items, high interdependency about an apparel manufacturer) not sufficiently contained with simply strong structural interorganizational coordination mechanisms. Not only information technology is not leveraged sufficiently, but more importantly the lack of commitment and the highly conflictual climate of the relationship does not encourage a rich information exchange between the two partners. On the other hand, control linkage relationships reveal an appropriate use of technology (i.e., IOIS) to support routine and straightforward exchange of data necessary in a low interorganizational information processing needs contingency.

7.1.5. Taxonomy of IOIS-CTR Gestalts

Prior research adopting a configurational approach falls into two major streams: one of testing typologies and another of uncovering taxonomies. For instance, Haas, Haal, and Johnson (1966) appraised Etzioni's (1961) and Blau and Scott's (1962) typology of organizations. Woodward (1965) demonstrated how the distinction in technology accounted for many differences in organization structure, while Burns and Stalker (1961) showed that organic and mechanistic firms differed in their structure, process, and environment. Similarly, Hambrich (1983a) tested and extended Miles and Snow (1978) strategic typology of defenders, analyzers and prospectors, while Miller (1988) tested a typology of organizations based upon their method of production, rates of innovation, and product sophistication. All these studies have one common theme: the classification scheme was empirically tested through a test of data on indicators that operationalize the relevant dimensions and/or concepts.

On the other hand, uncovering taxonomies involves classification through a systematic analysis. For instance, Hambrick (1983b) derived a taxonomy of eight industrial environments through cluster analyses conducted on the PIMS database. In the strategic groups research, researchers Hatten and Hatten (1985), Hayes, Spence, and Marks (1983), and Baird and Kumar (1983) have conducted studies that follow this inductive (i.e., data driven) approach to uncovering configurations.

This research has taken an integrated approach whereby the strengths and advantages of both the taxonomy and typology approaches to data analysis are been maximized, at the same time minimizing the disadvantages of these approaches. By grounding the proposed

research model in strong, well-established theories such as organization theory, political economy theory, transaction cost economics theory, and information theory, we derived a set of operational indicators to derive a set of naturally occurring taxonomies or patterns of interorganizational relationships and their impact on CTR performance in the U.S. apparel industry. Since, the main focus of this research study was the role of interorganizational information systems or in a general sense, information technology in bringing about changes in the CTR performance in business processes, we derived and plotted a taxonomy of IOIS-CTR gestalts which highlight the degree of IOIS utilization and the degree of CTR performance derived from these interorganizational relationships . Appendix D displays these configuration gestalts.

A web diagram with lines emerging from the center of the bubbles (i.e., configuration gestalts) representing the degree of interdependency and coordination (without the technology component) helps capture the richness of the interorganizational relationships present in the U.S. Apparel industry. The lines on the left of the bubble indicate the degree of interdependency (i.e., environmental, relationship, and internal), while the lines on the right of the bubble indicate the degree of interorganizational coordination through structure and process mechanisms. A closer look at the configuration gestalt mapped with the help of a web diagram above (see Appendix D) indicates that integral linkage, intensive linkage, and control linkage all utilize IOIS at a high level and seem to result in greater CTR performance. On the other end of the spectrum, virtual linkage employs a low level of IOIS accompanied by a lower level of CTR performance, while quasi linkage, inspite of a lower utilization of IOIS exhibits greater CTR performance. A note of warning though in interpreting this

taxonomy: it should be borne in mind that these configuration gestalts represent the collective means and mechanisms of interorganizational interdependency and interorganizational coordination, of which IOIS (i.e., the technology dimension) is one component. Thus, no attempt should be made to derive causation from this proposed taxonomy as these configuration gestalts were derived from the individual and interaction effects of more than one variable.

7.1.6. Distribution of Configurations of Fit

Table 29 summarizes the relative ratio of each configuration in the retailer and manufacturer data sample. The results indicate that the broad spectrum of retailer-manufacturer relationships exist in the dyad. In particular, we note the significant presence of integral linkage and structural linkage relationships in the U.S. retailer sample. Similarly, the U.S. manufacturer sample displays a significant presence of structural linkage, and quasi linkage relationships.

Table 29. Configuration Map Across U.S. Apparel Retailers and Manufacturers

	Structural Linkage	Integral Linkage	Virtual Linkage	Pure Linkage	Formal Linkage	Intensive Linkage	Quasi Linkage	Control Linkage
Retailer	**13.2%**	**65.0%**	10.8%	1.5%	2.5%	7.0%	N/A	N/A
Manufacturer	**22.5%**	12.5%	5.6%	2.5%	N/A	N/A	**52.5%**	4.4%

The results provide important insights not only in the differences between the two members of the dyad (i.e., apparel retailer and manufacturer), but also the similarities. For instance, both retailers and manufacturers display a relatively high percentage of structure linkage relationships testifying to the high interdependency that drives the need to coordinate across the firm boundaries in order to achieve CTR performance.

7.2. LIMITATIONS OF THE RESEARCH

First, it is important to point out that much of the research presented here is exploratory in nature and as such may need further conceptualization to identify other hidden dimensions for analysis.

The set of analyses suffers from its underlying deterministic and reductionist approach to the phenomenon of CTR through IOIS. It still does not provide any insights into the trade-offs and interactive uses of different interorganizational coordination mechanisms under various interdependency contingencies. The immediate normative derivation from these multiple regressions would argue for higher investments in all three interorganizational coordination mechanisms under higher interdependency. In reality, such prescriptions are useless given the severe resource scarcity constraints confronting management. Therefore, what is needed is multivariate analysis that can include more than one dependent variable. In addition to the above limitations of multiple regression analyses, the proposed research model does not capture the richness of real world dyadic relationships.

Though attempts were made to secure objective, quantitative data, the data on which these research findings were based are perceptual in nature. Threats to validity of the survey research in this study include: 1) Statistical conclusion validity; 2) Internal validity; 3) Construct validity; and 4) External validity. Moreover, threats to measurement validity relate to two broad sets of concerns. First, there are issues about the validity of key informant analysis (motivational barrier, perceptual and cognitive limitations, and lack of information). Second, there are issues about the measurement scheme and instrument. These include theoretical meaningfulness of concepts, observational meaningfulness of concepts, internal consistency of operationalizations, convergent validity, discriminant validity, and nomological validity.

Another limitation is that the list of apparel items considered for this study could have been categorized on the basis of seasonal demand, market segmentation, and other variations.

The findings of this research may be limited to the U.S. apparel industry. Other configurations may emerge in other industrial (e.g., electronics, pharmaceutical, insurance), national or international relationships (e.g., strategic alliances, joint ventures). These limitations call for further empirical research in other industries and countries.

One important limitation of this empirical study lies in the uncovering of configurations of interorganizational interdependency-coordination fit that may well be limited to the U.S. apparel industry. Other configurations may emerge in other industrial, national, or international research settings. Similarly, some configurations appearing in the U.S. apparel industry may not exist in other contexts. For example, inclusion of non U.S. apparel manufacturers may have yielded other configurations.

Another limitation of this research is the exclusion of costs involved in setting up IOIS in organizations. With the proliferation of the use of internet, organizations are exploring ways of utilizing this cost-effective medium as a platform for implementing their IOIS. Thus the consideration of the impact of internet technologies on the changing landscape of IOIS would result in interesting, and perhaps different configurations to achieve CTR.

7.3. CONTRIBUTIONS OF THE RESEARCH

The potential contributions of this research can be broadly categorized under theoretical and empirical, and normative (predictive) headings.

Theoretical

The theoretical contribution stems from the development and validation of a conceptual model which brings together four dominant research perspectives usually considered separately. The model argues for an interaction view of the relationship between structure, process, and technology, under the strong contingency effect of sources of interdependency. This integrative model provides a rich conceptual tool to better understand and describe the determinants and components of IOIS-enabled CTR.

Empirical

The results derived from statistical analyses will provide insights about:

i) IOIS-enabled CTR mechanisms that exist in the U.S. apparel industry.

ii) the CTR performance variations across these interdependency configurations.

iii) configurations about the fit between interdependency and CTR.

iv) distinct patterns of IOIS across these interdependency configurations.

Normative

MIS is an applied discipline where researchers are concerned with the ability of research studies to inform and guide management practice. Hence, it is important that the proposed model has the inherent potential to offer normative insights. The model provides important insights into areas such as:

i) the relative importance of the various CTR mechanisms under different conditions of interdependency.

ii) Trade-offs among the various CTR mechanisms.

iii) Selection of partners for interorganizational relationships given the possible constraints under different conditions of interdependency.

iv) Selection of CTR mechanisms and their implementation under given conditions of market and partnership.

7.4. IMPLICATIONS OF THE RESEARCH

This research has investigated the important phenomenon of cycle time reduction by looking at the dyadic relationships in the supply chain in the U.S. apparel industry. There are several important implications that impact both the theory and practice of information systems management.

7.4.1. Implications for Theory

The importance of interdependency as a contingency variable that determines the impact on cycle time performance in critical business processes and the facilitating role played by interorganizational coordination is consistent with existing organizational theory literature (Aiken & Hage 1968; Clark 1965). The conceptualization of interorganizational interdependency as a comprehensive, multidimensional variable is not only grounded in strong fundamentals (Dill 1969; Thompson 1967), but also provides a fresh perspective to look at technology-enabled CTR phenomenon in and across organizations.

The conceptual model presented in this research offers an important extension of Galbraith's (1977) information processing model from an intra-organizational focus to an interorganizational focus. The empirical support for this conceptualization to explain the role of IOIS in CTR performance by analyzing a sample of interorganizational relationships in the U.S. apparel industry offers a theoretical explication to the interorganizational theory literature. The support for the basic axiom that the fit between interorganizational information processing needs and interorganizational information processing capabilities is a strong determinant of CTR effectiveness and performance has been demonstrated by this empirical investigation.

7.4.2. Implications for Practice

The results from this empirical research investigating interorganizational relationships and the phenomenon of IOIS-enabled CTR in the U.S. apparel industry not only identify the configuration gestalts that are active, but also offers insights into the use of

information technology to leverage CTR performance in certain critical business processes. Given the richness of real dyadic relationships, the research findings identifies critical thrust areas and applications that management could focus their efforts on.

In addition to the uncovering of real configurations, the presence of multiple and varied configurations to coordinate tasks across firm boundaries for a range of apparel products puts the phenomenon of CTR performance in the right perspective for management. This research has also successfully highlighted complexities in interorganizational coordination brought about by interdependencies in the environment, relationships, and the internal firm that management can focus on to develop effective strategies.

7.5. DIRECTIONS FOR FUTURE RESEARCH

There are several avenues that could be pursued for further research. An interesting and promising area in cycle time research is the specific role that information technology can play in organizing, coordinating, and executing functional and administrative tasks. With the dissolution of organizational boundaries, an investigation of the effects of information technology in reducing information processing times and improving organizational effectiveness and performance is an especially high-payoff area of research. Also, future research could analyze the facilitating role of coordination across organization boundaries by incorporating the interaction effect of other, equally important variables such as uncertainty, organizational dynamics, and business competition.

Future research could explore the configuration dynamics involved in specific market segments (e.g., high-fashion) and investigate the relationship between CTR and information technology.

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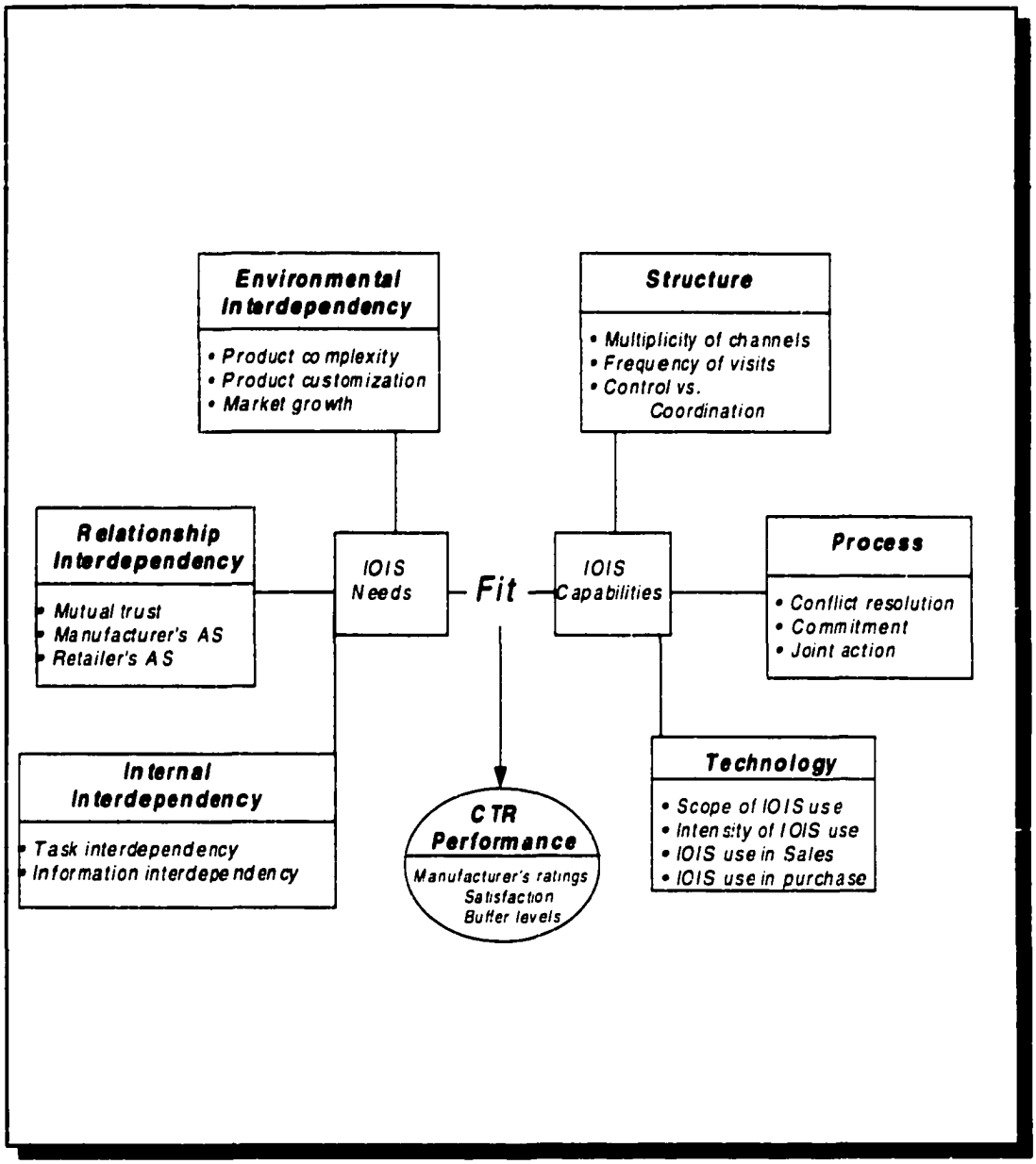
APPENDICES

APPENDIX A -OPERATIONAL RESEARCH MODEL



APPENDIX B - SURVEY INFORMATION

APPAREL RETAILER SURVEY QUESTIONNAIRE

U.S. Apparel Industry Study

This study sponsored by the FedEx Center for Cycle Time Research, The University of Memphis is interested in studying the role of interorganizational information systems in Cycle time reduction performance in the apparel retailer-manufacturer supply chain in the United States.

Please answer the following questions relating to your tasks and responsibilities in your specific purchase function for the apparel item that you have chosen from the list provided.. It should take no longer than 20 minutes to complete this questionnaire. Your individual responses will be kept completely confidential.

After answering all the questions, please mail the survey in the self-addressed and stamped envelope provided.

THANK YOU for your cooperation and time.

Please circle the MOST (only one) appropriate response for all the questions in the survey.

The following questions concern your perceived **environmental interdependency** for the apparel item that you have selected in the purchase function performed by you in the apparel industry.

1. How *technically complex* (in terms of specifications) is it to order the apparel item?

simple						complex
1	2	3	4	5	6	7

2. What is the *maturity level of technology* required to manufacture the apparel item?

new						mature
1	2	3	4	5	6	7

3. What is the *engineering content* required for manufacturing the apparel item?

low						significant
1	2	3	4	5	6	7

4. What is the *level of customization* required for the apparel item before purchase/sales?

low level						high level
1	2	3	4	5	6	7

5. What is the projected *market growth* for the apparel item?

declining						growing
1	2	3	4	5	6	7

The following questions measure the **perceived interdependency** in your relationship with the manufacturer of the selected apparel item.

6. How would you characterize the degree of *mutual trust* between your firm and the manufacturer?

extremely weak						extremely strong
1	2	3	4	5	6	7

7. What is the degree of *comfort* about sharing sensitive information in your area with the manufacturer?

very uncomfortable						very comfortable
1	2	3	4	5	6	7

8. To what extent has your firm made *major investments* for its relationship with the manufacturer in the following areas?

	low						high
understanding the others business	1	2	3	4	5	6	7
business meetings	1	2	3	4	5	6	7
technology access	1	2	3	4	5	6	7
inter-firm communication	1	2	3	4	5	6	7
exchange of standards	1	2	3	4	5	6	7
purchase-related information	1	2	3	4	5	6	7
sales-related information	1	2	3	4	5	6	7
developing good relationships	1	2	3	4	5	6	7

The following questions pertain to the perceived **internal interdependency** in the information-related tasks and activities that you perform for the selected apparel item.

9. To what extent there is a ***clearly known way*** to do your job when it relates to this manufacturer?

ambiguous					very clear	
1	2	3	4	5	6	7

10. To what extent are there ***established practices*** and procedures that you can follow in doing your job with this manufacturer?

no set practices				established practices		
1	2	3	4	5	6	7

11. To what extent is your ***job description*** detailed or broadly defined?

not defined					clearly defined	
1	2	3	4	5	6	7

12. To what extent the ***boundaries of your job*** vague or clear?

very vague					very clear	
1	2	3	4	5	6	7

13. How often do you perform ***repetitive tasks***?

frequent						infrequent
1	2	3	4	5	6	7

14. How often do you perform the ***same tasks*** in the same way most of the time?

frequent						infrequent
1	2	3	4	5	6	7

15. How much of your total job has to do with this manufacturer for this apparel item? (select one)

less than 5%	6-10%	11-25%	26-50%	51-100%
1 2	3	4	5	

16. What percentage of your total job is spent directly with this manufacturer?

less than 5%	6-10%	11-25%	26-50%	51-100%
1 2	3	4	5	

The following questions deal with the **structural mechanisms** (such as formal communication, control, and joint-meetings) in place in your firm that facilitates interorganizational coordination with the retailer in your area.

17. To what degree does your firm work with the manufacturer in the following business functions?

	Low	Medium	High
Sales	1	2	3
Shipments	1	2	3
Quality	1	2	3

18. In the past year, how many visits were made by your personnel in the following areas to your manufacturer?

	not once	once	2-5 times	6-10 times	more than 10 times
purchasing	1	2	3	4	5
quality control	1	2	3	4	5
planning	1	2	3	4	5

19. Assign 0 to 100 points to the following control and coordination tasks that you perform with your manufacturer for a given apparel item.

Negotiating price with manufacturer	_____
Monitoring manufacturer's performance	_____
Resolving very urgent problems	_____
Coordinating with manufacturer/retailer for continuous improvements	_____
Exchanging ideas and keeping in touch	_____

The following questions deal with the **process mechanisms** (such as conflicts, resolution, and joint action) in place in your firm that facilitates interorganizational coordination with the manufacturer in your area.

20. To what extent have major past disagreements between your firm and the manufacturer been resolved in an adversarial or collaborative way?

adversarial						collaborative
1	2	3	4	5	6	7

21. To what extent is there an equal sharing of risks between your firm and the manufacturer in your functional area?

other firm has more share					our firm has more share
1	2	3	4	5	6	7

22. To what extent is there an equal sharing of burden between your firm and the manufacturer in your functional area?

other firm has more share					our firm has more share	
1	2	3	4	5	6	7

23. To what extent is there an equal sharing of benefits between your firm and the manufacturer in your functional area?

other firm has more share					our firm has more share	
1	2	3	4	5	6	7

24. To what extent there exists joint effort and cooperation between your firm and the manufacturer in the following areas?

	minimal					extensive
long range planning	1	2	3	4	5	6	7
order planning	1	2	3	4	5	6	7
training/education	1	2	3	4	5	6	7
item scheduling	1	2	3	4	5	6	7
market forecast	1	2	3	4	5	6	7
communication	1	2	3	4	5	6	7
quality assurance	1	2	3	4	5	6	7

The following questions deal with the **technological mechanisms** (such as scope and use of interorganizational information systems) in place in your firm that facilitates interorganizational coordination with the manufacturer in your area.

25. To what extent is data exchanged in the electronic form with this manufacturer in the following functional areas?

	minimal					extensive
purchasing	1	2	3	4	5	6	7
quality control	1	2	3	4	5	6	7
transportation	1	2	3	4	5	6	7
payment	1	2	3	4	5	6	7

26. Have the following documents been exchanged electronically between your firm and the manufacturer?

	Yes	No
Requests for quote	1	2
purchase order	1	2
schedule release	1	2
design specs.	1	2

27. Is data exchanged electronically between your firm and the manufacturer in your functional area?

Yes	No
1	2

28. To what extent is the electronic exchange of data integrated with other internal applications in your functional area?

No integration					tight integration	
1	2	3	4	5	6	7

29. Do you have established standards for electronic exchange in your functional area?

Yes	No
1	2

The following questions deal with the **cycle time reduction performance** (based on manufacturer ratings, satisfaction, and buffer levels) measures in your firm.

30. How would you rate the manufacturer on a 10-point scale in the following areas?

	lowest								highest
processing time	1	2	3	4	5	6	7	8	9	10
delivery	1	2	3	4	5	6	7	8	9	10
quality	1	2	3	4	5	6	7	8	9	10
price	1	2	3	4	5	6	7	8	9	10
engineering/ design capabilities	1	2	3	4	5	6	7	8	9	10
quality of relationship	1	2	3	4	5	6	7	8	9	10
quality of management process	1	2	3	4	5	6	7	8	9	10

31. How would you rate your satisfaction with the manufacturer in the following areas?

	very unsatisfied						very satisfied
quality information	1	2	3	4	5	6	7
amount of information	1	2	3	4	5	6	7
quality of information		1	2	3	4	5	67
level of cooperation	1	2	3	4	5	6	7
satisfaction with delivery	1	2	3	4	5	6	7
satisfaction with quality	1	2	3	4	5	6	7
satisfaction with apparel	1	2	3	4	5	6	7

THANK YOU VERY MUCH FOR YOUR TIME

APPAREL MANUFACTURER SURVEY QUESTIONNAIRE

U.S. Apparel Industry Study

This study sponsored by the FedEx Center for Cycle Time Research, The University of Memphis is interested in studying the role of interorganizational information systems in Cycle time reduction performance in the apparel retailer-manufacturer supply chain in the United States.

Please answer the following questions relating to your tasks and responsibilities in your specific sales function for the particular apparel item sold to this manufacturer. It should take no longer than 20 minutes to complete this questionnaire. Your individual responses will be kept completely confidential.

After answering all the questions, please mail the survey in the self-addressed and stamped envelope provided.

THANK YOU for your cooperation and time.

Please circle the MOST (only one) appropriate response for all the questions in the survey.

The following questions concern your perceived **environmental interdependency** for the apparel item that has been indicated in the sales function performed by you in the apparel industry.

1. How *technically complex* (in terms of specifications) is it to manufacture the apparel item?

simple						complex
1	2	3	4	5	6	7

2. What is the *maturity level of technology* required to manufacture the apparel item?

new						mature
1	2	3	4	5	6	7

3. What is the *engineering content* required for manufacturing the apparel item?

low						significant
1	2	3	4	5	6	7

4. What is the *level of customization* required for the apparel item for the sale?

low level						high level
1	2	3	4	5	6	7

5. What is the projected *market growth* for the apparel item?

declining						growing
1	2	3	4	5	6	7

The following questions measure the **perceived interdependency** in your relationship with the retailer of the indicated apparel item.

6. How would you characterize the degree of *mutual trust* between your firm and the retailer?

extremely weak						extremely strong
1	2	3	4	5	6	7

7. What is the degree of *comfort* about sharing sensitive information in your area with the retailer?

very uncomfortable						very comfortable
1	2	3	4	5	6	7

8. To what extent has your firm made *major investments* for its relationship with the retailer in the following areas?

	low						high
understanding the others business	1	2	3	4	5	6	7
business meetings	1	2	3	4	5	6	7
technology access	1	2	3	4	5	6	7
inter-firm communication	1	2	3	4	5	6	7
exchange of standards	1	2	3	4	5	6	7
purchase-related information	1	2	3	4	5	6	7
sales-related information	1	2	3	4	5	6	7
developing good relationships	1	2	3	4	5	6	7

The following questions pertain to the perceived **internal interdependency** in the information-related tasks and activities that you perform for the indicated apparel item.

9. To what extent there is a ***clearly known way*** to do your job when it relates to this retailer?

ambiguous						very clear
1	2	3	4	5	6	7

10. To what extent are there ***established practices*** and procedures that you can follow in doing your job with this retailer?

no set practices						established practices
1	2	3	4	5	6	7

11. To what extent is your ***job description*** detailed or broadly defined?

not defined						clearly defined
1	2	3	4	5	6	7

12. To what extent the ***boundaries of your job*** vague or clear?

very vague						very clear
1	2	3	4	5	6	7

13. How often do you perform ***repetitive tasks***?

frequent						infrequent
1	2	3	4	5	6	7

14. How often do you perform the ***same tasks*** in the same way most of the time?

frequent						infrequent
1	2	3	4	5	6	7

15. How much of your total job has to do with this retailer for this apparel item?(select one)

less than 5%	6-10%	11-25%	26-50%	51-100%
1 2	3	4	5	

16. What percentage of your total job is spent directly with this retailer?

less than 5%	6-10%	11-25%	26-50%	51-100%
1 2	3	4	5	

The following questions deal with the **structural mechanisms** (such as formal communication, control, and joint-meetings) in place in your firm that facilitates interorganizational coordination with the retailer in your area.

17. To what degree does your firm work with the retailer in the following business functions?

	Low	Medium	High
Sales	1	2	3
Manufacturing/delivery	1	2	3
Quality	1	2	3

18. In the past year, how many visits were made by your personnel in the following areas to your retailer?

	not once	once	2-5 times	6-10 times	more than 10 times
sales	1	2	3	4	5
quality control	1	2	3	4	5
planning	1	2	3	4	5

19. Assign 0 to 100 points to the following control and coordination tasks that you perform with your retailer for a given apparel item.

Negotiating price with retailer	_____
Monitoring retailer's performance	_____
Resolving very urgent problems	_____
Coordinating with retailer for continuous improvements	_____
Exchanging ideas and keeping in touch	_____

The following questions deal with the **process mechanisms** (such as conflicts, resolution, and joint action) in place in your firm that facilitates interorganizational coordination with the retailer in your area.

20. To what extent have major past disagreements between your firm and the retailer been resolved in an adversarial or collaborative way?

adversarial						collaborative
1	2	3	4	5	6	7

21. To what extent is there an equal sharing of risks between your firm and the retailer in your functional area?

other firm has more share					our firm has more share	
1	2	3	4	5	6	7

22. To what extent is there an equal sharing of burden between your firm and the retailer in your functional area?

other firm has more share					our firm has more share	
1	2	3	4	5	6	7

23. To what extent is there an equal sharing of benefits between your firm and the retailer in your functional area?

other firm has more share					our firm has more share	
1	2	3	4	5	6	7

24. To what extent there exists joint effort and cooperation between your firm and the retailer in the following areas?

	minimal					extensive
long range planning	1	2	3	4	5	6	7
delivery planning	1	2	3	4	5	6	7
training/education	1	2	3	4	5	6	7
apparel engineering	1	2	3	4	5	6	7
product forecast	1	2	3	4	5	6	7
communication	1	2	3	4	5	6	7
quality assurance	1	2	3	4	5	6	7

The following questions deal with the **technological mechanisms** (such as scope and use of interorganizational information systems) in place in your firm that facilitates interorganizational coordination with the retailer in your area.

25. To what extent is data exchanged in the electronic form with this retailer in the following functional areas?

	minimal					extensive
sales	1	2	3	4	5	6	7
quality control	1	2	3	4	5	6	7
transportation	1	2	3	4	5	6	7
payment	1	2	3	4	5	6	7

26. Have the following documents been exchanged electronically between your firm and the retailer?

	Yes	No
Requests for quote	1	2
sales order	1	2
material release	1	2
design specs.	1	2

27. Is data exchanged electronically between your firm and the retailer in your functional area?

Yes	No
1	2

28. To what extent is the electronic exchange of data integrated with other internal applications in your functional area?

No integration					tight integration	
1	2	3	4	5	6	7

29. Do you have established standards for electronic exchange in your functional area?

Yes	No
1	2

THANK YOU VERY MUCH FOR YOUR TIME

INVITATION LETTER FOR APPAREL RETAILERS

(on FedEx Center Letter Head)

(FIELD)Date

(FIELD)Full Name
(FIELD)Title
(FIELD)Company
(FIELD)Address1
(FIELD)Address2
(FIELD)Address3
(FIELD)City, (FIELD)State, (FIELD)Zip
(FIELD)Country

Dear (FIELD)Last Name:

As part of our ongoing research into cycle time issues here at the FedEx Center for Cycle Time Research (FECCTR), The University of Memphis, we are investigating the role of interorganizational information systems such as EDI (electronic data interchange) in reducing cycle times in critical business processes in the U.S. apparel industry.

A key to the success of this project is the voluntary participation of both leading apparel retailers and manufacturers in the industry. Towards this end, your firm has been chosen to participate in this study. In order to conduct this research, we would examine the relationship between your firm and a given apparel manufacturer (i.e., your supplier). A survey questionnaire will measure your perceptions of the various aspects of your relationship and is enclosed herewith. **You are requested to forward it to an appropriate purchase manager or senior manager in charge of your procurement function**. All necessary instructions to complete and mail the survey are detailed in the enclosed questionnaire.

We would like to assure you that all your responses, both at the firm level and individual level, will be completely confidential. As research partners in this project, your organization will receive privileged information, in the form of a summary report. If you have any questions or would like to contact us, don't hesitate to call (901) 327-7202 or FAX (901) 678-3702.Thank you in advance for participating in this research project.

Sincerely,

Jim Wetherbe, Director, FECCTR
The University of Memphis

Amarnath Prakash, Researcher
The University of Memphis

INVITATION LETTER FOR APPAREL MANUFACTURERS

(on FedEx Center Letter Head)

(FIELD)Date

(FIELD)Full Name
(FIELD)Title
(FIELD)Company
(FIELD)Address1
(FIELD)Address2
(FIELD)Address3
(FIELD)City, (FIELD)State, (FIELD)Zip
(FIELD)Country

Dear (FIELD)Last Name:

As part of our ongoing research into cycle time issues here at the FedEx Center for Cycle Time Research (FECCTR), The University of Memphis, we are investigating the role of interorganizational information systems such as EDI (electronic data interchange) in reducing cycle times in critical business processes in the U.S. apparel industry.

A key to the success of this project is the voluntary participation of both leading apparel retailers and manufacturers in the industry. Towards this end, your firm has been chosen to participate in this study. We have already obtained survey responses from the apparel retailer with whom you are engaged in a business relationship for a given apparel item. Now, in order to obtain your perceptions on the relationship with this retailer (and for that particular apparel item), **you are requested to forward it to an appropriate sales manager or senior manager in charge of marketing the apparel item to the retailer (both the item and retailer are indicated in the questionnaire).** All necessary instructions to complete and mail the survey are detailed in the enclosed questionnaire.

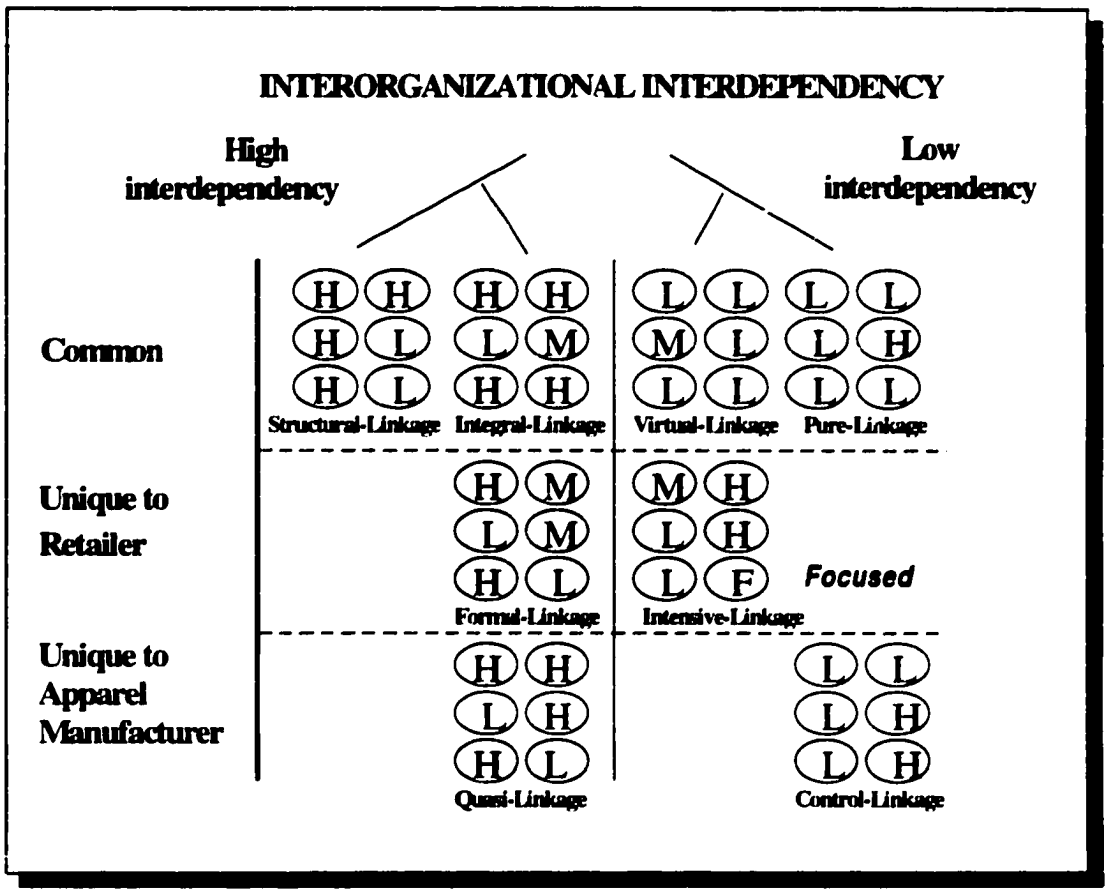
We would like to assure you that all your responses, both at the firm level and individual level, will be completely confidential. As research partners in this project, your organization will receive privileged information, in the form of a summary report. If you have any questions or would like to contact us, don't hesitate to call (901) 327-7202 or FAX (901) 678-3702. Thank you in advance for participating in this research project.

Sincerely.

Jim Wetherbe, Director, FECCTR
The University of Memphis

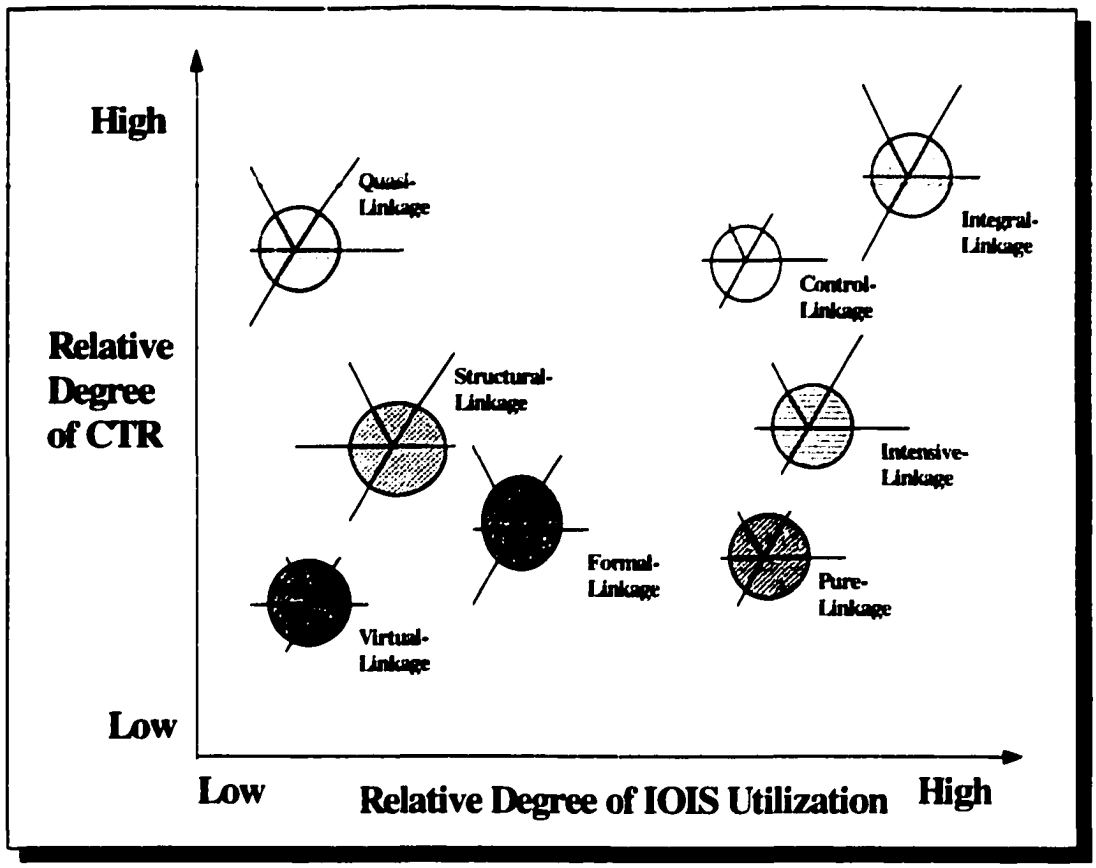
Amarnath Prakash, Researcher
The University of Memphis

APPENDIX C - CONFIGURATIONS OF FIT



Configurations of Interorganizational Interdependency-Coordination Fit To achieve CTR in the U.S. Apparel Industry

APPENDIX D-CONFIGURATION GESTALTS



Configuration Gestalts in the U.S. Apparel Industry - IOIS Utilization and CTR Performance

APPENDIX E - APPAREL REGISTER

Comprehensive Apparel List *

The US dept of Commerce categorized all manufactured products in the U.S. apparel industry to obtain economic data and assigned a multiple digit code to each of the categories.

The Apparel categories have been assigned codes starting from 23..

Code	Description
2311	Men's and boys' suits, and overcoats
2321	Men's and boys' shirts except workshirts
2322	Men's and boys' underwear and nightwear
2325	Men's and boy's separate trousers and slacks
2326	Men's and boy's work clothing
2329	Men's and boy's clothing and NEC
2331	Women's misses and juniors blouses and shirts
2335	Women's and juniors dresses
2337	Women's misses, juniors suits and skirts
2339	Women's misses outerwear and NEC
2341	Women's misses underwear and nightwear
2342	Brassiers , girdles and allied garments
2353	Hats caps and millinery
2361	Girls, childrens, infants dresses and blouses
2369	Girls, childrens, infants outerwear and NEC
2381	Dress and work gloves except knit and leather
2384	Robes and dressing gowns
2385	Waterproof outerwear
2387	Apparel belts
2389	Apparel and accessories NEC

* SOURCE: ***VA BUSINESS DIRECTORY 1991-1992***
The Manufacturers index Virginia: The Virginia Chamber of Commerce

Researcher's Stratified Apparel List

Group A:

Suits, men's
Overcoats
Dress shirts
Underwear
Nightwear
Work clothing ..like uniforms
Trousers and slacks
Shorts

Group B:

Shirts, boys
Trousers, slacks
Overcoats
Shorts
Nightwear

Group C:

Men's and women's jeans
Blouses, womens
Shirts
Dresses
Suits (2pc)
Skirts
Underwear
Nightwear
Brassiers
Briefs
Hats, caps

Group D:

Dresses, girls and infants
Blouses
Outerwear

Researcher's Stratified Apparel List

Group E:

Dress and workgloves (except knit and leather)
Robes and dressing gowns
Waterproof outerwear
Apparel belts
Apparel accessories

Note: The groupings have been done randomly to arrive at a stratified list of apparel items.

VITA

Amarnath Chandra Prakash was born in Chittoor, India on June 24, 1963. Amarnath obtained his Bachelors in Mechanical Engineering in 1985 from the Regional Engineering College, a top-ranked engineering college and a Masters in Business Administration in 1987 from the internationally-recognized Institute of Management, both from India. After a long hiatus of eight years in industry and consulting, Amarnath decided to re-enter academia in August, 1993 to get his Doctorate of Philosophy in Business Administration, with a major concentration in Management Information Systems and a minor in Sociology, from The University of Memphis. He has accepted the position of Assistant Professor (MIS) at Texas Tech University starting May, 1996.

In his earlier consulting work in industry, Amarnath consulted with reputed multinationals such as Digital Equipment, where he was a Manager (Systems Consulting), and Royal Dutch/Shell Oil, where he was their IS consultant. His numerous consulting projects have taken him around the globe, including Europe, Middle-East and the United States.

Amarnath, while in the Ph.D. program, has published in more than 25 leading national and international journals and conferences. He is also a member of several professional organizations, including Association of Information Systems, Institute of Operations Research and Management Science, International Federation of Information Systems Professionals, and Decision Sciences Institute.