AN EMPIRICAL ANALYSIS OF THE EFFECTS OF STRUCTURE, BEHAVIOR,
AND COMMUNICATION IN A JUST-IN-TIME RELATIONSHIP

by

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ABSTRACT

A large body of descriptive literature on Just-In-Time (JIT) purchasing has developed since the introduction of the JIT philosophy in the United States by firms seeking to compete successfully in world markets. In JIT purchasing, the emphasis is shifted from an adversary-oriented relationship to a long-term, cooperation-oriented relationship. Experts on JIT purchasing suggest that the relationship between a manufacturer and a supplier should be a partnership, providing benefits to both parties. Essentially, manufacturers and suppliers set up new ways of doing business with each other that included physical as well as behavioral changes. This research project used relational contracting to develop a model of JIT purchasing. The study was conducted for three reasons: (1) to examine the effect of the cooperative partnership arrangement in JIT purchasing in attaining JIT goals, (2) to examine the influence of structure, behavior, and communication on the formation of the cooperative relationship and its influence on JIT outcomes, and (3) to statistically test the JIT model.

Data were gathered from employees of firms which have adopted JIT purchasing methods. A questionnaire was used to measure the JIT outcomes of performance and perception of

effectiveness, cooperation, structure, behavior, and communication.

Linear structural modeling (LISREL) was used to study the relationships among the research variables. As hypothesized, cooperation was significantly related to the JIT outcomes of performance and effectiveness and the behavioral variables were significantly related to cooperation. The hypothesized relationship between the behavior variables and domain consensus was also supported. Not supported by the data were the relationship between communication and cooperation and the relationship between structure and cooperation. Stability, the long-term nature of the relationship, and the company's commitment to JIT techniques were found to be related to the perceived effectiveness of JIT. Reduction in the number of vendors and sole sourcing were found to be significantly related to JIT performance.

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CHAPTER I

INTRODUCTION AND BACKGROUND

Introduction

The purpose of this research is to study the impact of structure, behavior, and communication on Just-In-Time (JIT) purchasing which in turn has an impact on production processes. The success of foreign competition in producing low cost and high quality goods has caused a reexamination of many manufacturing and purchasing strategies. The JIT purchasing strategy calls for a special relationship between manufacturer and supplier which affects the way they interact. This study examines the cooperative nature of this relationship in order to test those characteristics that lead to successful JIT performance in the new manufacturing environment.

The New Manufacturing Environment

Manufacturers in the United States for many years accepted production methods and problems as given and have worked within those parameters to optimize some goal. The Japanese, on the other hand, concentrated on innovative approaches to production and inventory control, product design, and process planning and control. The results of their efforts have made low cost, quality products easily accessible to consumers [Buffa, 1984]. Consequently, foreign companies have captured a large share of the world

market for products manufactured in high-volume repetitive operations. This loss in American market share and profitability has caused manufacturers and academicians to reexamine business and production strategies and to seek improvements through innovations, technology, and restructuring in order to bring high quality, competitively priced products to the marketplace. Buffa argues that attention should be refocused on the manufacturing function, emphasizing its role as a fundamental element in the strategic plans of a firm. Additionally, he states that "All activities in the line of material flow from suppliers --from fabrication and assembly to product distribution-- must be integrated for manufacturing strategy formulation" [p. 42].

One strategy in the new manufacturing environment that has emerged is the Just-In-Time (JIT) philosophy of management. JIT combines various flow techniques with ideas of quality and continuous improvement in human and physical resources. An important element of the philosophy is the JIT purchasing arrangement which serves to insure quality and dependable delivery. Firms adopting this type of purchasing arrangement do so at a certain risk. For instance, by limiting the number of vendors, a manufacturer becomes dependent on one or a few suppliers and flexibility is reduced. A supplier committing a good part of its

resources to a particular manufacturer with very specific requirements incurs opportunity costs and increases risk. However, the JIT purchasing arrangement has characteristics that make it beneficial for both parties.

Traditionally, the relationship between manufacturer and supplier is adversarial [Hahn, Pinto, and Bragg, 1983; Manoochehri, 1984; Rosenberg and Campbell, 1985; Schonberger, 1986]. Hahn, Pinto, and Bragg state that manufacturers must work with suppliers to shift the emphasis "from a highly competitive, adversary-oriented relationship to a long-term cooperation-oriented relationship" [p. 3]. The JIT purchasing relationship develops into a long-term and stable affiliation as both parties work to overcome localized goals--that is, individual company goals--in order to provide benefits for both. This partnership can be characterized as relational contracting in which each party gives up some of its independence to jointly obtain better results. Relational contracting requires a balance of structural, behavioral, and communication adaptations. It reduces risk and uncertainty by fostering cooperation. Additionally, the sharing of information, both accounting and other types, promotes cooperative behavioral characteristics that are thought to lead to positive operational and financial results. Finally, Rosenberg and Campbell [1985] suggest that "strong system approaches based

on cooperation and mutual trust" must be developed to facilitate the new partnerships.

The next section first provides background information on the JIT philosophy of management. This is followed by a discussion of JIT purchasing, the statement of the problem, and research objectives.

Just-In-Time Philosophy

In a narrow sense, JIT is a production system "which emphasizes producing exactly what is needed and conveying it to where it is needed precisely when required" [Hall, 1983]. Other definitions are broader. Sauers [1986], for example, calls it "a philosophy of viewing the production/distribution network from a systems perspective and involves continually striving to improve process efficiency, reduce inventory, and improve quality." Viewing this network as a system recognizes the fact that the components of JIT are interrelated.

Hay [1988] provides a comprehensive description of the JIT philosophy of management. It is directed at eliminating waste which is "anything other than the absolute minimum resources of material, machines, and manpower required to add value to the product" [p. 15]. Waste, then, is anything that does not add value to a product.

The elimination of waste has three thrusts that are highly interrelated--employee involvement, production and input quality, and flow techniques [Hay, 1988].

These thrusts are illustrated in Figure 1.1. Defining waste as anything that does not add value implies that activities such as counting, moving, storing, and inspecting are wasteful. In effect, these activities become holding points that create inventory within the productive flow. The JIT philosophy questions the necessity for the existence of inventories. Inventories have served as buffers between supplier and manufacturer, between production processes, between manufacturer and wholesaler or retailer, and between retailer and customer. These buffers camouflage problems in the whole production and distribution system and include buffers for scheduling errors, poor quality, uneven work flows, defective materials, and poor workmanship. The JIT philosophy calls for the identification of these hidden problems and the elimination of their causes in the manufacturing process, from the purchase of inputs to the distribution of final product. Eliminating the root causes allows management to significantly reduce, if not remove, inventory in the system. The system as a whole functions more effectively and efficiently.

Employee Involvement

One component of the JIT philosophy shown in Figure 1.1 is employee involvement [Hay, 1988]. It requires each worker to assume direct responsibility for his part in the production process. Because buffer inventories are eliminated or reduced significantly, poor workmanship on any

FIGURE 1.1 THE COMPONENTS OF THE JIT PHILOSOPHY

Source: Adapted from Hay [1988]

particular item can potentially interrupt the whole production line. Additionally, this calls for a team approach for solving production problems. Worker input becomes a valued asset in attaining the goal of continuous improvement. Finally, workers are rewarded for flexibility in the type of jobs they are able to perform. Employee involvement in continuous improvement in the production process, insight into production problems, and flexibility are important ingredients.

Quality

Another component focuses on quality throughout the entire production process from purchase of raw materials to final output [Hay, 1988]. Defective and spoiled inputs cause work stoppages along the production line. Poor workmanship during the production process causes spoiled or defective finished goods that will have to be reworked or scrapped if defects are discovered before shipping. When discovered by customers, defects generate warranty costs as well as dissatisfaction.

Flow

Finally, Figure 1.1 shows the flow techniques. These consist of ways in which manufacturing processes proceed from one operation to the next. Specific techniques used to improve the flow of materials are uniform plant load,

reduced setup time, overlapping operations, pull system, and JIT purchasing [Hay, 1988]. Attaining the correct rate and frequency on the production line (uniform plant load) leads to a balance that meets demand rather than producing for production's sake. Reduced setup time is crucial to achieving the flexibility required by the new manufacturing techniques. High setup costs in the traditional manufacturing process make long production runs necessary. Reducing both the time and cost of setups gives manufacturers the ability to change production as smoothly and as frequently as required to meet consumer demand. A third area, overlapping operations, calls for the arrangement of a production line around a series of related products rather than around functions such as grinding, milling, assembling, packaging and so on. This concept is also referred to as a cellular production plant layout. Each product group is processed within its own production line. This eliminates the buildup of inventory between functions. Another flow technique, the pull system or "Kanban," is a linked system in which each operation signals the previous operation when to produce more. If no signal is received, then the item or items are not produced. This contrasts with the traditional push system. The final flow technique, JIT purchasing, requires the delivery of high quality materials only as needed in the production process. Proponents of the JIT philosophy suggest that this requires

a partnership between the manufacturer and supplier [Schonberger and Gilbert, 1983; Lee, 1987]. It includes aspects of the supplier relationship, sole sourcing, delivery schedules, quality at source, and zero defects. While all aspects of the JIT philosophy of management are important, this research focuses on JIT purchasing.

Just-In-Time Purchasing

JIT purchasing is an important element of the JIT manufacturing philosophy. A reduction in lead time, assurance of quality, and reduced order quantities are crucial factors in eliminating waste both at the beginning and during a production process [Hahn, Pinto, and Bragg, 1983].

Implementing JIT purchasing requires a commitment from suppliers to deliver high quality materials as needed for production. If quality is low, defective materials interrupt the production process and cause unnecessary rework and scrap which do not add value and cause other problems. Reducing lead time and order quantities allow a manufacturer to reduce inventory held as buffer stock.

A successful JIT purchasing and delivery relationship requires cooperation and coordination between firms. The traditional purchasing relationship between manufacturers and suppliers in the United States is adversarial [Hahn, Pinto, and Bragg, 1983; Manoochehri, 1984; Rosenberg and Campbell, 1985; Schonberger, 1986]. Suppliers bid and

compete for contracts which are awarded to the lowest bidder. Manufacturers play suppliers against each another and thus suppliers are not willing to stake their futures on a buyer who may drop them on the next bidding cycle. There is no incentive for suppliers to invest in new production processes or human resources specific to a fickle manufacturer. In contrast, experts on the JIT philosophy suggest that the relationship between manufacturer and supplier should be a partnership, a marriage, providing mutual benefits to both parties. These close ties between firms contrast with the traditional "arm's length" transactions of the market.

New ways of doing business with JIT suppliers are necessary in order to obtain high quality input materials and a commitment to the JIT philosophy from these suppliers [Patel, 1987]. Structural changes are one key element in accomplishing these changes. Schonberger and Gilbert [1983] identified structural changes that include long-term and stable manufacturer/supplier relationships, avoidance of annual rebidding, sole source contracting, improved containerization and localized buying. These structural changes are designed to simplify and streamline relations between supplier and manufacturer.

The structural aspects of JIT increase the importance of a second key element, the behavioral characteristics of the relationship between the manufacturer and supplier.

The relationship should be close and cooperative. Both parties find it in their interest to be concerned about the mutual benefit and profitability of the other. Behavioral characteristics, such as domain consensus, equity, trust, and agreement on mutual goals, become more important.

A third crucial key is communication. Cooperation and coordination require information exchanges. Computer to computer hookups, the elimination of purchase orders, exchange of cost and quality control information, and meeting with suppliers to involve them in design specifications and the formation of joint task forces to resolve concerns are a few of the changes associated with a JIT purchasing system. Mechanisms are needed to insure open and honest communication between manufacturer and supplier. The information obtained must be reliable and useful. Communication allows trust to be established between trading partners and trust enhances the openness of the exchange.

The structural, behavioral, and communications aspects contribute to the cooperation that is necessary for successful JIT implementation. It creates an atmosphere wherein the manufacturer and supplier work not only to coordinate their individual efforts more closely but also work together for the benefit of both parties.

With the implementation of the JIT management philosophy in the manufacturing processes, firms become

motivated to extend their JIT manufacturing system to include the supply source. Since it is evident that this extension should encompass more than just pushing inventories back onto the supplier, careful thought and action must be undertaken in establishing a JIT purchasing relationship. What is lacking is a full understanding of the relationships between structure, behavior, and communication and cooperation as it affects a JIT relationship and JIT outcomes.

Statement of Problem

Manufacturers, attempting to regain profitability and market share, have scrutinized Japanese production techniques and their own production processes looking for improvements. There is general agreement that low unit cost and high quality are among the underlying factors contributing to the Japanese success.

In scrutinizing the American manufacturing processes, manufacturers found waste in their production systems in the form of excess slack. This slack is the result of holding just-in-case inventories to avoid the delays in production that can be caused by defective inputs, batch processing, and lengthy set up time [Hay, 1988]. In addition to the cost of carrying buffer inventory, the cost of rework and scrap add to overall unit costs.

Under pressure to compete more successfully, some manufacturers adopted the JIT philosophy of production and purchasing. If implemented appropriately, this philosophy can aid in both lowering unit cost of products and improving quality [McNair, Mosconi, and Norris, 1988]. Because JIT purchasing is one of the components of the JIT philosophy companies tend to implement first, there are considerable data available regarding successes and failures in implementation and results [Schonberger, 1986]. It is important that accountants understand the rationale of the JIT philosophy so that they can work with and support the other functional areas in obtaining quality products from their suppliers at reasonable cost.

Because raw materials are the major variable costs in the manufacturing process, especially in automated factories where direct labor is less significant or becoming fixed, much effort is spent controlling it. Accountants involved with a JIT production system must understand the effect of structure, behavior, and communication on cooperation in keeping price down and quality up. For instance, because JIT purchasing requires a long-term commitment from manufacturers, suppliers are able to recover their capital investments made to improve their production processes and quality and thus they are more willing and more likely to make these investments. In addition, manufacturers often work with suppliers by reviewing cost data and production

processes to see where savings can be made without negatively affecting quality. Consequently, manufacturers and suppliers work cooperatively to better design products at lower cost, which should assure the manufacturer a reliable source for materials.

Researchers on management philosophies and manufacturing processes are now becoming aware of the tremendous impact that the adoption of a JIT philosophy of management can have on the production process and in the subsystems that support the production process [Ansari, 1984; O'Neal, 1986 and 1987; McNair, Mosconi, and Norris, 1988]. However, there is little empirical work relating the general JIT philosophy and the specific issues concerning JIT purchasing. Academicians and practitioners have written about the JIT structural elements extensively. Yet, the important influences of behavior and communication have largely been neglected. These dimensions are important to the successful long-term operation of JIT purchasing because they determine whether the working relations are cooperative or competitive.

The purpose of this research is to empirically test the partnership relationship suggested by the JIT case study literature and by relational contracting. The model suggests that the structural, behavioral, and communication variables create an environment in which JIT purchasing

should thrive and that cooperation is supported by these dimensions. JIT requires a commitment on the part of the manufacturer and the supplier to work together for the mutual benefit of both in the long run. Coercion will make JIT purchasing work in the short run, but in the long run, JIT purchasing based on coercion will revert to the more traditional adversarial market-based arrangement. Obtaining support from suppliers to produce low cost, high quality materials necessitates a guarantee of a long-term and stable relationship. The proposed study relates these structural variables to the desired outcome of increased profitability and market share. It also describes and measures the degree of coordination and cooperation in terms of structural dimensions (sole sourcing, length of relationship, stability of relationship, localized buying). These structural dimensions influence behavioral sentiments as well as performance or outcome measures. The role of information and communication in facilitating cooperation in the partnership is also examined.

Research Objectives

The purpose of this research study is to improve our understanding of the structural, behavioral, and communication factors that affect the cooperative JIT relationship. The proposed research is guided by two objectives:

1. The first objective is to test the effect of the cooperative partnership arrangement in JIT purchasing in attaining the JIT goals.
2. The second objective is to show how structure, behavior, and communication influence the formation of a cooperative relationship between manufacturer and supplier and affect JIT outcomes.

Organization of the Study

In Chapter II, a discussion of the literature relevant to this study is presented. Relational contracting, the theoretical model, and the research model are developed in Chapter III. Next, research design, data collection, and method of statistical analysis are discussed in Chapter IV, while response rates, test for nonresponse bias, and the analysis of the research model using LISREL are presented in Chapter V. A summary of the results, conclusions, contributions, and recommendations for future research is found in Chapter VI.

CHAPTER II

LITERATURE REVIEW

Introduction

The literature review for this study is interdisciplinary. The focal point is the concept of relational contracting developed from Oliver Williamson's [1985 and 1986] conceptualization of the nature of transaction costs. The modeling of relational contracting will be discussed in greater detail in Chapter III. Selected research in the psychology, management, and marketing literature relating to relational contracting and cooperation is reviewed.

The Markets and Hierarchies Framework and Relational Contracting

The JIT purchasing relationship is discussed in terms of the markets and hierarchies framework. According to Williamson [1971], markets and firms (hierarchies) are competing methods of accomplishing the same transactions. The mode chosen depends on the relative efficiency of each in terms of transaction costs, which differ as a result of human characteristics and market properties. These transaction costs include the costs of obtaining information, of bargaining, and of monitoring.

When information is strategically withheld or distorted in an uncertain environment, hierarchies will tend to replace markets as an exchange mechanism in order to free this asymmetrically held information. The

framework suggests that transactions are performed either in the market or within firms, depending on the relative transaction costs incurred to overcome the effects of uncertainty, bounded rationality, and opportunism. In the market, information can be strategically withheld, each sale is a new bargaining agreement, and it is difficult to monitor each negotiation. In comparison, administrative procedures and accounting information can be used to ensure the flow of important information and openness in communication within a firm, as well as provide a mechanism for monitoring. A within firm market supports a permanent relationship without the need for continuous bargaining.

In the next chapter an intermediate state between markets and firms is presented and discussed. This state, called relational contracting, has characteristics that are similar to the JIT purchasing relationship. The focal point of relational contracting is cooperation. Relational contracting calls for a cooperative atmosphere between manufacturer and supplier and encourages the open exchange of information, eliminates the need for frequent and costly bargaining, and reduces the costs of monitoring. It is theorized that cooperation is supported by structural, behavioral, and communication factors. Each is discussed in turn.

Cooperation

Cooperation has been studied extensively in the psychology, sociology, and management literature and to a lesser extent in the marketing literature [Hunt, Ray, and Wood, 1985, p. 17]. This review of cooperation will define what cooperation is and highlight some of the general findings.

Frazier [1983], who developed his definition of cooperation from the work of Stern and Reve [1980], characterized cooperation as the composite of two elements: ability and effort.

Cooperation reflects the firms' ability to collaborate and work together in a joint fashion toward their respective goals. Effort concerns how much each firm puts into the relationship, their drive to reach such goals and to make the relationship successful. [p. 73]

Thus, a firm's ability to cooperate does not provide evidence that it is operating in a cooperative mode: the ability to cooperate must be combined with effort to attain mutually acceptable goals.

Others defined cooperation in terms of conflict and competition. Ross and Lusch [1985] studied the similarities between conflict and cooperation and found that specified domains and congruent perceptions of reality are associated with higher levels of cooperation. Deutsch [1973] noted that

. . .the crux of the difference between cooperation and competition lies in the nature of the way the goals of the participants in each of the situations are linked. In a cooperative situation the goals are so linked that everybody 'sinks or swims' together, while in the competitive situation if one swims, the other must sink. [p. 20]

In other words, cooperation may be defined as a situation where two or more people work together for mutually accepted goals in such a way that goal attainment for each party is more likely. In contrast, a competitive situation or zero-sum game calls for the gain of one person made at the expense of the other; that is, their goals are linked such that there is a negative relationship between their goal attainment. Goal compatibility then, is an important correlate of cooperation.

Deutsch [1973, pp. 29-30] provided a summary of the research in psychology on cooperation and competition. Four factors were significant: communication, perception (goal compatibility and domain consensus), attitude towards one another (trust), and task orientation. These factors determined whether the relationship was cooperative or competitive. Figure 2.1 illustrates some of the factors associated with cooperation and competition.

In assessing the management literature, Schermerhorn [1975] identified several major correlates of cooperation. He noted that resource scarcity or performance distress seemed to be the motivating force behind an organization's desire to obtain cooperation. He stated that

	Communication	Perception	Attitude Toward One Another	Task Orienta- tion
C o o p e r a t i o n	Open and honest exchange of relevant information	Increased sensitivity to similarities and common interests	Trusting and willingness to respond to requests	Joint problem solving and enhancement of mutual power and resource collaboration
C o m p e t i t i o n	Lack of communication or misleading information	Increased sensitivity to differences and threats	Suspicious hostile	Coercive processes used to influence

FIGURE 2.1 SUMMARY OF RESEARCH AND THEORY
ON COOPERATION AND COMPETITION

Organizations may be favorably disposed toward interorganizational cooperation where there is a need to gain access to otherwise unavailable resources, free external resources for alternative uses, and/or more efficiently employ existing resources.

His three major correlates of interorganizational cooperation were similar to Deutsch's. They were boundary permeability (communication), organizational goals (behavior), and opportunities to cooperate (structure and behavior).

Walton and Dutton [1969] presented a model of interunit conflict and collaboration in which they discussed antecedent factors. They relied on Walton's [1966] theory to explain the system dynamics of conflict (competition) and collaboration (cooperation). They identified three components of the relationship: 1) information exchange 2) structure of the interactions, and 3) attitudes towards the other units. These components paralleled Schermerhorn's correlates of interunit cooperation, and can foster or hinder cooperation. Thus, Deutsch, Schermerhorn, and Walton and Dutton, using different terminology but similar concepts, were in strong agreement regarding the basic factors affecting cooperation. The next sections relate these factors to the main factors in this research (structure, behavior, and communication).

Structural Variables

Schermerhorn's "opportunities to cooperate" are related to the behavioral and structural variables employed in this research. These opportunities consisted of prevailing norms and physical opportunities. The prevailing norms were those behaviors in the organization that encouraged a climate that was supportive of cooperation. Prevailing norms are discussed in the behavioral section. The second dimension is structure or the physical opportunities and is presented in Figure 2.2 in which JIT purchasing is compared to traditional purchasing practices.

Schonberger and Gilbert [1983] identified some of the specific structural changes associated with the adoption of JIT purchasing. These variables included a long-term and stable manufacturer/supplier relationship, avoidance of annual rebidding, sole or single source contracts, improved containerization, and localized buying. Each of these is discussed in turn.

Sole sourcing, also known as single sourcing, is a purchasing policy that calls for reducing the number of vendors for as many items as practical. This allows the buyer to concentrate on fewer relationships. A benefit of single sourcing is improved two-way communication when each party learns more about the problems, needs, and cost structures of the other. Treleven [1987] noted that "This

JIT Purchasing	Traditional Purchasing
Strong, long-term relationship	Competitive relations
Sole or single sourcing	Many sources
Suppliers nearby	Suppliers widely distributed
JIT delivery	Full truck deliveries

FIGURE 2.2 COMPARISON OF THE PHYSICAL ATTRIBUTES
IN TRADITIONAL AND JIT PURCHASING

Source: Adapted from R. Wolf [1984]

mutual understanding establishes the basis for cooperative, constructive problem solving" [p. 2]. To mobilize other companies in support of its JIT operation, manufacturers offer sole source commitments in return for ensured quality and reliable deliveries.

The long-term relationship allows the manufacturer and supplier to achieve stability in their dealings with each other. The long duration of the relationship reduces the degree of risk involved for the supplier so that he is more likely to invest in some processes for the benefit of the buyer. These investments might not occur otherwise. It assures the manufacturer a stable supply of inputs.

Localized buying is another important structural variable. The closer the supplier is to the manufacturer, the more feasible it is to have JIT delivery of materials. Smaller loads can be delivered on an "as needed" basis. Also this helps in the detection of defective goods since goods are used in the production line immediately and not stored or accumulated. If the manufacturer finds defective goods, the supplier is notified so that the manufacturing process can be corrected immediately.

Improved containerization allows the buying company to quickly check for count. If quality is assured by the supplier, items can be directly moved into the production process without inspection--thereby eliminating some of the waste associated with moving and storing inventory.

Containerization adds to the JIT commitment and helps smooth the JIT process.

Horngren and Foster [1987], Schonberger [1986], Schonberger and Ansari [1984], Hall [1983, 1987], Hay [1988], Treleven [1987], and Lee [1987] have identified these characteristics as consistent with the structure of a JIT purchasing arrangement. O'Neal [1986, 1987] studied some of the characteristics of JIT purchasing and found that longer-term relationships, more frequent interactions, greater customer support, a reduction in the number of suppliers, and an increase in the frequency of deliveries were among the structural variables in the JIT linkage.

In addition, there are structural variables associated with relational contracting, as in JIT. The variables include asset specificity, uncertainty, and frequency and are discussed in Chapter III as part of theory development.

Behavioral Variables

As has been noted above, the JIT relationship is not only an economic arrangement but also a partnership established for the benefit of both parties. As such, it is a social system with the attendant behavioral aspects. Deutsch [1973], Schermerhorn [1975], and Walton and Dutton [1979] identified several behavioral variables that affect the nature of the relationship. The behavioral variables are discussed next.

Perception of Equity

In a relational contracting situation, each organization, while working to maximize joint goals, will not want to suffer losses as a result of the partnership. Parties will endure some lesser wins in the short run because each realizes that, in the long run, there is an equitable sharing of the benefits. According to Van de Ven and Walker [1984],

Norms of equity refer to the degree to which each organizational party judges that the other fulfills its commitments and that the relationship is worth-while, equitable, productive, and satisfying. [p. 604]

The perception of equity is based on a social comparison of one's situation to another. That is, individuals compare their profits with others [Adams, 1963]. Wall and Nolan [1986] wrote that a state of equity existed when

. . . a person (P) perceives his or her ratio of inputs to outcomes proportionate to the ratio of a comparison other (O). Inequity results when the ratios are not perceived as equal. Inequity is conceptualized as an aversive motivational state that P will attempt to reduce by altering his or her own input/output ratio, altering O's input/output ratio or by perceptually distorting the situation to reduce the tension level. [p. 1036]

They applied Equity Theory to a task situation that required cooperation by a group of students. They found that inequity was related to conflict. Stated in a positive manner consistent with the present study, equity was related to cooperation. Equity was also related to satisfaction--both process and outcome satisfaction.

One method of monitoring the benefits of the relationship is through the use of accounting information to make a comparison of the ratio of inputs to outputs. Baiman [1982] used agency theory to describe the role of information and observability in devising contracts between economic agents. The value of ex post accounting information is that it helps to insure the quality of ex ante information. The ex post information validates the equitable distribution of benefits over time. The sharing of private ex ante information with regard to production schedules and sales forecasts is validated as these things occur. Accounting information is an important factor in one's perception of equity and is an antecedent of equity. By monitoring production schedules, sales forecasts, and profits ex post, the supplier is more likely to receive the best available ex ante information. Thus accounting information provides at least two benefits. The first is that it is an absolute measure of benefits that can be monitored. The second is that it insures the quality of ex ante information.

Perceptions of equity influence cooperation. If the distribution of benefits is perceived as equitable in the long run, then each party will be willing to continue to cooperate. However, if this perception of equity is too low, a firm will seek other partners with which to transact business.

Goal Congruence

Goal congruence or goal compatibility was defined by Reve [1980] as the extent to which organizations "simultaneously attain their goals" or the extent to which an organization perceives that it is presently attaining its goals in a relationship given the actions of the other organization. Goal congruence allows organizations to more fully engage in the exchange of proprietary information and other interactions. It reduces the distortions and rationing of information that might otherwise hinder the effectiveness of a JIT partnership. This construct has been used extensively in marketing and management to study conflict in distribution channels [Rosenberg and Stern, 1971; Etgar, 1976] and cooperation between agencies [Van de Ven and Walker, 1984]. These goals include business or economic goals, social goals, and consumer or client goals.

Domain Consensus

Domain consensus is the degree of mutual agreement over the allocation of roles, tasks, and functions. Thompson [1967] stated that

Domain consensus defines a set of expectations both for members of an organization and for others with whom they interact, about what the organization will and will not do. [p. 29]

It is the agreement over who does what in a relationship and definition of basic territories. Benson [1975] reported that researchers [W. Miller, 1958; and Braitto, Paulson, and

Klonglan, 1972] supported the idea that "consensus on operating philosophies produces cooperative relations" [p. 235]. Paulson [1976] tested the affect of domain consensus on perceived cooperative interaction and found a positive link.

Trust

Trust is a basic component in building a cooperative relationship [Blau 1964; Deutsch 1973; Pruitt 1981]. Schurr and Ozanne [1985] defined trust as "the belief that a party's word or promise is reliable and a party will fulfill his/her obligations in an exchange relationship" [p. 940]. Bariff and Galbraith [1978] attributed the existence of mistrust, along with insufficient information sharing for planning and performance measures, as important causes of intradepartmental conflict. Zand [1972] used Gibb's [1964] model to conceptualize "the transforming of one's inner state of trust (or mistrust) into behavior that is trusting (or mistrusting) through (1) information, (2) influence, and (3) control" [Zand, 1972, p. 230]. In a trusting situation vulnerability is increased with more and more disclosure of accurate, relevant, and complete data, with more interdependence and greater commitment, and with more acceptance of the influence from others. He found higher levels of trust were related with better goal clarity between parties and better communication in solving managerial problems. The results of this experiment, using

upper-middle managers in an off-site location, indicated that it is "useful to conceptualize trust as behavior that conveys appropriate information, permits mutuality of influence, encourages self-control, and avoids abuse of the vulnerability of others" [Zand, 1972, p. 238].

Schurr and Ozanne [1985], using M.B.A. students in a game situation, found that trust led to higher levels of buyer/seller integrative interactions or cooperative behavior aimed at satisfying mutual objectives. According to them

Integrative behavior has special relevance to buyer behavior because integrative behavior represents a form of cooperation that is more likely to result in goal achievement by both buyers and sellers, and hence, in more enduring buyer-seller relationships.

Pruitt [1981] suggested that higher trust is associated with cooperative behavior while low trust is related to conflict.

Communication Variables

Facilitating the easy and open exchange of information is an important factor in reducing opportunistic behavior and information impactedness. In a market situation, according to the markets and hierarchies framework, the remedy for opportunism is to change firms. Within a firm, the existence of some authority (management) in the hierarchy is expected to reduce opportunism and free information. In a relational contracting situation, such as

JIT purchasing, mutual trust to a large degree mitigates opportunistic behavior.

According to Deutsch [1973], "mutual trust can be established in people with an individualistic orientation through communication" [p. 198]. A limitation of Deutsch's and his associates' research is that the interaction is observed in two-person laboratory settings. He suggested that there is a need to investigate trust in more complex social situations involving more people. In addition to its effects on trust, communication in the form of financial statements affects perceptions of equity as noted above.

Voissem and Sistruck [1971] found that frequency of communication increased the mutual cooperativeness of players in a prisoner's dilemma game. In addition, experience with a particular partner enabled a pair to exchange information more openly [Schoeninger and Wood, 1969]. This experience is associated with building trust in a relationship. This trust set off a synergism that led the players to developed better problem solving techniques over time.

A study by Dutton and Walton [1966] examined the degree of shared information within two different manufacturing plants--one with a cooperative climate and the other with a competitive climate. They found cooperative plants shared a high degree of information and their performance surpassed the plant with a competitive climate. Van de Ven and Walker

[1984] studied relationships among agencies and found that communication fostered the growth of the relationship as well as consensus building.

Miller [1959] suggested that the more one organization knows about the strengths and limitations of the other, the more likely cooperative behavior is to occur. Knowledge of the other organization provides a basis for more reasonable demands and expectations.

It is important also that one party is able to change its relationship with another by opening up channels of communication. Improved understanding can result and thus lead to more cooperative modes of behavior. Voissem and Sistruck [1971] researched this potential for problem solving using nonzero-sum games and found that cooperative behavior appeared to be facilitated in games by players communicating their intentions to each other. More communication led to more cooperation and mutual cooperation in nonzero-sum games led to gains for both players. Mutual competition led to small losses for both. Cooperative attempts, however, on the part of one player, when coupled with a competitive move by the other player, led to a major gain by the competitive player and a minor gain or loss by the cooperative one. The value of cooperation with respect to end results and also the value of communication with respect to enhancing cooperation is shown in the research evidence on cooperation in gaming situations.

The focus in the accounting literature is usually on the formal information reporting system. Clancy and Collins [1979], however, focused on the uses of and relationships between the formal and informal accounting and information systems. They found that informal systems served a "useful and necessary adjunct to formal systems." However, Dirsmith and Covalleski [1985] obtained contradictory results. Instead of being complementary, they argued that informal information systems produced aberrant behavior due to errors in the informal systems. Johnson [1986] extended the work of Clancy and Collins and studied the use of formal and informal information systems in the evaluation of individual performance. Johnson concluded that the formal and informal systems may be complementary in that the informal system may have compensated for inadequacies of the formal system.

This prior research on types of information systems emphasized the importance of using more than one source of information. However, the formal/informal dichotomy is perhaps too narrow a lens with which to focus on the importance of communication in a JIT relationship. This research study will use a broader perspective as suggested by the markets and hierarchies framework in which the free exchange of information between partners should help

establish open and honest communication and preclude asymmetrically held information. The information obtained must be reliable and useful. Communication allows trust to be established between trading partners and trust enhances the openness of the exchange.

Outcomes

Performance outcomes can be measured using economic or perceptual indicators, and the indicators can be defined in terms of overall company achievements, JIT production outcomes, or JIT purchasing outcomes. Figure 2.3 shows some of the available outcome measures. From a companywide perspective, firms implement the JIT philosophy of production and purchasing to achieve better profitability and to increase or maintain market share.

In the production process, JIT can also be measured in terms of cost savings and other measures that are more difficult to quantify but, nonetheless, can be measured. These include such measures as less rework and shorter setup times. Indicators of performance in JIT purchasing situations include higher asset turnover, quality of inputs, reliable delivery, decreased scrap, lower ordering costs, and lower carrying costs. These quantitative measures, however concrete they are, are not without problems. For example, it is difficult to say which among all the measures mentioned above is the true indicator for evaluating success in a JIT situation.

	Economic Indicators	Perceptual Indicators
Global Company Indicators	Net Income Market Share	Perceived Effectiveness of JIT
JIT Production Indicators	Lower Unit Cost Higher Quality	Perceived Effectiveness of JIT Production System
JIT Purchasing Indicators	Higher Turnover Quality of Inputs Reliable Delivery Decreased Scrap Lower Ordering Costs Lower Carrying Costs	Perceived Effectiveness of the JIT Relationship

FIGURE 2.3 OUTCOME MEASURES FOR THE JIT PHILOSOPHY

Other possible indicators of success are perceptual: that is, they measure the degree to which JIT purchasing and/or production is perceived to be effective. This effectiveness can be an overall company measure, a production measure, or a purchasing relationship measure. Van de Ven and Ferry [1980] provided an example of a broad indicator with which to measure success in a relationship. They suggested that an appropriate indicator measures "the extent organizations carry out commitments and the parties believe that the relationships are worthwhile, productive, and satisfying" [p. 308].

Finally, the influence of cooperation on performance has been studied extensively. In a meta-analysis of over 100 studies Johnson et al. [1981] found that cooperation resulted in higher productivity especially for problem solving and related tasks. It seemed most useful for projects that require pooling of efforts and sharing information.

Chapter Summary

In this chapter, relational contracting was introduced in the context of the choice between market-based and hierarchical transactions. The selected literature review was interdisciplinary, drawing on studies in the accounting, social-psychology, management, and marketing disciplines. Structure, behavior, and communication were related to cooperation as they affect JIT performance and effectiveness.

CHAPTER III

THEORETICAL DEVELOPMENT OF THE MODEL

Introduction

Many firms seeking to maintain or regain market share and profitability have adopted the Just-in-Time (JIT) philosophy of management [Hay, 1988; Hall, 1987; Schonberger, 1986; Schonberger and Gilbert, 1983]. One component of this manufacturing philosophy is JIT purchasing. It calls for more interaction between supplier and manufacturer, along with less frequent changes in suppliers. The goal is to build better relations with a few suppliers who can provide high quality materials when needed for production.

This chapter develops a theoretical model based on a markets and hierarchies framework [Williamson, 1985, 1986] to study the dynamics of the manufacturer/supplier relationship. The model associates JIT with a particular kind of relationship called relational contracting. The relational contracting model suggests that structural, behavioral, and communication variables encourage an atmosphere of cooperation, which is conducive to a successful JIT purchasing arrangement. This type of contracting requires a long term and stable commitment between the buyer and supplier. The success of this arrangement can be measured in financial and operational

outcomes and in the perceptions of participants. Each of these ideas is developed in the following sections.

JIT Philosophy Benefits Manufacturers

The JIT philosophy has been adopted by manufacturing firms for the purpose of lowering overall unit costs and improving quality. These two goals are among the main reasons why foreign manufacturers have been so successful. When a manufacturer adopts the JIT philosophy, attention is directed at elimination of waste using the components identified by Hay [1988]: (1) a high level of employee involvement, (2) a higher, more consistent quality of inputs and (3) various improved flow techniques. This waste, defined as anything that does not add value to a product, includes activities such as counting, moving, storing, and inspecting. For example, by reducing setup time, manufacturers find they no longer need buffer stock to meet demand because equipment downtime is minimal. Waste is also decreased when the quality of inputs is improved. Poor quality materials affect unit cost of production in terms of scrap and rework cost and lost time. In addition, if quality inputs can be assured, then there is little need for costly inspections. Inventory obsolescence is less of a problem because there is so little inventory and it is turned over quickly. In some cases, the cost per unit of inputs may be somewhat higher because of higher quality and

more demand on suppliers, but final unit cost is lower because of eliminated waste. In other cases, costs of inputs may be lower. This occurs because risk is reduced as a result of the long-term and stable JIT relationship which extends the suppliers time horizon for recovering capital investments made to improve production processes and quality. JIT purchasing and production, then, supports the achievement of two important goals--the reduction of overall costs and the assurance of higher quality--that can lead to improvements in both profits and market share.

Improved quality has two bottom line benefits: (1) customer satisfaction should improve, and (2) warranty expenses should drop dramatically. These two improvements can have a direct affect on market share and profitability.

When JIT production is implemented, manufacturers quickly find that JIT purchasing is a crucial factor because of the need for reliable delivery and quality inputs. Figure 3.1 shows the overall relation between JIT purchasing, production, market share, and profitability.

Some of the elements of the JIT philosophy require only physical changes. Others, such as JIT purchasing, require a basic change in the attitudes of the firms involved. To succeed, JIT purchasing requires more than just reliable delivery, at the right time and in the right place. It requires development of a relationship based on cooperation

FIGURE 3.1 OVERALL RELATIONSHIP BETWEEN JIT PURCHASING, PRODUCTION, MARKET SHARE, AND PROFITABILITY

between the supplier and manufacturer [Schonberger and Gilbert, 1983]. In the long run, the benefits of JIT purchasing may disappear if the relationship reverts to or remains the traditional adversarial one where the lowest cost is the most important criteria. For this reason, it is important to study the factors that support a cooperative relationship, namely, the structural, behavioral, and communication variables (Figure 3.2). Identification of these factors pinpoints aspects of the JIT partnership that are critical to the development of a cooperative relationship.

With the adoption of the JIT philosophy, improvements can be expected in increased or sustained profitability and market share. The direct outcomes associated with JIT purchasing include measurement of increased inventory turnover, inventory reduction, better quality inputs, decreased scrap, reliable delivery, less rework, reduced carrying costs, and lower ordering costs. The indirect outcomes appear as lower unit cost and improved quality of the final product, which contribute to increased profitability and market share.

A relational contracting approach, as developed from the markets and hierarchies framework, is used to provide a theoretical basis for the study of the JIT purchasing relationship. Focusing on cooperation, factors conducive to

FIGURE 3.2 THE JIT PURCHASING RELATIONSHIP

relational contracting are discussed as they might exist in a JIT purchasing situation. In the next section the markets and hierarchies framework is discussed.

The Markets and Hierarchies Framework

The JIT purchasing relationship can be discussed in terms of the markets and hierarchies framework [Williamson, 1971]. It provides a background from which to examine the dynamics of the partnership. Spicer and Ballew [1983, p. 79] believe that it can be used to address the following issues:

(1) problems of cooperation and exchange in markets and firms, (2) the dynamic forces affecting the relative transactional efficiencies of alternative ways of organizing, and (3) the central place of information and its associated costs among these forces.

These ideas are important because this research looks at cooperation as a central dimension in facilitating an alternative way of organizing transactions that is neither pure market nor pure hierarchy. In a JIT partnership, open communication in the form of information sharing is a particularly critical issue because of its influence on the behavior dimensions and also because of the proprietary nature of that information.

The markets and hierarchies approach is based on the premise that transactions are performed either in the market or within firms, depending on the relative transaction costs

incurred to overcome the effects of uncertainty, bounded rationality, and opportunism. The transaction costs include the costs of obtaining information, of bargaining, and of monitoring. The market is able to attenuate transaction costs when there are a large number of alternative sources for standardized commodities. As the number of sources decrease or as the commodities become less standard, firms may integrate vertically (become hierarchies) to overcome opportunism and the lack of good information and to reduce transaction costs. This integration may be a less expensive device for harmonizing the interests of various parties although it has other costs such as loss in flexibility. Integrating vertically releases impacted information because control mechanisms are available to management to foster information sharing. Williamson states that

Not only does the firm have the constitutional authority and low-cost access to the requisite data which permit it to perform more precise own-performance evaluation (of both a contemporaneous and ex post variety) than can a buyer, but its reward and penalty instruments.....are more refined. [1986, p. 87]

Conflict resolution mechanisms are efficient whereby intra-organization disputes can be settled by fiat if necessary.

Markets and firms, however, are only polar extremes. There are other governance structures that are neither pure market nor pure hierarchy. Relational contracting is one such structure that blends the characteristics of both

markets and firms in a pseudo-hierarchical arrangement between independent parties. This type of contracting rewards independent firms in terms of reduced uncertainty and joint profits when they are able to cooperate for the mutual benefit of manufacturer and supplier. Relational contracting is discussed in more detail in the next section.

Relational Contracting

Relational contracting is one type of governance structure that occurs when there are incentives (because of the effects of uncertainty, opportunism, and bounded rationality) to use transactional arrangements other than pure market or pure hierarchy (vertical integration). Williamson [1986, pp. 101-130] explains why different contractual arrangements exist and identifies, based on Macneil's ideas [1980] of discrete and relational exchange, three critical dimensions for characterizing transactions. These dimensions, uncertainty, frequency, and asset specificity, are discussed next.

Uncertainty

Uncertainty, in some degree, is a prerequisite to the choice of structure. In a certain world (low degree of uncertainty), there are no risks because all information is available. Uncertainty in moderate or high degrees makes planning, decision making, and negotiating more difficult. Examples of conditions in the environment that influence the

degree of uncertainty include unknown supply and demand, government intervention, and tax changes.

Frequency

Frequency consists of three categories: one-time, occasional, and recurrent. A one-time purchase assumes no mutual dependence. A commodity is paid for and the transaction is completed. There is no expectation of future transactions. Occasional purchases are similar to one-time purchases in that there is no expectation of an ongoing relationship. For the purpose of this discussion one-time and occasional purchases are assumed to be the same. Recurrent purchases are repeated purchases. They may occur with standardized commodities or occur with specialized goods requiring significant investment by the supplier. Recurrent purchases become more interesting when asset specificity is considered. This subject is discussed below in the context of investment characteristics.

Asset Specificity

Williamson [1985] argues that asset specificity is a critical dimension for describing transactions. He says that

Parties engaged in a trade that is supported by nontrivial investments in transaction-specific assets are effectively operating in a bilateral trading relation with one another. Harmonizing the contractual interface that joins the parties, thereby to effect adaptability and promote continuity, becomes the source of real economic value. [p. 30]

Asset specificity is the degree to which specific investment costs are incurred to produce specialized goods. If a supplier's productive assets are of a nonspecific nature, and thus redeployable for other productive uses, then the firm is not limiting its options by producing for a particular manufacturer. Moreover, if the productive outputs are standardized, they can be easily sold elsewhere giving the supplier greater flexibility. However, investment in additional equipment to produce specialized output for a particular buyer or producing special nonstandard items limits a supplier's flexibility and increases risk. If all contracting were for standardized commodities, then long-term relational contracting would not be necessary in order to reduce the uncertainty. It would be feasible to use only recurrent spot contracting.

Idiosyncratic transactions are "ones where the human and physical assets required for production are extensively specialized..." [Williamson, 1986, p. 114]. These are investments tailored to specific relationships. They are not readily or easily redeployed for other productive uses.

In the mixed situation, there is less asset specificity and the economies of scale favor outside purchases. A supplier may incur idiosyncratic cost when he produces inputs for a particular buyer that, because of special design or quality, is not suited for other buyers or when

the supplier builds a plant near a specific buyer to provide quick and reliable delivery. If a supplier is guaranteed a long-term relationship, the supplier may be more likely to invest in special processes and equipment for a particular manufacturer.

According to Williamson [1986] asset specificity applies to the characteristics of the investments made by suppliers. It also seems that asset specificity applies to the buyer that has invested in some production processes which require only special inputs that a particular source is providing. For example, in automating a manufacturing process, a manufacturer may use robot technology that requires specially designed assembly parts that are not standard in the industry. Thus, the buyer becomes dependent on limited number of sources who will provide those parts.

Types of Transactions

The types of transactions that might occur given a combination of investment characteristics and frequency assuming uncertainty is discussed next. Figure 3.3 is a table summarizing these combinations.

Cells one and two represent commodities in which many buyers can purchase items from many alternative sources. Market transactions are the usual exchange or governance mode and these transactions can be enforced by litigation.

		INVESTMENT CHARACTERISTICS		
		Non-Specific	Mixed	Idiosyncratic
F R E Q U E N C Y	A	Cell 1 Purchasing standard equipment Market Mediated	Cell 3 Purchasing customized equipment Arbitration	Cell 5 Constructing a plant Arbitration
	B	Cell 2 Purchasing standard material Market Mediated	Cell 4 Purchasing customized material Relational	Cell 6 Site-specific transfer of intermediate product across successive stages Hierarchy

A=Occasional purchases
B=Recurrent purchases

FIGURE 3.3 TRANSACTION TYPES AND GOVERNANCE STRUCTURES

Source: Adapted from Williamson, 1986

However, protection against opportunism is mainly provided by the alternatives present in the marketplace. Relationships are not of particular value.

Cells three and five represent occasional purchases of a mixed and idiosyncratic nature. Williamson suggests that there is interest in sustaining the relationship especially for idiosyncratic transactions. Because the supplier has invested heavily in producing specific goods, the goods cannot be disposed of in the market and some other form of governance must exist. Rather than using litigation, the parties will use third party arbitration to settle disputes. For example, he says that architects provide relatively independent expertise in a construction contract question.

The governance structure in cell six is usually represented by vertical integration of the buyer and supplier. In this type of governance structure, JIT purchasing can exist but transaction disputes are mediated within the vertically integrated firm.

Cell four, relational contracting, preserves the autonomy of both parties while creating strong incentives to maintain the relationship between manufacturer and supplier. This type of bilateral governance occurs for several reasons. Some manufacturers may not be able to produce the goods economically within the firm. The supplier may be able to take advantage of the economies of scale. By specializing in certain products, a supplier may also be

able to control quality and costs more effectively. The incentive to maintain this bilateral relationship arises from the supplier's investment in specific assets to produce customized materials for a manufacturer.

JIT is a form of relational contracting in which guaranteed quality and sole sourcing require a supplier to invest in specific processes for a particular manufacturer and calls for the reduction in the number of vendors on the part of the manufacturer. Each may forego opportunities to supply or be supplied by other firms. Williamson [1986] states that, "Bilateral structures [such as JIT purchasing] have only recently received the attention they deserve and their operation is least well understood" [p. 114].

Uncertainty and recurrent purchases of goods produced with asset specific investments increase transaction costs when purchases are made in the market place. A firms may integrate vertically to reduce these costs or may adopt an intermediate governance structures such as relational contracting. Various benefits and costs are associated with relational contracting. Among the benefits, Dwyer, Schurr and Oh [1987] identify reduced uncertainty, managed dependence, exchange efficiency, and the "possibility of significant gains in joint--and consequently individual--payoffs as a result of effective communications and collaboration to attain goals." Additional costs, however,

may be incurred if goals are highly divergent leading to conflict. The model and the variables that facilitate relational contracting and consequently JIT purchasing are discussed in the next section.

Model Development

This study uses relational contracting, developed from the markets and hierarchies framework, as an approach for explaining how the structural, behavioral, and communication variables facilitate a successful JIT purchasing arrangement. Spicer and Ballew (see page 44) suggested that the markets and hierarchies framework was useful in addressing three issues in particular. The first and second issues are the changes in competitive/cooperative behaviors depending on the choice of governance structure as well as effect of various forces (structure and behavior) affecting each. The third issue is concerned with the changes in communication under the three governance structures. Figure 3.4 illustrates each governance structure and related structure, behavior, and communication variables.

Relational contracting is depicted as a governance structure whose successful development is dependent on achieving a cooperative relationship between manufacturer and supplier. To achieve this cooperation, Figure 3.2 showed the general relationships between the structural, behavioral, and communication variables and cooperation as they affect JIT purchasing outcomes. This model for JIT

	Markets	Relational Contracting	Hierarchies
Structure	Little or no formal structure. No future expectations or obligations.	Long-term and stable relation needed to achieve cooperative arrangement.	Harmonization of interests by bureaucratic solutions. Decisions by fiat if necessary.
Behavior	Competitive behavior. No ongoing relationship except for the transaction.	Cooperation facilitated by trust, goal compatibility, domain consensus, and equity. Benefit to both partners important.	Cooperation enforced from above as needed. Control and reward mechanisms using accounting numbers.
Communication	Minimal buy/sell negotiations	Mechanisms needed to insure open and honest communication between buyer and supplier. Interorganizational network.	Extensive intraorganizational communication network.

FIGURE 3.4 STRUCTURE, BEHAVIOR, AND COMMUNICATION VARIABLES AND THE MARKETS AND HIERARCHIES APPROACH

purchasing gives a broad picture of the relationships that support the cooperative environment described above.

The structural component consists of the physical elements. It includes the presence of long term contracts which facilitate stability, reduction of the number of suppliers with the establishment of sole sourcing, and finally improved containerization and localized buying, which helps attain rapid and reliable deliveries. The second component, the behavioral variables associated with cooperation, include trust, perception of equity, domain consensus, and goal compatibility. The final component measures the openness, frequency, reliability, freedom of exchange, ease, and usefulness of the information exchange. Each of these components influences the JIT cooperative relationship. The influence of cooperation on the outcomes of the JIT purchasing relationship is reflected the effectiveness of the relationship and overall performance of JIT.

Research Model

Relational contracting is used as the basis for the research model in this study. In this section the model variables are defined and the relationship between the variables in the model are discussed. The research model in Figure 3.5 shows the effects of structure, behavior, and communication on cooperative relations and JIT outcomes. As was discussed in the literature review, the hypothesized

FIGURE 3.5 JIT PURCHASING RESEARCH MODEL

behavior variables showed complex associations with each other and with communication. These associations appear in the model.

The model suggests that attaining cooperation is the result of various factors, namely structure, behavior, and communication, which act together to produce a certain atmosphere that makes it possible to sustain the dynamics of the JIT purchasing relationship. These factors and the the variables associated with each were discussed in Chapter II and are summarized again in the discussion of model.

Since JIT purchasing is a joint effort for the mutual benefit of both entities, it follows that cooperative efforts lead to improved economic indicators of both an operational and financial nature and positive perceptions regarding the relationship. The economic indicators include improved quality of inputs, decreased scrap, lower ordering costs, lower carrying costs, and reduction in inventory. In addition to these, this study measures an overall perception of the effectiveness of the relationship.

The structural variables in this model are derived from the JIT literature, which describes the physical attributes of JIT purchasing. The long term nature of a JIT relationship, the reduction in the number of suppliers, and sole sourcing allow a manufacturer to concentrate his efforts

with his suppliers in developing a cooperative relationship to achieve quality inputs. The structural variables also affect the JIT outcomes. Without the cooperative JIT purchasing atmosphere, however, the relationship will revert to the traditional adversarial relationship and JIT purchasing achievements will not endure.

The behavioral variables associated with this model are goal compatibility, domain consensus, trust, and perceptions of equity. Not only are these variables related to cooperation, but some are also associated with other behavioral variables and with communication. These associations are discussed in terms of the research model above.

Goal compatibility influences cooperation which enhances the likelihood of mutual goal attainment or outcomes. It also reduces distortion that might otherwise hinder the effectiveness of a JIT partnership. The relationship between goal compatibility and domain consensus is exploratory. It is reasonable to expect that compatible goals would facilitate agreement over their respective tasks vis-a-vis each other. Domain consensus, defined as the mutual agreement over the allocation of roles, tasks, and functions, is facilitated by communication between the supplier and manufacturer. A positive link between domain consensus and cooperative interaction was found to exist by Paulson [1976]. The perception of equity is influenced by accounting information

such as financial statements, cost estimates, forecasts, and production data, which are shared in a system of open communications. Perception of equity is linked in a positive direction to cooperation and process and outcome satisfaction. Trust has been identified as a basic component in building a cooperative relationship [Blau, 1964; Deutsch, 1973; Pruitt, 1981; Schurr and Ozanne, 1985]. High levels of trust are associated with cooperative behavior.

Communication is an important variable in relational contracting. The open exchange of information helps reduce opportunistic behavior and information impactedness. The information system, the one-to-one personal contact and the exchange of personal help to build trust between the manufacturer and the supplier. As mentioned above, the exchange of information contributes to the perception of an equitable division of benefits in the JIT partnership.

The influence of communication on cooperation was shown to be important [Dutton and Walton, 1966; Voissem and Sistruck, 1971; Deutsch, 1973; Van de Ven and Walker, 1984]. In general, the more one organization knows about the strengths and limitations of the other, the more likely cooperative behavior is to occur.

Chapter Summary

A theoretical model was developed based on relational contracting to study the dynamics of the JIT manufacturer/supplier relationship. Using Williamson's

conceptualization of the different governance structures for transactions, the expected structural, behavioral and communication requirement for each governance structure was presented. Then, the generalized relationships were depicted in the theoretical relational contracting model. Finally, the research model, illustrating the specific relationships to be tested, was presented. The next chapter discusses the methodological issues for this study.

CHAPTER IV

RESEARCH METHODOLOGY

Introduction

The methodological issues of the proposed research are discussed in this chapter. The first part covers research design and the second part presents the statistical procedures and hypotheses. Included in the research design description is a discussion of the subjects, sample, data collection, pretesting, problems associated with nonresponse bias, and operationalization of the measures for the questionnaire. The second part discusses structural modeling, presents the research model and associated hypotheses, and gives an overview of the two-step process for analyzing the data.

Research Design

Subjects

To test the research hypotheses of this study, data were collected from members of organizations using JIT purchasing as part of their overall manufacturing strategy. The subjects held positions with titles including purchasing agent, buyer, purchasing manager, procurement officer, procurement manager, materials manager, and purchasing supervisor.

Sample

The names of potential JIT companies and consequently their employees were obtained from two sources. One source consisted of published names of companies that had been identified as world class manufacturers and a few referrals. Telephone calls were made to firms to obtain names of purchasing personnel. Names of 154 potential respondents were generated from this source. The second source consisted of a list of purchasing personnel from original equipment manufacturing firms with Standard Industrial Codes 34-39 (fabricated metal products, machinery, electric and electronic equipment, transportation equipment, instruments and related products, and miscellaneous manufacturing industries). A list of 2,500 randomly selected names was purchased from a pool of 62,342 names that were available from this source.

Data Collection Procedures

Questionnaires were distributed by mail. In the cover letter, each subject was asked to provide his perceptions regarding the JIT purchasing relationship between his company and its suppliers. (See Appendix A.) In addition, each respondent was reminded that his perceptions were vital to the success of the research project. The respondents were assured that their perceptions and comments were confidential; the data gathered would be used in aggregate

statistical analyses only. Each respondent could obtain a summary of the results by enclosing a business card. A business reply envelope was provided for their convenience.

Approximately two weeks after the initial mailing, a second request was made. A questionnaire was included for the convenience of the respondent as well as a short appeal letter and a business reply envelope.

Pretesting

Pretesting of the questionnaire was performed in two stages. In the first stage, the questionnaire was reviewed by academics and purchasing professionals for validity, meaning, ambiguity, redundancy, and clarity. In the second stage, the revised questionnaire was tested in a pilot study of 225 subjects from the OEM purchasing personnel mailing list. A complete packet (questionnaire, cover letter, and business reply envelope) was mailed to each. Five questionnaires were returned as undeliverable. The response rate was 23% (24 were JIT firms and 26 did not use JIT). This response rate was used to estimate the mailing size needed to obtain a sufficient sample for analyzing data using structural equation modeling.

Nonresponse Bias

The possibility of the occurrence of nonresponse bias is high in mail questionnaires because of typically low return rates. Kerlinger [1973, p. 414] states that "every

effort should be made to obtain returns of at least 80 to 90 percent or more, and lacking such returns, to learn something of the characteristics of the nonrespondents."

Yu and Cooper [1983] discuss the effects of response rates to questionnaires. According to them,

The efficiency of sampling does not guarantee its accuracy. Of special importance is the inaccuracy in sample estimates caused by nonresponse bias, which occurs when a researcher (1) fails to obtain information from a sizable portion of the sample members and (2) the missing members' responses affect conclusions about the variables of interests. [p.36]

The problem of nonresponse bias was addressed by (1) the nature of the appeal in the cover letter from a university source, (2) a second mailing to respondents to encourage response, and (3) testing for nonresponse bias.

Armstrong and Overton [1977] suggest that late respondents can be compared to nonrespondents. They assume that respondents who take longer to respond more closely resemble nonrespondents than early respondents. Thus, significant differences in means between early and late respondents may indicate the presence of underlying differences between respondents and nonrespondents and would indicate nonresponse bias. The results of this testing is reported in Chapter V. In the next section the measurement constructs are operationalized.

Data Measures and Constructs

The constructs to be investigated in this study were derived from the theoretical and research base reviewed in the previous chapters. Each construct is conceptually defined and measures of each developed.

The questionnaire contained measurement scales for the eight research variables: goal compatibility, domain consensus, communication, equity, trust, structure, cooperation, and perceived effectiveness and performance of JIT. A seven-point Likert-type scale was used. The final section elicited general information. A discussion of each instrument follows. (Appendix B contains the questionnaire items.)

JIT outcomes were operationalized using perceptions of performance and effectiveness. The goals of JIT purchasing and production are to increase profits and sustain or improve market share. The intermediate performance goals of JIT include increased inventory turnover, inventory reduction, improved input quality, improved vendor response time, reliable delivery, decreased scrap, lower ordering costs, and lower carrying costs. Because respondents' access to specific proprietary company data might vary from firm to firm, respondents were asked to determine the extent to which JIT purchasing impacted the outcomes described above. The instrument was adapted from Ansari [1984]. The author did not report reliability. Perception of

effectiveness of the relationship was operationalized using an instrument developed by Van de Ven and Ferry [1980]. It measures the extent to which organizations carry out commitments and the extent to which they believe that the relationships are worthwhile, productive, and satisfying. Perceptions of effectiveness were collected to obtain respondents' overall attitude regarding the JIT relationship in addition to the performance indicators.

The perception of cooperation was operationalized using Hall et al.'s [1977] measure. Their questionnaire included items about coordination of activities, disagreement, and disagreement handling. In addition, items were constructed to measure several dimensions of cooperation--problem solving atmosphere, helpfulness, and the working relationship with the supplier. These items are considered appropriate for the theoretical construct being investigated.

The construct for communication was adapted from the forty-five-item Dennis Communication Inventory [Ledbetter, Snyder, and Cox 1985]. Items concerning openness and candor in the exchange of information, the reliability of information, the usefulness of the information, quantity, ease of getting in touch, and quality of communications were employed. No reliability coefficient was reported.

The measurement instrument for structure was operationalized using a dimensional method. Van de Ven and

Ferry [1980] state that

. . . the dimensional method of defining and studying structure has the major advantage of inclusiveness and generality . . . and this provides greater potential for drawing inferences from one study to the next. [p. 303]

The dimension of intensity measures the strength of a company's relationship and is an indicator of the investment made in it [Marrett, 1971]. Three items were constructed that related to the company's commitment to JIT purchasing and production methods. The elements of JIT purchasing were identified and described by Schonberger and Gilbert [1983], Schonberger and Ansari [1984], Hall [1983, 1987], and Hay [1988]. These items measured the extent to which the JIT relationship was long term and stable. Items concerning sole sourcing, reduction in vendors and the proximity of vendors were also used.

Four behavioral constructs--goal compatibility, domain consensus, trust, and equity--were used to test the behavioral dynamics of the JIT relationship. The measure for goal compatibility was operationalized using the extent to which an organization perceives that it is presently attaining its goals in a relationship given the actions of the other organization. Broadly, it is the extent to which manufacturers and suppliers attain their individual goals while pursuing mutual goals. The items for goal compatibility were adapted to reflect the JIT manufacturer/supplier

purchasing relationship from a construct developed by Reve [1980]. Reliability coefficients of .77 and .78 were reported for the two groups studied.

Domain consensus is defined as the level of agreement between the manufacturer and the supplier over roles, tasks, and functions. The statements reflecting domain consensus are adapted from a construct developed by Reve [1980]. The scale elicited the respondent's perceptions regarding resolution of disagreements, agreement over current ordering practices, respective responsibilities, including defective parts and timely deliveries. Reve reported reliability coefficients of .75 and .82, respectively, for each of the two study groups.

Trust is measured by a six-item scale adapted from Sullivan, Peterson, Kameda, and Skimada [1981]. These authors used a shortened version [Kaplan, 1973; Corazzini, 1977] of Rotter's interpersonal trust scale [1967]. Sullivan et al. identified the significant dimensions of trust: sincerity, strength of the relationship, reliance, expectations about of future behavior, and trust itself. The scale was employed in a cross cultural study concerning conflict resolution approaches and trust for American and Japanese managers. The authors reported an internal reliability of .76 for their eleven-item measure for the American sample. Chronbach's alpha for the Japanese sample was .78.

The measurement instrument for perception of equity was adapted from the Linda Nolan's original six-item instrument described in the article by Wall and Nolan [1986]. Equity is conceived as the "extent to which individuals felt each member contributed equally to the work load" [p. 103]. Items were used which related to an equitable share of benefits and contributions. The authors reported a Cronback alpha of .89.

The final part of the questionnaire requested information on the length of time the company and respondents have been involved in JIT purchasing. A third question asked percent dollar value of JIT purchasing. Information concerning JIT production, years with JIT production methods, current job title, number of employees, end product, and Standard Industrial Code was also obtained.

Statistical Procedure and Hypotheses

Structural Equation Modeling

Structural equation modeling is used to test the JIT purchasing model using LISREL developed by Joreskog. This method of modeling combines path analysis and factor analysis to evaluate relationships between latent and observed constructs. It also evaluates the relationship among the latent constructs themselves taking into consideration measurement error and the possible interdependence among variables. Bagozzi [1980, p.108]

discusses the requirements for using this statistical procedure: the hypotheses are theoretically derived, the distribution is multivariate normal, interval scaling is used, and the relationships are linear. Joreskog and Sorbom [1985] describe LISREL as

. . .a general computer program for estimating the unknown coefficients in a set of linear structural equations. The computer program is based on a general model which is particularly designed to handle models with latent variables, measurement errors and reciprocal causation (simultaneity, interdependence). In its most general form the model assumes that there is a causal structure among a set of latent variables. The latent variables appear as the underlying causes of the observed variables. Latent variables can also be treated as caused by observed variables or as intervening variables in a causal chain.

The research model was presented in the previous chapter in Figure 3.6. The LISREL model applied in this research is presented in Figure 4.1. The research hypotheses are presented next.

Hypothesis 1 tests the overall research model.

H1: JIT effectiveness and performance can be explained from the structural, behavioral, and communication dimensions as they influence cooperation.

The fit of the overall research model is tested using three of the measures of overall fit recommended by Joreskog and Sorbom [p. 42-43]: Chi-square, the goodness of fit index (GFI), and the root mean squared residual (RMR).

FIGURE 4.1 THE LISREL MODEL

The model for JIT purchasing hypothesizes the relationships for eight constructs. These research hypotheses, stated in the alternate form, follow from the model.

- H2: A positive relationship exists between goal compatibility and cooperation.
- H3: A positive relationship exists between domain consensus and cooperation.
- H4: A positive relationship exists between communication and cooperation.
- H5: A positive relationship exists between trust and cooperation.
- H6: A positive relationship exists between perception of equity and cooperation.
- H7: A positive relationship exists between communication and perception of equity.
- H8: A positive relationship exists communication and domain consensus.
- H9: A positive relationship exists between cooperation and JIT outcomes.

Three exploratory hypotheses, not empirically supported in the literature, hypothesize the influence of structure on cooperation, the influence of goal compatibility on domain consensus, and the influence of structure on JIT performance and effectiveness. The hypotheses are as follows:

H10: A significant positive relationship exists between goal compatibility and domain consensus.

H11: A significant positive relationship exists between structure and cooperation.

H12: A significant positive relationship exists between structure and JIT performance and effectiveness.

The significance of each of the structural coefficients associated with each of the hypothesis is tested using LISREL's T values. They "provide the number of sampling distribution standard deviations the estimate is away from zero and hence can be used to test the null hypothesis that the true parameter value is zero" [Hayduk, p. 174].

By comparing LISREL's T value to a critical value obtained from a normal probability table, the significance level of each structural coefficient is determined.

LISREL Model Specification

The LISREL model, illustrated in Figure 4.1, consists of four latent or unobserved exogenous variables predicted outside the model and four latent or unobserved endogenous variables predicted within the model. The exogenous variables (ξ) are goal compatibility, communication, trust, and structure. The endogenous variables (η) are domain consensus, equity, cooperation, and the JIT outcomes. The latent constructs are represented by circles while the

observed variables are represented by squares. The arrows between the latent constructs indicate causal relationships. LISREL allows the researcher to model the relationships between the exogenous variables. These relationships (referred to as ϕ s) are similar to the correlations among the predictors in multiple regression and are depicted by curved lines with double arrows. The effects of the exogenous variables on the endogenous variables are denoted by γ s while the effect of endogenous variables on endogenous variables are denoted by β s. Errors in the measurement model are denoted as δ for exogenous variables; ϵ for endogenous variables. Each equation contains an error factor called ζ . λ_x indicates the relationship between an "x" variable and an exogenous variable. Similarly, λ_y relates the observed "y" items to the unobserved endogenous constructs. Figure 4.2 illustrates the LISREL terminology in terms of the research constructs.

Figures 4.3-4.5 contain the structural equations, the measurement equations for the x's, and the measurement equations for the y's, respectively. Both the general form for the equations and the specific research equations are presented.

The Two-Step Approach

Anderson and Gerbing [1988] recommend a two-step approach in which the measurement model is evaluated

ξ_1	-	GOAL COMPATIBILITY
ξ_2	-	COMMUNICATION
ξ_3	-	TRUST
ξ_4	-	STRUCTURE
η_1	-	JIT OUTCOMES
η_2	-	COOPERATION
η_3	-	DOMAIN CONSENSUS
η_4	-	EQUITY
x_1 - x_7	-	indicants of GOAL COMPATIBILITY
x_8 - x_{17}	-	indicants of COMMUNICATION
x_{18} - x_{23}	-	indicants of TRUST
x_{24} - x_{31}	-	indicants of STRUCTURE
y_1 - y_{15}	-	indicants of JIT OUTCOMES
y_{16} - y_{22}	-	indicants of COOPERATION
y_{23} - y_{27}	-	indicants of DOMAIN CONSENSUS
y_{28} - y_{31}	-	indicants of EQUITY

Definitions of LISREL's General Terms

ξ (xi)	-	an unobservable (latent) exogenous variable
η (eta)	-	an unobservable (latent) endogenous variable
x	-	an observed indicant of an exogenous variable
y	-	an observed indicant of an endogenous variable
p	-	the number of y -variables
q	-	the number of x -variables
m	-	the number of η -variables
n	-	the number of ξ -variables

Parameter Matrices

Λ_y (Lambda-y)	-	a $p \times m$ matrix of the relationships among y 's and η 's
Λ_x (Lambda-x)	-	a $q \times n$ matrix of the relationships among x 's and ξ 's
B (Beta)	-	an $m \times m$ matrix of the relationships among the η 's
Γ (Gamma)	-	an $m \times n$ matrix of the relationships among the ξ 's and η 's
Φ (Phi)	-	an $n \times n$ matrix of the relationships among the ξ 's
Ψ (Psi)	-	an $m \times m$ matrix of the relationships among the η 's error terms (ζ 's)
Θ_ϵ (Theta-Epsilon)	-	a $p \times p$ matrix of the relationships among the y 's error terms (ϵ 's)
Θ_δ (Theta-Delta)	-	a $q \times q$ matrix of the relationships among the x 's error terms (δ 's)

FIGURE 4.2 LISREL NOTATION AND TERMINOLOGY

General Form: $\eta = B\eta + \Gamma\xi + \zeta$

Specific Form:

$$\begin{bmatrix} \eta_1 \\ \eta_2 \\ \eta_3 \\ \eta_4 \end{bmatrix} = \begin{bmatrix} 0 & B_{12} & 0 & 0 \\ 0 & 0 & B_{23} & B_{24} \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} \eta_1 \\ \eta_2 \\ \eta_3 \\ \eta_4 \end{bmatrix} + \begin{bmatrix} 0 & 0 & 0 & \gamma_{14} \\ \gamma_{21} & \gamma_{22} & \gamma_{23} & \gamma_{24} \\ \gamma_{31} & \gamma_{32} & 0 & 0 \\ 0 & \gamma_{42} & 0 & 0 \end{bmatrix} \begin{bmatrix} \xi_1 \\ \xi_2 \\ \xi_3 \\ \xi_4 \end{bmatrix} + \begin{bmatrix} \zeta_1 \\ \zeta_2 \\ \zeta_3 \\ \zeta_4 \end{bmatrix}$$

FIGURE 4.3 STRUCTURAL EQUATIONS FOR LISREL

General: $X = \Lambda_X \xi + \delta$

Specific:

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \\ x_5 \\ x_6 \\ x_7 \\ x_8 \\ x_9 \\ x_{10} \\ x_{11} \\ x_{12} \\ x_{13} \\ x_{14} \\ x_{15} \\ x_{16} \\ x_{17} \\ x_{18} \\ x_{19} \\ x_{20} \\ x_{21} \\ x_{22} \\ x_{23} \\ x_{24} \\ x_{25} \\ x_{26} \\ x_{27} \\ x_{28} \\ x_{29} \\ x_{30} \\ x_{31} \end{bmatrix} = \begin{bmatrix} \lambda_{11} & 0 & 0 & 0 \\ \lambda_{21} & 0 & 0 & 0 \\ \lambda_{31} & 0 & 0 & 0 \\ \lambda_{41} & 0 & 0 & 0 \\ \lambda_{51} & 0 & 0 & 0 \\ \lambda_{61} & 0 & 0 & 0 \\ \lambda_{71} & 0 & 0 & 0 \\ 0 & \lambda_{82} & 0 & 0 \\ 0 & \lambda_{92} & 0 & 0 \\ 0 & \lambda_{10,2} & 0 & 0 \\ 0 & \lambda_{11,2} & 0 & 0 \\ 0 & \lambda_{12,2} & 0 & 0 \\ 0 & \lambda_{13,2} & 0 & 0 \\ 0 & \lambda_{14,2} & 0 & 0 \\ 0 & \lambda_{15,2} & 0 & 0 \\ 0 & \lambda_{16,2} & 0 & 0 \\ 0 & \lambda_{17,2} & 0 & 0 \\ 0 & 0 & \lambda_{18,3} & 0 \\ 0 & 0 & \lambda_{19,3} & 0 \\ 0 & 0 & \lambda_{20,3} & 0 \\ 0 & 0 & \lambda_{21,3} & 0 \\ 0 & 0 & \lambda_{22,3} & 0 \\ 0 & 0 & \lambda_{23,3} & 0 \\ 0 & 0 & 0 & \lambda_{24,4} \\ 0 & 0 & 0 & \lambda_{25,4} \\ 0 & 0 & 0 & \lambda_{26,4} \\ 0 & 0 & 0 & \lambda_{27,4} \\ 0 & 0 & 0 & \lambda_{28,4} \\ 0 & 0 & 0 & \lambda_{29,4} \\ 0 & 0 & 0 & \lambda_{30,4} \\ 0 & 0 & 0 & \lambda_{31,4} \end{bmatrix} \begin{bmatrix} \xi_1 \\ \xi_2 \\ \xi_3 \\ \xi_4 \end{bmatrix} + \begin{bmatrix} \delta_1 \\ \delta_2 \\ \delta_3 \\ \delta_4 \\ \delta_5 \\ \delta_6 \\ \delta_7 \\ \delta_8 \\ \delta_9 \\ \delta_{10} \\ \delta_{11} \\ \delta_{12} \\ \delta_{13} \\ \delta_{14} \\ \delta_{15} \\ \delta_{16} \\ \delta_{17} \\ \delta_{18} \\ \delta_{19} \\ \delta_{20} \\ \delta_{21} \\ \delta_{22} \\ \delta_{23} \\ \delta_{24} \\ \delta_{25} \\ \delta_{26} \\ \delta_{27} \\ \delta_{28} \\ \delta_{29} \\ \delta_{30} \\ \delta_{31} \end{bmatrix}$$

FIGURE 4.4 MEASUREMENT EQUATIONS FOR LISREL - X

General: $y = \Lambda_y \eta + \epsilon$

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Specific:

$$\begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ y_4 \\ y_5 \\ y_6 \\ y_7 \\ y_8 \\ y_9 \\ y_{10} \\ y_{11} \\ y_{12} \\ y_{13} \\ y_{14} \\ y_{15} \\ y_{16} \\ y_{17} \\ y_{18} \\ y_{19} \\ y_{20} \\ y_{21} \\ y_{22} \\ y_{23} \\ y_{24} \\ y_{25} \\ y_{26} \\ y_{27} \\ y_{28} \\ y_{29} \\ y_{30} \end{bmatrix} = \begin{bmatrix} \lambda_{11} & 0 & 0 & 0 \\ \lambda_{21} & 0 & 0 & 0 \\ \lambda_{31} & 0 & 0 & 0 \\ \lambda_{41} & 0 & 0 & 0 \\ \lambda_{51} & 0 & 0 & 0 \\ \lambda_{61} & 0 & 0 & 0 \\ \lambda_{71} & 0 & 0 & 0 \\ \lambda_{81} & 0 & 0 & 0 \\ \lambda_{91} & 0 & 0 & 0 \\ \lambda_{10,1} & 0 & 0 & 0 \\ \lambda_{11,1} & 0 & 0 & 0 \\ \lambda_{12,1} & 0 & 0 & 0 \\ \lambda_{13,1} & 0 & 0 & 0 \\ \lambda_{14,1} & 0 & 0 & 0 \\ \lambda_{15,1} & 0 & 0 & 0 \\ 0 & \lambda_{16,2} & 0 & 0 \\ 0 & \lambda_{17,2} & 0 & 0 \\ 0 & \lambda_{18,2} & 0 & 0 \\ 0 & \lambda_{19,2} & 0 & 0 \\ 0 & \lambda_{20,2} & 0 & 0 \\ 0 & \lambda_{21,2} & 0 & 0 \\ 0 & \lambda_{22,2} & 0 & 0 \\ 0 & 0 & \lambda_{23,3} & 0 \\ 0 & 0 & \lambda_{24,3} & 0 \\ 0 & 0 & \lambda_{25,3} & 0 \\ 0 & 0 & \lambda_{26,3} & 0 \\ 0 & 0 & \lambda_{27,3} & 0 \\ 0 & 0 & 0 & \lambda_{28,4} \\ 0 & 0 & 0 & \lambda_{29,4} \\ 0 & 0 & 0 & \lambda_{30,4} \end{bmatrix} \begin{bmatrix} \eta_1 \\ \eta_2 \\ \eta_3 \\ \eta_4 \end{bmatrix} + \begin{bmatrix} \epsilon_1 \\ \epsilon_2 \\ \epsilon_3 \\ \epsilon_4 \\ \epsilon_5 \\ \epsilon_6 \\ \epsilon_7 \\ \epsilon_8 \\ \epsilon_9 \\ \epsilon_{10} \\ \epsilon_{11} \\ \epsilon_{12} \\ \epsilon_{13} \\ \epsilon_{14} \\ \epsilon_{15} \\ \epsilon_{16} \\ \epsilon_{17} \\ \epsilon_{18} \\ \epsilon_{19} \\ \epsilon_{20} \\ \epsilon_{21} \\ \epsilon_{22} \\ \epsilon_{23} \\ \epsilon_{24} \\ \epsilon_{25} \\ \epsilon_{26} \\ \epsilon_{27} \\ \epsilon_{28} \\ \epsilon_{29} \\ \epsilon_{30} \end{bmatrix}$$

FIGURE 4.5 MEASUREMENT EQUATIONS FOR LISREL - Y

separately from the full structural equation model thereby reducing the potential for interpretational confounding. The first step is the confirmatory factor analysis model or confirmatory measurement model. It "specifies the posited relations of the observed variables to the underlying constructs, with the constructs allowed to intercorrelate freely" [Anderson and Gerbing, p. 414]. This approach assures the unidimensionality of the measurement constructs. The second step tests the measurement and structural model simultaneously. Hayduk [1987, p. 178] relying on Herting and Costner [1985] describes the process as follows:

Measurement misspecifications are located by estimating a confirmatory factor analysis model providing only correlations among the measured concepts, and hence no effects among the concepts that might be misspecified, so that all the diagnostic power of the residuals, modification indices, and so on, are focused purely on the measurement structure of the model. With the measurement structure suitably altered, we re introduce the postulated causal structure among the concepts and use the 'new' residuals, modification indices, and so on, for diagnosing the conceptual causal model.

They [p. 417] suggest "four basic ways to respecify indicators that have not 'worked out as planned': relate the indicator to a different factor, delete the indicator from the model, relate the indicator to multiple factors, or use correlated measurement errors."

Items that do not exhibit convergent and discriminant validity are candidates for deletion. Evidence of

convergent validity is demonstrated by consistent lambda loadings on the same construct. Evidence of discriminant validity is demonstrated by items measuring different constructs loading as expected on the appropriate constructs.

Modification indices, based on partial derivatives, provide an indication that an item is not behaving as expected. They can be used to help identify which item, when deleted or error terms correlated, will affect the fit of the model. Each index predicts a change in Chi-square associated with relaxing one parameter.

The second step tests the full model consisting of the respecified measurement model and structural model using the three goodness of fit indexes mentioned earlier.

Chapter Summary

The methodological issues employed in this study were presented. The research design was described first. It consisted of a discussion of the subjects, the sample, data collection and pretesting procedures, nonresponse bias problems, and the operationalization of the constructs. The second part presented the statistical procedures and hypotheses. Structural equation modeling was selected for analyzing the data using a two-step approach that tested the measurement model first and then incorporated the structural

model into the measurement model and tested the entire model. The twelve research hypotheses were presented and terminology for LISREL was explained. The next chapter contains the results of the LISREL analysis for the model and the significance of the structural coefficients.

CHAPTER V

EMPIRICAL RESULTS

Introduction

In the previous chapter, the research design and the statistical procedures for testing the research model were presented. In the first part of this chapter, the response rates and the test for nonresponse bias are discussed. The second part presents the LISREL analysis based on the research design. The measurement model is refined using confirmatory factor analysis and a reliability test is performed for each of the constructs. Following this, the full LISREL model is used to test the measurement and structural models simultaneously. Finally, the results of the tests of the individual structural coefficients in the model are discussed.

Response Information

Response Rates

Questionnaires were mailed to the 154 subjects obtained through published sources and to 1,161 subjects from the 2,500 names on the purchased mailing list. The overall response rate, including initial mailing and second requests, was 42%. The response rate for respondents using JIT purchasing was 17%. The total number of usable JIT purchasing questionnaires was 191. Table 5.1 contains a summary of the response rates.

TABLE 5.1
SUMMARY OF QUESTIONNAIRE RESPONSE RATES

Questionnaires mailed	1315
Questionnaires not delivered	<u>26</u>
Subjects receiving questionnaires	1289
No response	<u>754</u>
Responses	535
Firms not using JIT purchasing	<u>317</u>
Firms using JIT purchasing	218
Responses not usable for data analysis	<u>27</u>
Responses usable for data analysis	<u>191</u>
Overall response rate (Subjects responding/subjects receiving questionnaire)	<u>42%</u>
JIT responses rate (Firms using JIT purchasing/subjects receiving questionnaire)	<u>17%</u>

Test for Nonresponse Bias

Testing for nonresponse bias was performed by comparing the means of the early and late respondents (late respondents resemble nonrespondents) using the research constructs for this study. The null hypothesis is there is no difference between early and late respondents. Table 5.2 lists the results using Wilk's Criterion. At the .05 level, the null hypothesis could not be rejected. Evidence of difference in means between early and late respondents was not found.

Statistical Testing

Anderson and Gerbing [1988] recommend a two-step approach in which the measurement model is evaluated separately from the full structural equation model thereby reducing the potential for interpretational confounding. The first step is the confirmatory factor analysis model, or confirmatory measurement model.

Before examining the measurement model, a test of the full LISREL model was performed to provide a baseline for respecification. Testing the initial model produced a Chi-square value of 4133 with 1752 degrees of freedom. The goodness of fit index was .543 and the root mean square residual was .096. These measures of overall fit did not indicate a good fit. Therefore, the potential for improvement can be examined through measurement respecification.

TABLE 5.2
TESTS FOR NONRESPONSE BIAS

<u>Test</u>	<u>F-Test</u>	<u>PR > F</u>
Wilk's Criterion	0.75	.6733

Measurement Testing

Confirmatory factor analysis is used to test the measurement model. Initial estimates were computed using two-stage least-squares and the final solution was computed by the maximum likelihood method. Because of the large number of indicants for each construct, the maximum likelihood estimates were examined for low loading items to obtain candidates for deletion. (Appendix B contains the measurement items for each of the constructs.) The following y-items were dropped because their loadings indicated they did not correlate highly with their respective latent variable.

- y6: Lower overall cost of finished product
- y10: Increased profits
- y16: Maintenance of cooperative relationship
- y21: Differences worked out
- y23: Unresolved differences
- y27: Disagreement over timely delivery

Next, the x-indicants were inspected and the following items became candidates for deletion.

- x1: Adjustment to changing market conditions
- x5: New practices
- x6: Opinions over definition of quality
- x9: Candidness with supplier
- x12: Information that is needed
- x15: More information exchange with JIT supplier
- x22: Future dealing similar to past dealings
- x26: Use of sole sourcing
- x27: Reduced number of vendors
- x28: Vendors located nearby

Of the x-items, x₂₆ and x₂₇ were retained because they were important theoretical elements of the concept of JIT structure. The other items were deleted because the items

were redundant, ambiguous, or did not contribute significantly to the meaning of the construct.

Next, an examination of the phi matrix revealed correlations greater than .9 between the goal compatibility, trust, and equity constructs. According to Hayduk, correlations greater than .9 give an indication of multicollinearity. One solution is to eliminate one or two of the constructs; another is to make a composite variable from each of the original constructs and use each as an indicant of a general factor. Composite variables were produced for goal compatibility, trust, and equity by using the summates. These three composite variables became indicants of a factor called General Behavioral Factor (GBF). The modified research model is presented after analysis of the measurement model is complete. The GBF is shown in Figure 5.1.

Indicants loading on more than one factor do not exhibit discriminant validity. Large modification indices provide evidence that items want to load on one another and therefore are candidates for deletion because the items lack discriminant validity. The following indicants had high modification indexes and were examined.

- Y₁: Inventory reduction
- Y₅: Improved vendor response time
- Y₈: Lower carrying costs
- Y₁₁: Supplier carrying out responsibilities
- Y₁₇: Helpfulness of supplier
- Y₂₂: Coordination of activities

FIGURE 5.1 THE GENERAL BEHAVIORAL FACTOR AND ITS INDICANTS

x₁₄: Recent developments
 x₁₆: Ease of access
 x₁₇: Communication quality
 x₂₉: Promotion of JIT purchasing

With the exception of item y₁₇, these items were eliminated because they lacked discriminant validity. The "helpfulness of supplier" indicant was retained because it was theoretically important to the construct for cooperation.

An inspection of the overall loadings of the constructs revealed that the items representing JIT outcomes and items representing structure were each falling into several groups within their loadings. For JIT Outcomes, items y₂, y₃, y₄, y₇, and y₉ composed one group, which were performance measures. Items y₁₂, y₁₃, y₁₄, and y₁₅ were items relating to effectiveness of the relationship. Two constructs were then formed--one for performance and one for effectiveness.

The structural indicants exhibited the same behavior. They were grouping within the construct into three categories--the first involving the length and stability of the relationship, the second involving sole sourcing and the reduction in the number of vendors, and the third involving the company's commitment to JIT. These three then became separate factors consisting of two items each.

The hypotheses involving the new construct GBF and the separate structural and outcome constructs were modified to reflect the changes described above. Modified hypotheses (MH) replace hypotheses 2, 5, 6 and 10.

MH1: A positive relationship exists between GBH and cooperation. (H2,5, and 6)

MH2: A positive relationship exists between GBH and domain consensus. (H10)

That is, GBH is hypothesized to affect cooperation and domain consensus. Items that had previously predicted JIT outcomes now predicted both JIT performance and JIT effectiveness. The structure hypotheses were also modified. The three separate structural elements are now hypothesized to relate individually to cooperation and to the modified outcome variables. The hypotheses reflecting changes for outcomes and structure are:

H9a: A positive relation exists between cooperation and JIT performance.

H9b: A positive relation exists between cooperation and JIT effectiveness.

H12a: A positive relation exists between structure-1 and JIT performance.

H12b: A positive relation exists between structure-1 and JIT effectiveness.

H12c: A positive relation exists between structure-2 and JIT performance.

H12d: A positive relation exists between structure-2 and JIT effectiveness.

H12e: A positive relation exists between structure-3 and JIT performance.

H12f: A positive relation exists between
structure-3 and JIT effectiveness.

Another procedure used to refine the measurement model, especially when deletion of a variable is not indicated on theoretical grounds, is to correlate error terms. While not all candidates for correlation of error terms were correlated, thirteen were identified and allowed to correlate.

The Chi-square value of 416.46 with 328 degree of freedom was obtained for the final measurement model. The goodness of fit index (GFI) was .877 indicating a moderately good fit. The root mean squared residual (RMR) was .046 indicating the same. Comparing these results with the preliminary testing, it is evident measurement respecification has improved the fit of the measurement model considerably. The revised model obtained as a result of step one, measurement model respecification, is illustrated in Figure 5.2. The overall model remains fundamentally the same with these modifications.

The standardized solution for the respecified measurement variables appears in Tables 5.3 and 5.4. The constructs were tested for convergent validity by testing the significance of the lambdas or the pattern coefficients [Anderson and Gerbing, 1988]. The criteria for significance is twice its standard error. The lambda values were all significant indicating evidence of convergent validity.

FIGURE 5.2 MODIFIED MODEL AS A RESULT OF MEASUREMENT RESPECIFICATION

TABLE 5.3
STANDARDIZED SOLUTION FOR THE
RESPECIFIED MEASUREMENT MODEL - Y

	JIT PERFORMANCE	JIT EFFECTIVENESS	COOPERATION	DOMAIN CONSENSUS
Y ₂	.585	0	0	0
Y ₃	.639	0	0	0
Y ₄	.778	0	0	0
Y ₇	.521	0	0	0
Y ₉	.603	0	0	0
Y ₁₂	0	.729	0	0
Y ₁₃	0	.834	0	0
Y ₁₄	0	.570	0	0
Y ₁₅	0	.843	0	0
Y ₁₇	0	0	.782	0
Y ₁₈	0	0	.907	0
Y ₂₀	0	0	.757	0
Y ₂₁	0	0	.680	0
Y ₂₄	0	0	0	.643
Y ₂₅	0	0	0	.915
Y ₂₆	0	0	0	.637

TABLE 5.4
STANDARDIZED SOLUTION FOR THE
RESPECIFIED MEASUREMENT MODEL - X

	GENERAL BEHAVIOR FACTOR	COMMUNI- CATION	STRUCTURE-1	STRUCTURE-2	STRUCTURE-3
X _E	.850	0	0	0	0
X _{GC}	.873	0	0	0	0
X _T	.887	0	0	0	0
X ₈	0	.788	0	0	0
X ₁₀	0	.728	0	0	0
X ₁₁	0	.849	0	0	0
X ₁₃	0	.826	0	0	0
X ₂₄	0	0	.962	0	0
X ₂₅	0	0	.678	0	0
X ₂₆	0	0	0	.618	0
X ₂₇	0	0	0	.718	0
X ₃₀	0	0	0	0	.791
X ₃₁	0	0	0	0	.795

X_E - equity indicant of GBH
X_{GC} - goal compatibility indicant of GBH
X_T - trust indicant of GBH

A reliability analysis was performed on the four exogenous and the four endogenous constructs. The formula employed to calculate reliability for the exogenous constructs is

$$\rho = \frac{(\sum \lambda)^2}{(\sum \lambda)^2 + \theta_o}$$

and for the endogenous variables

$$\rho = \frac{(\sum \lambda)^2}{(\sum \lambda)^2 + \theta_e} .$$

While reliability alone is not a sufficient condition for interpretation of the results, it is nevertheless a necessary one [Kerlinger, 1973, p. 455]. The reliability measures obtained for each of the constructs is shown in Table 5.5. The test for reliability indicate that the constructs display acceptable to excellent reliability.

In summary, the measurement respecification indicated that trust, goal compatibility, and equity correlated very strongly with each other. Based on that evidence, the separate factors became composite indicants of GBF. Investigation of the structure and JIT outcome parameters led to the conclusion that structure was not one factor but three and that JIT Outcomes were two concepts--performance and effectiveness. The test for reliability was performed on each on the constructs. The next step is to test the full model.

TABLE 5.5
RESULTS OF THE TESTS OF RELIABILITY

Construct	Reliability
General Behavior Factor	.95
Communication	.93
Structure-1	.88
Structure-2	.73
Structure-3	.86
JIT Performance	.84
JIT Effectiveness	.90
Cooperation	.92
Domain Consensus	.86

Test of the Full Model

Having respecified the measurement model, the investigation of the properties of the research model continues with the introduction of the structural parameters. This is accomplished by freeing the hypothesized parameters and constraining or fixing the other parameters. This model is compared to a baseline model with no structural degrees of freedom (saturated measurement model above). Table 5.6 shows the results of the comparison of the full model and the saturated model. The increase in Chi-square of 52.89 was greater than the critical Chi-square value for 10 degrees of freedom at a significance level of .01. This indicates that the worsening of the fit of the model is significant.

At this point it is appropriate to look at the modification indices, which give an indication of which structural constraint was responsible for the worsening of fit. The inspection of the modification indices revealed that freeing the constraint between domain consensus and JIT effectiveness would help the fit of the model. It seemed reasonable that agreement over roles, tasks, and functions would contribute a perception of effectiveness of the JIT relationship. When the path was freed, the reduction in Chi-square for 1 degree of freedom was substantial and improved the fit of the model. See Table 5.7.

TABLE 5.6
COMPARISON OF THE SATURATED AND THE FULL MODEL

Model	Chi Square	Difference	D.F.	Significance Level
Saturated Measurement Model	416.46	-----	328	-----
Full Model	469.35	52.89	338	.01

TABLE 5.7
SIGNIFICANCE OF FREEING A STRUCTURAL CONSTRAINT

Model	Chi Square	Difference	D.F.	Significance Level
Full Model	469.35	-----	338	-----
Full Model With Domain Consensus Freed	431.38	37.97	337	.01

The two other tests of fit, the GFI and RMR, indicate results that are important to the evaluation of the research model. Table 5.8 reports the GFI and the RMR for the saturated model, the full model, and the model with the path from domain consensus to JIT effectiveness free. Values for GFI normally fall between zero and one [Joreskog and Sorbom, 1988] with a desired value of .9 or greater. The RMR for the same three models are .046, .056 and .049 respectively. A RMR of .05 or less is a widely accepted rule of thumb. However, some researchers have used a RMR as large as .1 as the threshold for good fit. The GFI and RMR indicate a reasonable fit for the model.

In summary, tests of the full model revealed that the model did not achieve significance for the Chi-square assessment of fit. However, relaxing the constraint on the path from domain consensus to JIT effectiveness did improve the fit. When the GFI and the RMR are examined, they were both found to be within an acceptable range. The results may indicate that other factors, such as uncertainty or the relative power of either party, may be affecting the model. The next section tests the hypotheses relating to the structural coefficients.

Tests of Structural Coefficients

Test of the individual hypotheses is performed using the T values in the LISREL output. Joreskog and Sorbom

TABLE 5.8
OTHER ASSESSMENTS OF FIT

	GFI	RMR
Saturated Model	.877	.046
Full Model	.863	.056
Full Model with Path from Domain Consensus to JIT Effectiveness	.874	.049

[1988, p. 41] define a T value as "the ratio between the parameter estimated and its standard error." T values indicate the number of sampling distribution standard deviations an estimate deviates from zero. The value of each structural coefficient, T value, and probability level are summarized in Table 5.9.

Examination of the structural coefficients revealed that not all of the relationships are as originally hypothesized. It shows that the relationship is more complex than what is usually described in the literature on JIT. The richness of the relationships are discussed in terms of the tests of the individual hypothesis where some relationships are not supported. Each of the hypotheses, as well as implications, is discussed next.

Previously, trust, goal compatibility, and equity were combined to produce indicators of General Behavioral Factor (GBF) because these indicators were so strongly correlated. Therefore, modified hypotheses replace 2, 5, 6, and 10 for testing. Also, because the structure construct now consists of three factors and the JIT outcome construct consists of two factors, they are all tested separately.

The relationship between General Behavior Factor (GBF) and Cooperation (H2, H5, H6) was examined. The null hypothesis was rejected indicating that GBF had a significant and positive association with cooperation. This supports prior research examining the relationship between

TABLE 5.9
TESTS OF HYPOTHESES USING T VALUES

	Structural Coefficient	T Value	Probability >T
Modified Hypothesis 1 (Hypotheses 2, 5, 6) General Behavioral Factor and Cooperation	.670	6.4	.00003
Hypothesis 3 Domain Consensus and Cooperation	-.279	2.345	.0096
Hypothesis 4 Communication and Cooperation	.097	.912	.1814
Hypothesis 8 Communication and Domain Consensus	.282	3.431	.0012
Hypothesis 9a Cooperation and JIT performance	.202	2.356	.0094
Hypothesis 9b Cooperation and JIT Effectiveness	.137	2.208	.0139
Modified Hypothesis 2 (H10) GBF and Domain Consensus	.236	2.945	.0016
Hypothesis 11a Structure-1 and Cooperation	.028	.400	.3446
Hypothesis 11b Structure-2 and Cooperation	.036	.541	.2946
Hypothesis 11c Structure-3 and Cooperation	-.010	-.146	.4443

TABLE 5.9

CONTINUED

	Structural Coefficient	T Value	Probability >T
Hypothesis 12a Structure-1 and JIT Performance	-.024	2.832	.0023
Hypothesis 12b Structure-2 and JIT Performance	.220	2.742	.0031
Hypothesis 12c Structure-3 and JIT Performance	.238	-.354	.1358
Hypothesis 12d Structure-1 and JIT Effectiveness	.214	3.619	.0011
Hypothesis 12e Structure-2 and JIT Effectiveness	-.096	-1.746	.0409
Hypothesis 12f Structure-3 and JIT Effectiveness	.218	3.748	.0011

the individual indicants of GBF (goal compatibility, trust, and perception of equity) and cooperation.

The influence of domain consensus on cooperation is considered (H3). The null hypothesis was rejected (.0096). However, the results were not in the hypothesized direction. The negative relationship between domain consensus and cooperation was indicated by a structural coefficient of $-.279$. The items for domain consensus relate to the existence of agreements over responsibilities. The negative relationship may indicate dissatisfaction with the agreements or that the more responsibilities are worked out in terms of formalization the less cooperation is perceived to exist.

The relationship between communication and cooperation is tested next (H4). The structural coefficient of $.097$ was not significant. This indicates that communication did not have a direct effect on cooperation. This finding is not in agreement with prior research where cooperation is enhanced by communication because individuals had developed better problem solving techniques over time. One reason that might account for this difference is that prior research on communication and cooperation has been performed in controlled laboratory settings. Another reason may be associated with the developmental nature of some JIT purchasing arrangements. Indeed, according to Frazier, Spekman, and O'Neal [1988, p. 54] "The adoption and

implementation of an 'ideal' JIT relationship are impossible to achieve in a short period of time if ever." JIT is a technique that calls for continual improvements, which means that the relationship itself is subject to reexamination. The area of communications may, in fact, require more work. Shortcuts may have been taken in the adaptation of JIT to the traditional American purchasing system.

The relationship between communication and domain consensus was also examined (Hypothesis 8). A significant positive relationship was found indicating that increased communication provided more agreements over respective responsibilities. This positive relationship allows communication (which had an insignificant effect on cooperation) to have an influence on JIT effectiveness through domain consensus. However, as discussed above, the relationship between domain consensus and cooperation was negative while the relationship between domain consensus and effectiveness (when the path was freed) was positive.

The relationship between cooperation and the JIT outcomes of performance and effectiveness was tested. The structural coefficient for 9a was .202 and significant. The structural coefficient for 9b was .137 and also significant. This finding supports objective one, which suggests the primary role that cooperation plays in achievement of JIT outcomes. It also supports previous

research, where it has been shown that cooperation is positively related to performance.

Three exploratory hypothesis were tested. A relationship between goal compatibility and domain consensus (H10) was hypothesized. This hypothesis was modified to suggest a relationship between GBF and domain consensus. A significant, positive relationship was found. This finding indicates that firms having compatible goals are more likely to reach consensus over respective roles, tasks, or functions in a relationship.

The relationships between the three structural variables and cooperation (H11a, H11b, and H11c) is the focus of the second exploratory hypothesis. Structure-1 (stable and long-term), structure-2 (sole sourcing and reduced vendors), and structure-3 (company commitment to JIT) were not significantly related to cooperation. This finding is informative in that the JIT literature suggests that these variables help in the formation of a cooperative partnership between manufacturers and suppliers. For example by reducing the number of vendors, a manufacturer is able to develop better relations with each supplier. Cooperation is independent of the structural elements in a JIT relationship, which may mean that it is possible to create a helpful, problem-solving relationship with a supplier to achieve JIT outcomes and not necessarily set up

the particular structural elements that are associated with JIT. It may also mean that cooperation and the structural elements are necessary but not sufficient conditions for successful JIT purchasing.

The relationships between structure-1, structure-2, and structure-3 and JIT performance (H12a,b,c) and effectiveness (H12d,e,f) are examined next. Different aspects of structure related variously to the JIT outcomes of performance and effectiveness. While the structural coefficient of $-.024$ for structure-1 (stable and long-term) was significant it revealed only a weak negative influence on performance. Structure-2 (sole sourcing and reduce vendors), however, had a significant and positive effect on performance with a coefficient of $.22$. Although the coefficient was positive for structure-3 and performance ($.238$), it was not significant. The use of sole sourcing and reduction in the number of vendors, then, are the most important facets of structure in influencing JIT performance.

In examining the relationship between structure-1, structure-2 and structure-3 and JIT effectiveness, other patterns begin to emerge. While all three structural factors were significantly related to JIT effectiveness, only structure-1 and structure-3 were positively related with coefficients of $.214$ and $.218$, respectively.

Structure-2 had a slight negative (-.096) influence on JIT effectiveness. The stability and duration of a relationship, as well as managements commitment to JIT, influences the perception that a relationship with a supplier is effective. However, sole sourcing and the reduction in the number of vendors negatively affects perceptions of effectiveness.

Chapter Summary

The results of the empirical analysis of the data were reported in this chapter. The response rate was 42% and the number of usable questionnaires was 191. The test for nonresponse bias indicated no significant difference between the early and late respondents (this assumes late respondents are similar to early respondents).

Confirmatory factory analysis was used to inspect the fit of the measurement model. Trust, goal compatibility, and equity were made composite indicators of a general behavioral factor. The concept structure was found to be three separate concepts--long term/stable, sole sourcing/vendor reduction, and company commitment. The JIT outcomes consisted of two constructs--performance and effectiveness. Test of reliability indicated acceptable to excellent reliability. The full model was tested by freeing the structural parameters. The path from domain consensus and to JIT effectiveness improved the fit of the model significantly when it was freed. Tests of the structural

coefficients revealed a complex relationship between the structure of JIT purchasing and the performance and effectiveness indicators.

CHAPTER VI

SUMMARY AND CONCLUSIONS

In the previous chapter, the research model was tested using a two-step approach. The measurement model was refined using confirmatory factor analysis. Then, the full LISREL model was used to simultaneously test the measurement and structural models. Finally, a test of significance was performed on each of the structural coefficients.

This chapter provides a summary of the results and conclusions. The contributions of this study, the limitations of the research, and recommendations for future research are presented.

Summary of Findings and Implications

The purpose of this research study is to improve our understanding of the structural, behavioral, and communication factors that influence the cooperative JIT (Just-In-Time) purchasing partnership and JIT outcomes. The proposed research is guided by two objectives:

1. The first objective is to test the effect of the cooperative partnership arrangement of JIT purchasing in attaining the JIT goals.
2. The second objective is to show how structure, behavior, and communication influence the formation of a cooperative

relationship between manufacturer and supplier and affect JIT outcomes.

These objectives are discussed in terms of the research hypotheses.

The JIT Purchasing Model

A large body of descriptive literature on JIT purchasing has developed since the introduction of the JIT philosophy in the United States by firms seeking to compete successfully in world markets. In JIT purchasing, the emphasis is shifted "from a highly competitive, adversary-oriented relationship to a long-term cooperation-oriented relationship" [Hahn, Pinto, and Bragg, 1983, p. 3]. Experts on JIT purchasing suggest that the relationship between manufacturer and supplier should be a partnership, a marriage, providing mutual benefits to both parties. Essentially, manufacturers and suppliers set up new ways of doing business with each other which included physical as well as behavioral changes. This research project used relational contracting to develop a model of JIT purchasing. The model, showing the relationship between structure, behavior, and communication and cooperation as it affects JIT outcomes, was empirically tested and found to be complex. JIT success appears to be an interplay of factors, some of which relate to performance and some of which relate to perception of effectiveness. The research findings and implications are presented next.

Cooperation and JIT Outcomes

Cooperation was hypothesized to influence performance and perceived effectiveness. The results support the relationships between cooperation and performance and between cooperation and perceptions of effectiveness. The underlying implications of these findings is that cooperation is a necessary component in achieving JIT goals. The data indicate that the idea of cooperation and thus a cooperative partnership, which is largely a Japanese transference, holds in the cultural translation. Cooperation, thus, is an important element of the JIT relationship between a manufacturer and supplier where companies work to overcome strictly individual company goals in order to provide mutual benefits.

Structure and Cooperation

This section discusses the research findings concerning the three structural components and cooperation. Structure-1 (long term and stable), structure-2 (reduced number of vendors and sole sourcing) and structure-3 (commitment) were hypothesized to influence cooperation. The relationships between structure-1, structure-2, and structure-3 and cooperation were not significant. This finding does not follow the general wisdom of the literature of JIT purchasing, which suggests that having a long-term and stable relationship with fewer vendors aids in the formation of cooperation because there are fewer suppliers. Having

fewer suppliers should allow manufacturers to develop better relationships with the remaining vendors. The cooperative working relationship between manufacturer and supplier does not appear to occur as a result of reducing the number of vendors or sole sourcing.

Structure and JIT Outcomes

The results of testing the significance of the coefficients for the three components of structure and JIT performance and effectiveness indicate that a complex relationship exists. Structure-1 (long term and stable) was hypothesized to influence performance and perceptions of effectiveness. The relationship between structure-1 and performance was significant but showed only a small negative association. Structure-2 (reduced number of vendors) is significantly and positively related to performance. The relationship between structure-3 (commitment to JIT) was not significantly related to performance. Sole sourcing and reducing the number of vendors appears to be clearly related to attaining JIT performance.

Structure-1 and effectiveness showed a significant positive relationship. The coefficient for the relation between structure-2 and effectiveness was significant; however, it was negative. The relationship between structure-3 and effectiveness was significant and positive. While reduction in the number of vendors and sole sourcing

positively related to performance, it was negatively associated with effectiveness. At the same time, stability and duration of the relationship and company commitment influenced effectiveness. The pattern that begins to emerge from testing the relationships between each of the structure concepts and performance is that performance is the result of reducing the number of vendors and sole sourcing. However, the perception of effectiveness or the perception that the relationship is productive, worthwhile, and satisfying is the result of the long-term nature and stability of the relationship and of the company's support and commitment to JIT processes. The implication of the findings for structure factors as they influence cooperation and JIT outcomes is complex. Although structure may have no effect on cooperation, both structure and cooperation must be present in order to obtain JIT outcomes of performance and effectiveness.

General Behavioral Factor and Cooperation

Goal compatibility, trust, and equity were found to be strongly correlated and were made composite indicators of a general behavioral factor (GBF). The relationship between GBF and cooperation (H2, H5, H6) was examined. The null hypothesis was rejected indicating that GBF had a significant and positive association with cooperation. This supports prior research examining the relationship between the individual indicants of GBH (goal compatibility, trust,

and perception of equity) and cooperation. This result indicates the importance of establishing trust, entering relationships with companies who have compatible goals, and ensuring that the benefits accrue to both manufacturer and supplier. The policy implications for this is that management must work to influence attitudes regarding JIT implementation. It is evident that JIT is not simply a technique for pushing inventory back on suppliers. It encompasses unfreezing existing attitudes and behaviors and establishing new ones to obtain the cooperation necessary for JIT to work properly in the long run.

Domain Consensus and Cooperation

Domain consensus was hypothesized to have an influence on cooperation. The null hypothesis was rejected. However, the negative relationship between domain consensus and cooperation was not in the hypothesized direction. The items for domain consensus relate to the existence of agreements over responsibilities. The negative relationship may indicate dissatisfaction with the agreements or that the more responsibilities are worked out in terms of formalization of the relationship the less cooperation is perceived to exist.

Communication and Cooperation

Communication is hypothesized to influence cooperation. However, the coefficient was not significant, indicating

that communication did not have a direct influence on cooperation. The finding is contrary to prior research where cooperation is enhanced by communication because individuals are able to develop better problem solving techniques. This finding suggests several communication problems: manufacturers are not receiving the information they need, that manufacturers and suppliers are not up front in their communications, or that there are problems with the reliability of what is communicated.

Communication and Domain Consensus

Communication was hypothesized to influence domain consensus. A significant positive relationship was found indicating the important role communication played in developing agreements over respective responsibilities. This positive relationship allows communication (which had an insignificant effect on cooperation) to have an effect on cooperation and JIT effectiveness through domain consensus.

General Behavior Factor and Domain Consensus

A relationship between goal compatibility and domain consensus was hypothesized. This hypothesis was modified to suggest a relationship between GBF and domain consensus. A significant, positive relationship was found. This finding indicates that compatibility over goals, trust, and perception of equity make it easier to reach consensus over the respective responsibilities of the JIT partners.

The Relational Contracting Model

In the new manufacturing environment, manufacturers are challenged to rethink current business and production practices. A reexamination of the entire process, from the purchase of raw materials to the sale of finished products, is called for. The focus of this study has been the JIT purchasing relationship between manufacturers and their suppliers.

Relational contracting as defined by the markets and hierarchy approach was used to frame the model of this relationship. Markets and hierarchies are polar extremes on a continuum wherein relational contracting is nearer the hierarchy or firm pole. According to the framework, transactions are performed either in markets or firms depending on the transaction costs incurred to overcome the effects of uncertainty, bounded rationality, and opportunism. These transaction costs include the cost of obtaining information, of bargaining, and of monitoring. In a market situation, information can be strategically withheld, each sale is a new bargaining agreement, and it is difficult to monitor each negotiation. In comparison, administrative procedures and accounting information can be used to ensure the flow of important information and openness in communication within a firm, as well as provide a mechanism for monitoring. A within firm market supports a

permanent relationship without the need for continuous bargaining.

Relational contracting, an intermediate state, blends the characteristics of both markets and hierarchies into a pseudo-hierarchical arrangement between independent parties because there are incentives to maintain a relationship. These incentives occur in JIT purchasing because of the need for guaranteed quality with little or no inspection, the need to exchange proprietary information regarding production processes, and the need for close alignment of goals so as to achieve JIT deliveries. Entering into a relational contracting situation or partnership has several benefits including reduced uncertainty, managed dependency, exchange efficiency, and the "possibility of significant gains in joint--and consequently individual--payoffs as a result of effective communication and collaboration to attain goals" [Dwyer, Schurr, and Oh, 1987].

The results of this research indicate that many of the hypothesized relationships in the model hold. However, of great concern, is the insignificant relationship between communication and cooperation. The idea of freeing asymmetrically held information, openness and candor between manufacturer and supplier, reliability, and high quality of the information is central to both JIT purchasing and relational contracting. The data appear to indicate potential problem areas that may possibly negatively influence JIT success.

It was stated earlier that JIT is more than simply pushing back inventories on suppliers. If this is the limit of a firm's commitment to JIT purchasing, then it is suggested that the relationship will in the long run revert to the traditional adversary-oriented one rather than the long-term cooperation-oriented one of relational contracting and of the ideal JIT purchasing partnership. Frazier, Spekman, and O'Neal [1988] have stated that both manufacturer and supplier "must be prepared to devote resources not only to meet the tangible requirements of the JIT system, but also to build the commitment and trust necessary for a strong JIT exchange to be established." Attention must be directed to establishing and maintaining good communications, in terms of openness, candor, reliability, and quality. It should also be stated in defense of companies using JIT purchasing, that JIT is a journey and because many companies are still in the early stages in the development of the JIT relationship, there exists the possibility of achieving better communication between manufacturers and their suppliers.

The Objectives

The first objective of the research was to test the proposition concerning the central role of cooperation in a JIT purchasing arrangement. Much has been written concerning this role of cooperation in attaining the mutual benefits of the JIT relationship. The benefits include not

only achieving better quality inputs when needed, but also attaining increased profitability and market share. Cooperation was found to directly influence both performance and effectiveness indicators.

The second objective was to show how structure, behavior, and communication influence the formation of a cooperative relationship between manufacturer and supplier and the attainment of JIT outcomes. The research revealed a far richer, more complex, relationship among these factors. The insignificant influence of communication on cooperation should raise a flag to both manufacturer and supplier. Of special importance is the finding that the three structure elements affect JIT performance and effectiveness in different ways.

Implications of the Findings for Manufacturers

The general purpose of this research was to expand our understanding of the JIT purchasing relationship as it has been adopted in the United States. The role of cooperation in achieving JIT outcomes of performance and effectiveness is important. Cooperation is the result of various behavioral factors acting in concert. These behavioral factors are highly interrelated and include goal compatibility, trust, equity, and domain consensus. Goal compatibility allows an organization to more freely interact with another. A high degree of goal compatibility makes it

possible for a company to cooperate more fully with another firm because there is less fear, for example, that a supplier will compete for the same customers as the manufacturer. Trust has been defined as a basic component in building a cooperative relationship. In a successful JIT purchasing relationship, trust is enhanced through open communication between partners, which includes the willingness to share propriety information to solve mutual problems. Equity is the perception that the distribution of benefits is equitable at least in the long run. Because each partner gives up some independence, for example by foregoing opportunities to sell or buy from others, it is important that each benefit from the association. Otherwise, the partnership will not be able to sustain itself. Domain consensus is the agreement over respective roles, tasks, and functions. It was hypothesized that domain consensus would influence cooperation positively. The results of the data analysis indicated that the existence of agreements over specifics of the relationships led to less cooperation. If more agreements are the equivalent to less flexibility, then it can be seen that too many agreements might restrict a relationship when, indeed, flexibility is required.

The three components of structure relate differently to the JIT outcomes of performance and effectiveness. A firm implementing a JIT purchasing system should be aware of the

important relation between reducing the number of vendors and JIT performance. Equally important, however, is the influence of stability and management commitment to the perception that the JIT purchasing relationship is effective.

Contributions

The primary contribution of this study is the empirical testing of one of the important components of the JIT philosophy of management in the new manufacturing environment. JIT production and purchasing affect profitability and market share by reducing the overall costs of the finished product while improving quality. Because control of physical assets and costs of raw materials is an important function of accounting, this study provides evidence regarding the new manufacturing strategy of developing JIT relationships with suppliers to obtain quality products at a fair price. This fair price takes into consideration cost savings that occurred because inputs into the production process did not have to be inspected, inventoried, scrapped, or reworked. The JIT purchasing relationship lends itself to empirical testing of the physical as well as the behavior elements in the relationship between the manufacturer and supplier.

The JIT purchasing relationship was examined in terms of structure, behavior, and communication. This model will

provide researchers a basis for further development and testing.

For companies using JIT, the model of relational contracting can be used to identify area for improvement. For companies adopting JIT for the first time, the model identifies the relationship between factors associated with the attainment of JIT success. For buyer and supplier, it should define expectations for involvement in a JIT relationship.

This study contributes to the developing body of knowledge associated with the technological and organizational changes in the new manufacturing environments that have occurred in reaction to increased competition. Other researchers have used exploratory case study approaches or simply composite descriptions of JIT purchasing to understand and explain some of the relevant factors relating to issues of performance measurement in a JIT environment. The present study developed a conceptual model of one of the JIT subsystems--that of JIT purchasing--and tested it on a cross-section of firms.

This research provides evidence concerning the conditions necessary for successful development of JIT purchasing relationships and also contributes to accountants' understanding of the JIT purchasing process especially as they affect strategic plans for manufacturing in the new environment. It provides additional information

about the new manufacturing excellence which can be used to enhance and expand traditional cost and managerial accounting materials.

Limitations

This study examined a specific element of the JIT philosophy, that of JIT purchasing, to improve our understanding of the structural, behavioral, and communication factors that affect the JIT relationship between manufacturers and their suppliers. The subjects were individuals associated with the purchasing function of manufacturers using JIT purchasing as part of their overall strategy in the new manufacturing environment. A limitation of this research is that the research focused on only the manufacturers' side of the relationship. As an initial empirical study in this area, it provides a framework for further testing of the relationship using paired manufacturers and suppliers.

This research is not generalizable to all JIT applications in the United States. It is limited in that the subjects were concentrated in the OEM sector where a high percentage of JIT production and purchasing companies were thought to exist.

Another limitation is the potential nonresponse bias. The problem of this bias was addressed by the appeal in the cover letter, a second mailing, and testing for nonresponse bias. While considerable effort was made to minimize the

effects of this bias and testing was performed to see if there was a difference in the early and late respondents, it is important, nonetheless, to acknowledge its possible presence.

Finally, there are problems associated with survey research. The instrument was pretested on a number of subjects to validate the research measures. The measures were largely adapted from existing measures to accommodate the JIT environment and through this adaptation process, some of the original meaning may have been lost. Lack of precision in measurement is a potential problem in this type of research.

Future Research

There are numerous opportunities for research on issues pertaining to the new manufacturing environment, especially those relating to the JIT philosophy. The present research gathered data from a cross section of manufacturing firms to investigate the JIT purchasing relationship. Future research, using the respecified measurement instruments, could be extended to include both sides of the relationship using a design pairing manufacturers and their suppliers.

Other constructs not in the present model should be considered for inclusion in a model extension. For example, power, interdependence, and amount of uncertainty might provide further insight into the JIT purchasing relationship.

The current research could be extended to other industries as well. While this study centered on OEM manufacturers, the apparel industry has had numerous adoptions of JIT. In addition, a study of companies in specific industries within the OEM group would be appropriate.

Research addressing the differences in companies that have adopted JIT and those that have not might provide valuable guidance for potential adopters. Finally, a comparative study of JIT and nonJIT companies using the present research model would extend this research and test the traditional adversarial versus JIT cooperative dichotomy suggested by the JIT literature.

Chapter Summary

The new manufacturing environment calls for companies to reexamine their manufacturing strategy. Among the many creative solutions to the problems of loss of profitability and market share, has been the adoption of the JIT philosophy of management, which includes JIT purchasing and JIT production. This research examined, in depth, the former using a relational contracting model based on the markets and hierarchies framework. Cooperation was found to have a significant influence on performance and perception of effectiveness. The three elements of structure had no significant effects on cooperation and the data indicated

that structure affected performance and effectiveness in different ways. Communication influenced cooperation indirectly through domain consensus. Finally, the general behavioral factor directly and indirectly, through domain consensus, had a significant effect on cooperation and the JIT outcomes.

This research expanded the understanding about the JIT philosophy of management and examined, specifically, the JIT relationship between manufacturers and suppliers. The conceptual model of the JIT relationship was derived from a markets and hierarchy framework, using relational contracting to model the relationship.

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APPENDIX A
LETTERS TO RESPONDENTS

Letter to Subjects for First Mailing

Date

Name
Address
Address

Dear Name:

The Just-In-Time philosophy of management for production and purchasing has been adopted by many companies in order to compete more successfully in world markets. We are working on a research project that will identify important factors which manufacturers feel promote or hinder the Just-In-Time purchasing relationship between manufacturers and their suppliers.

Your perceptions regarding JIT purchasing are vital to the success of this study. Please take 15-20 minutes and complete the enclosed questionnaire. Then mail it in the business reply envelope provided.

Information is being collected from a large number of randomly selected firms. Your responses are completely confidential. The data gathered will only be used in aggregate statistical analysis. If you have any questions, please call 806-742-2198.

We appreciate your time and cooperation and look forward to receiving the completed questionnaire. A summary of the results will be mailed if you enclose a business card.

Sincerely,

Lane K. Anderson, Ph.D
Ernst & Whinney Professor

Leslie R. Winkler, M.B.A.
Doctoral Candidate

Letter Accompanying the Second Mailing

Date

Name
Address
Address

Dear Name:

Several weeks ago you were sent a questionnaire seeking your perceptions concerning Just-In-Time purchasing. Completed questionnaires from professionals in companies using JIT purchasing are needed in order for this research to be successful.

If you have already responded, please accept my sincere thanks. If not, will you please take time from your busy schedule and complete the questionnaire? I have enclosed another copy for your convenience as well as a business reply envelope. (In the event your company is not involved with JIT purchasing, follow the directions on the questionnaire.)

As I mentioned before, your responses are completely confidential. I am available to answer questions at 806-742-2198. Enclose your business card if you desire a summary of the results.

Sincerely,

Leslie R. Winkler, M.B.A.
Doctoral Candidate

APPENDIX B
QUESTIONNAIRE

JIT OUTCOMES

- Y₁ Inventory reduction
- Y₂ Decreased scrap
- Y₃ Improved quality
- Y₄ Success in getting vendor to meet quality requirements
- Y₅ Improved vendor response time
- Y₆ Lower overall cost of finished product
- Y₇ Lower ordering costs
- Y₈ Lower carrying costs
- Y₉ Improved competitiveness of our products
- Y₁₀ Increased profits
- Y₁₁ How well has your JIT supplier carried out its responsibilities and commitments in regard to your firm during the past six months?
- Y₁₂ How well has your company carried out your responsibilities and commitments in regard to your JIT supplier in the past six months?
- Y₁₃ To what extent do you feel the relationship between your firm and your JIT supplier is productive?
- Y₁₄ To what extent is the time and effort spent in developing and maintaining the relationship with your JIT supplier worthwhile?
- Y₁₅ Overall, to what extent were you satisfied with the relationship between your firm and your JIT supplier during the past six months?

COOPERATION

- Y₁₆ It is important to maintain a cooperative relationship with my supplier.
- Y₁₇ My supplier has been helpful.
- Y₁₈ There is a supportive atmosphere in solving problems between my organization and my JIT supplier.
- Y₁₉ My company has a poor working relationship with my JIT supplier.
- Y₂₀ My supplier and my company work jointly to solve problems.
- Y₂₁ The differences between my company and my supplier are usually worked out.
- Y₂₂ The activities of my organization and my supplier's are well coordinated.

DOMAIN CONSENSUS

- Y₂₃ There are often serious disagreements between my firm and my JIT supplier.
- Y₂₄ There is agreement between my supplier and my firm regarding our current ordering practices.
- Y₂₅ My supplier and my firm are in general agreement over respective responsibilities.
- Y₂₆ There is an agreement between my supplier and my firm regarding who is responsible for defective parts.
- Y₂₇ There are often disagreements between the supplier and our firm regarding timely deliveries.

EQUITY

- Y₂₈ My company receives an equitable share of benefits from participation in the JIT relationship.
- Y₂₉ My supplier does not do his fair share.
- Y₃₀ My supplier and my firm contribute equally to making the JIT relationship work well.

GOAL COMPATIBILITY

- X₁ My supplier is not always able to adjust rapidly to changing market conditions.
- X₂ My supplier and my firm share a common outlook concerning how JIT should work.
- X₃ My supplier is concerned about the quality of the goods we buy.
- X₄ My supplier and my firm have goals which are compatible.
- X₅ My supplier often suggests new practices which help the flow of materials from them to us.
- X₆ My supplier and my firm have different opinions when it comes to how to define quality.
- X₇ My supplier and my firm are able to work together to keep costs down.

COMMUNICATION

- X₈ People in my supplier organization are encouraged to be open with us.
- X₉ My organization tries to be up front with my suppliers.
- X₁₀ Information and opinions are freely exchanged between our firms.
- X₁₁ The information received from my suppliers is reliable.
- X₁₂ My firm usually says what it means and means what it says.
- X₁₃ My supplier is providing us with the information that my firm wants and needs.
- X₁₄ I am pleased with my supplier's efforts in keeping me up-to-date on recent developments that relate to my firm's welfare.
- X₁₅ My company exchanges far more company information with my JIT suppliers than with other suppliers.
- X₁₆ It is relatively easy to get in touch with individuals in the supplier's firm.
- X₁₇ The quality of communications with people in my supplier's firm is very good.

TRUST

- X₁₈ My supplier acts sincerely in our dealings.
- X₁₉ My supplier works hard to establish a close relationship.
- X₂₀ My company cannot rely on my JIT supplier.
- X₂₁ I expect that future relations with my supplier will be good.
- X₂₂ I believe that dealings with our JIT supplier will be consistent with past encounters.
- X₂₃ My company trusts the JIT supplier.

STRUCTURE

- X₂₄ Do you consider the relationship with your JIT supplier stable?
- X₂₅ Is the relationship with your JIT supplier for the long term?
- X₂₆ Does your firm use sole sourcing?
- X₂₇ Has your firm reduced the number of vendors?
- X₂₈ Are your JIT vendors located nearby?
- X₂₉ Does your company sincerely promote JIT purchasing?
- X₃₀ How committed is your company to JIT production methods?
- X₃₁ How committed is your company to JIT purchasing methods?

OTHER REQUESTED INFORMATION

Does your firm use Just-In-Time purchasing?

How long has your company participated in JIT purchasing?

How long have you personally been involved with JIT purchasing?

What percentage of the dollar value of your unit's purchasing is JIT purchasing?

Does your firm use JIT production?

If yes, how long?

What is your current job title?

What is the approximate number of employees at your location?

What is the primary end product manufactured (or service performed) at this location.

Please circle the number indicating your Standard Industry Classification (SIC).

- 33 PRIMARY METALS INDUSTRIES
- 34 FABRICATED METAL PRODUCTS
- 35 MACHINERY, EXCEPT ELECTRICAL
- 36 ELECTRIC AND ELECTRONIC EQUIPMENT
- 37 TRANSPORTATION EQUIPMENT
- 38 PROFESSIONAL, SCIENTIFIC, CONTROL INSTRUMENTS
- 39 MISCELLANEOUS MANUFACTURING INDUSTRIES
- 99 OTHER. PLEASE SPECIFY _____