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I am submitting herewith a dissertation written by Rammohan Pisharodi entitled "A Behavioral Process Model of Customer Service Evaluation Based on Supplier-Customer Differences in Perception." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Business Administration.

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A BEHAVIORAL PROCESS MODEL OF CUSTOMER SERVICE EVALUATION BASED ON SUPPLIER-CUSTOMER DIFFERENCES IN PERCEPTION

A Dissertation

Presented for the

Doctor of Philosophy

Degree

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Rammohan Pisharodi

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Dedicated to my parents, Kattur Balakrishna Pisharodi and Vijayalakshmi Pisharodi, whose beliefs and ambitions have been a source of motivation for me throughout my life.

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ABSTRACT

Many of the contemporary techniques for customer service evaluation are based on the measurement of customer perceptions of customer service requirements. However, very little research effort seems to have been directed at finding out whether knowledge of customer perceptions really helps the supplier in generating the desired market response (sales, customer satisfaction, etc.).

The goals of this doctoral dissertation are:

1. to conceptualize the role of customer service perceptions in customer service evaluation,
2. to develop a suitable research design using the above conceptualization and to conduct an empirical study of the relationship between customer service perceptions and market response, and
3. to use the results of this study for the development of some guidelines for customer service evaluation and management.

A unique aspect of this research is that customer-supplier pairs are used as units of analysis rather than aggregated groups of customers and suppliers.

One of the premises of the behavioral process model proposed in this dissertation is that differences may exist

between suppliers and customers in their perceptions of customers service. Suppliers and customers may differ in their perceptions of the industry's typical levels of customer service and in their perceptions of the the actual service levels of the supplier.

In this dissertation, supplier-customer differences in the perception of customer service are modeled as two independent variables--one related to the industry's typical levels and the other related to the actual service levels provided by the supplier. The dependent variable, market response, is the response of the customer to the supplier's physical distribution customer service. The influence of the independent variables on the dependent variable is moderated by the customer's cognitive process of comparing the supplier's actual service levels against the industry's typical service levels.

Customer service evaluation is conceptualized as an effort made by the supplier to understand the perceptions of the customer in order to use this information for influencing market response.

The most important relationships in the proposed behavioral process model were summarized in the form of a four-construct theoretical structure. Four hypotheses were developed for testing the relationships in the theoretical structure.

The data required for testing the four research hypotheses was collected using mail questionnaires. Responses were collected from a national sample of grocery manufacturers and their customers (wholesalers and chain retailers). Data was collected from a sample of 91 supplier-customer pairs (or dyads).

The objective of the first phase of data analysis was to ensure unidimensionality, and a high level of reliability and validity in the measurement of the constructs in the theoretical structure. After the purification of the measures, the four research hypotheses were empirically tested by applying the causal modeling approach using the program LISREL VI (Joreskog and Sorbom, 1984).

The results of data analysis strongly supported the conceptualized relationship between the customer's cognitive comparison process and market response. It indicated that if the customer perceives the supplier's actual service levels to be higher than what is typical in that industry, it is likely to result in higher market response (eg. more sales, higher market share, greater customer satisfaction, etc.).

The results of the analysis of the relationship between supplier-customer differences in the perception of customer service and market response are less conclusive. While most of the statistics generated during the analysis support this relationship, some do not. However, the results of the analysis seem to indicate that if the supplier's perception of the industry's typical levels is higher than the customer's, it is likely to lead to more favorable market response by its indirect influence on the dependent variable through the customer's cognitive process of comparison. Similarly, the results of the analysis seem to indicate that if the customer's perception of the supplier's actual levels is higher than the supplier's, it is likely to lead to more favorable market response by its indirect influence on the dependent variable through the customer's cognitive process of comparison.

The findings of this research indicate that knowledge of the customer's perceptions of customer service can be very useful to the supplier for developing effective customer service packages which are likely to result in the desired market response.

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CHAPTER I

INTRODUCTION

1.1 BACKGROUND

The contribution of physical distribution to the national economy has been increasing in recent years. While the contribution of manufacturing to the GNP of the USA has declined to about 50 percent, the contribution of physical distribution activities has increased to about 20 percent of the GNP (Lambert and Stock, 1982). The very size of the contribution indicates that a small increase in the efficiency of the physical distribution system can lead to very large savings for the U.S. In a recent study (1978), A. T. Kearney, Inc. conservatively estimated that if U.S. distribution productivity could be improved by as little as 10 percent, a 40 billion savings could be realized (Stewart and Morehouse, 1978).

Although distribution has come a long way from the days when Peter Drucker called it the economy's "dark continent" (Drucker, 1962), tremendous opportunities for improving the efficiency of physical distribution still exist. Research has indicated that an average U.S. company can improve its physical distribution productivity by 20 percent or more by improving its distribution process (Stewart and Morehouse, 1978).

The output of physical distribution may be looked upon as the 'place' component of the marketing mix. Adequate attention to physical distribution is crucial for the success of any business enterprise. Failure in this can lead to failure in the marketplace through either poor profit performance, inadequate product support, and/or excessive distribution costs (LaLonde, 1977).

The area of customer service represents physical distribution's interface with the demand creation portion of marketing (Lambert and Stock, 1982). In general, "Customer Service" has been a "catch-all" term used by industry for all its customer-satisfying effort at its interface with its customers. Its popular definitions range from the very narrow to the very broad. LaLonde and Zinszer (1976) have defined it as broadly as a "customer oriented corporate philosophy which integrates and manages all the elements of the customer interface within a pre-determined optimum cost-service mix. For the purposes of this dissertation, the term "customer service" will stand for _physical distribution customer service_. While the use of this term might reflect an underlying philosophy, "customer service" will primarily stand for the variables which the logistics system strives to provide at its interface with its customers. It will also stand for the variables (services and benefits) which the customer receives from the logistics system.

While customer service may be used to generate sales, higher levels of customer service usually demand greater investment of resources. Due to this trade-off, distribution managers typically prefer to maintain their customer service variables at optimum levels rather than at the highest possible levels. In order to determine these "optimum" levels, several customer service evaluation models and methods have been developed. Because of the belief that the importance of customer service in determining supplier patronage is "ultimately evaluated by the customer receiving the service" (Ballou, 1973), many of these models have been based on the measurement of customer perceptions of customer service requirements. These models implicitly assume that it is appropriate to use measured customer perceptions as guidelines for determining the optimum customer service mix. In other words, they assume that there is a clear relationship between the measured perceptions of customer service variables and the responses of customers to these variables.

Although this relationship appears to be logical, it raises some issues:

1. The role of customer service perceptions in the relationship between the customer service variables and market response response[1] has not been conceptualized in detail. The development of measures of customer service perception without adequate conceptualization raises questions regarding the construct validity, the content validity, and the nomological validity of these measures.

2. The assumption that there is a clear relationship between the measured perceptions of customer service variables and the responses of customers to these variables has not been thoroughly tested. Perception is only an intermediate variable between customer service and market response (Figure 1). The relationship between market response and perceptions of customer service requirements may be moderated by the influence of other variables.

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[1]In this dissertation, the term "market response" represents customer purchase and post-purchase behavior in response to marketing stimuli such as customer service. The concept of "market response" has been discussed in greater detail in the next chapter.

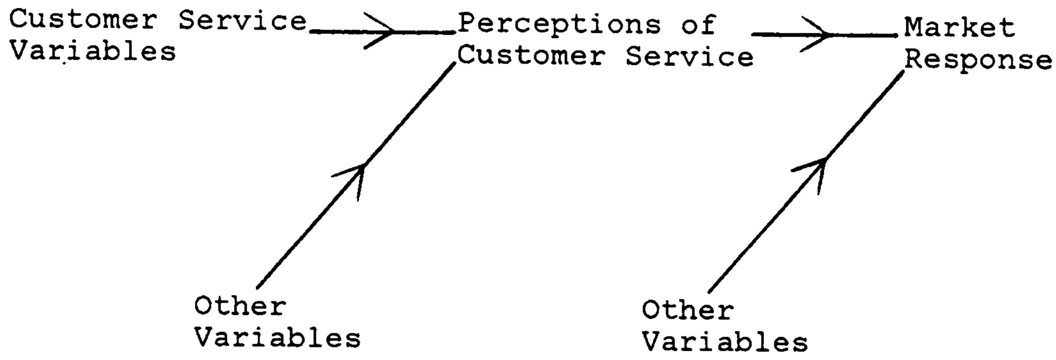

Figure 1: Perception as an Intervening Variable.

3. Measures of customer service perception have typically tried to determine the customer's perceived "importance" of various service attributes. Consumer behavior literature indicates that attributes that are perceived as the most "important" by the customer need not necessarily be the most influential in determining preferences and choices (Alpert, 1979).

In spite of the above questions, the conceptual nature of this relationship and its empirical validity, remain relatively unexplored.

1.2 DEFINITION OF THE PROBLEM

Many of the contemporary models for customer service evaluation are based on an assumed relationship between measured perceptions of customer service variables and customer (or market) response to these variables. However, the conceptual underpinings and the empirical validity of this relationship have not been explored in detail.

In spite of the above gap in knowledge, a considerable level of research effort has been directed at the development of perception-based models of customer service. Model development without sufficient conceptualization and empirical testing could lead to a misallocation of resources in the form of research effort and research expenditure. The adoption of such decision models could also misguide physical distribution managers, and this could lead to the misallocation of their customer service resources.

The inadequate conceptualization and lack of empirical research information regarding the crucial relationship between measured perceptions of customer service variables and market response to these variables indicates a weak link in the theoretical foundations of several customer service models.

1.3 OBJECTIVES OF THE RESEARCH PROJECT

The specific objectives of this research are:

1. to conceptualize the relationship between customer service perceptions and market response;
2. to conceptualize the role of customer service perception measurement in customer service evaluation and management;
3. to develop a behavioral process model of customer service evaluation based on the above conceptualization;
4. to develop a suitable research design for empirically testing the above model;
5. to study the influence of selected situation-specific factors on the above model;

6. to identify directions for future research; and
7. to use the results of the above study for the development of some guidelines for customer service evaluation and management.

1.4 THE PROPOSED MODEL

This research has been based on a descriptive model of the role of perceptions in customer service evaluation (Figure 2). The specified descriptive model is the conceptual framework on which this dissertation is based. The specific theoretical structure to be tested in this dissertation (Figure 3) is derived from the descriptive model. The theoretical structure to be tested focuses only on a crucial relationship, and it does not attempt to measure all the variables in the descriptive model.

The descriptive model treats the supplier and the customer as goal directed systems. Their interaction is a form of goal directed behavior. According to the theory of psychological congruity (Sirgy, 1983), this involves a psychological comparison between a perceptual set (e.g. the current level of customer service) with an evoked frame of reference (a comparison level). If the perceptual set is less attractive than the evoked frame of reference, a goal oriented system would try to reduce the deviation between the two by various means. If the customer feels that the

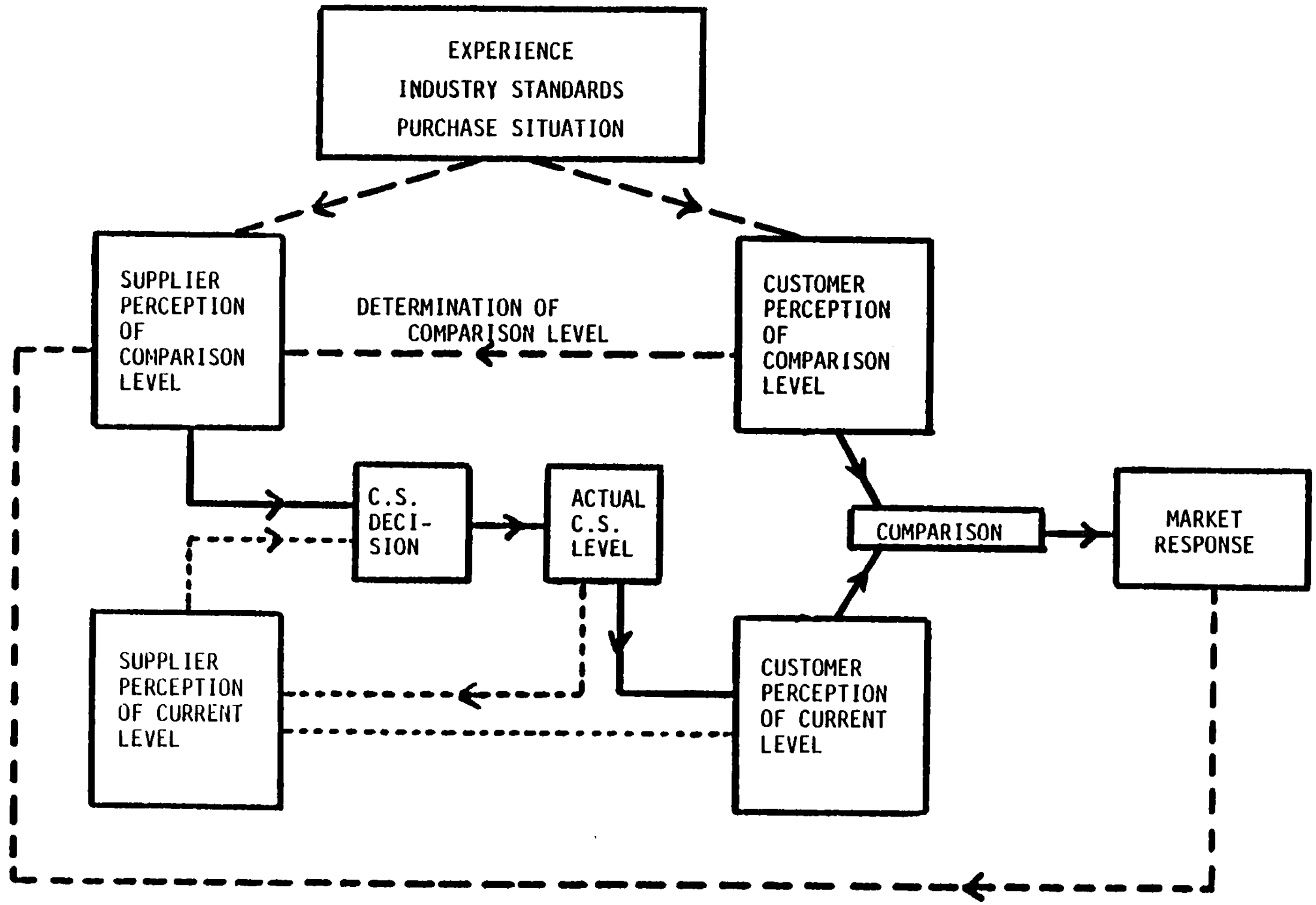

Figure 2: The Proposed Behavioral Process Model of Customer Service Evaluation

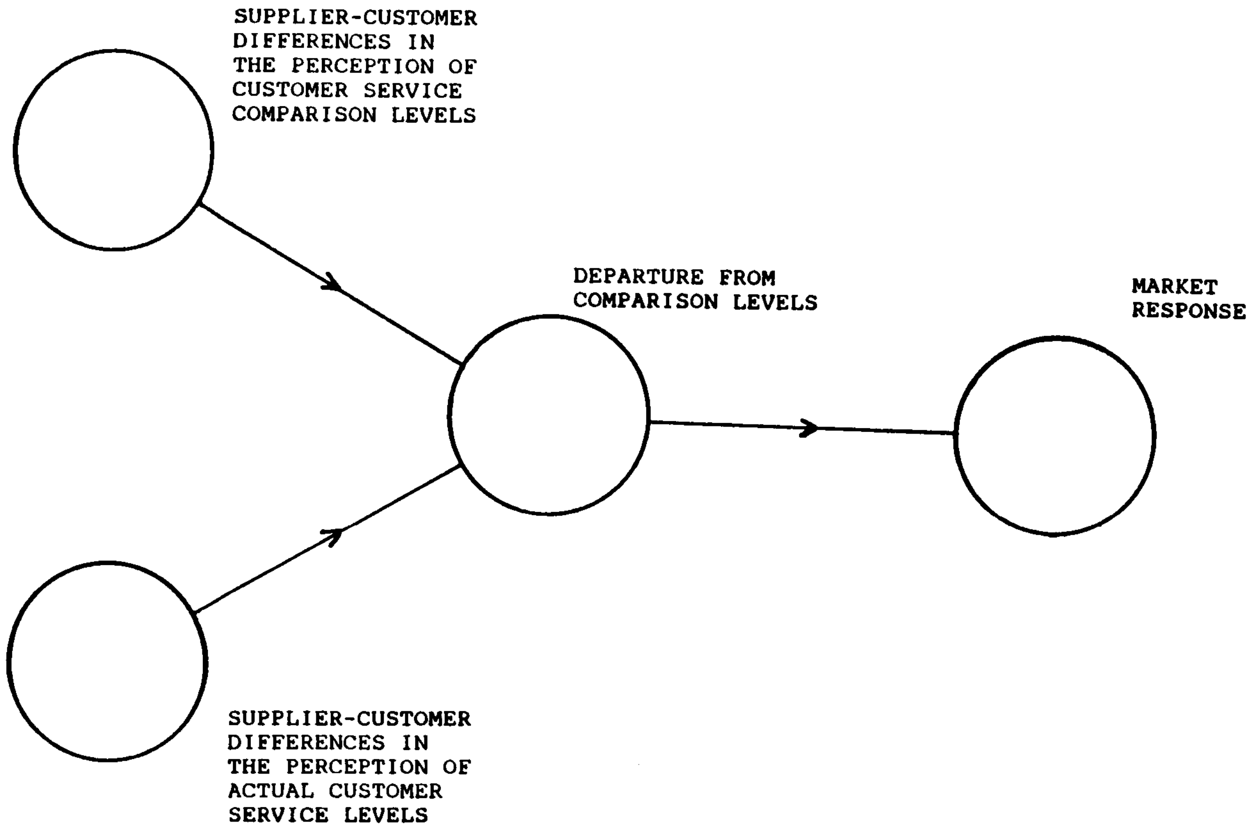

Figure 3: The Theoretical Structure to be Tested

deviation is too large (high perceptual incongruity) he might be tempted to switch to a new supplier who would cause only a smaller deviation. At the same time, since the supplier usually has a vested interest in maintaining the relationship, the supplier will try to maintain his customer service at levels which will keep the customer's perceptual incongruity within acceptable limits.

If the customer feels that the deviation is in the opposite direction (i.e. that the perceptual set is better than the evoked frame of reference), he would have a tendency to respond favorably to the service. Whether the supplier favors such a deviation would depend upon the supplier's competitive strategy (competitive parity vs. competitive superiority) and the cost implications of maintaining such a deviation.

In other words, the evoked frame of reference is a benchmark against which the perceptual set is compared and evaluated. Knowledge of the customer's benchmark should help the supplier in obtaining desired customer response.

The proposed model is based on the premise that differences between the customer service perceptions of the supplier and of the customer may inhibit the ability of the supplier to provide service levels which will result in the most favorable customer response. Customer service evaluation is treated as a purposeful activity aimed at reducing the above mentioned differences between supplier perceptions and customer perceptions.

The model indicates that suppliers as well as customers perceive at least two different levels of customer service. They are:

1. <u>the current level</u> (supplier's current level of customer service); and
2. <u>the comparison level</u> (bench-mark against which the existing level is compared and evaluated, e.g., the industry standard, etc.).

The response of the customer to the supplier's offering is directly influenced by <u>the degree</u> and <u>the direction</u> of the difference between the customer's perception of the comparison level for that supplier and the customer's perception of the current level of service from that supplier.

In order to influence the response of the customer, the supplier should be able to influence the customer's perception of the current level vis-a-vis the comparison level. For this, he needs to know what the customer perceives as the comparison level. If the supplier has this information (which he may try to obtain through customer service evaluation) he should be able to modify his customer service package so that it influences market response favorably.

The proposed model describes how the supplier's perception of the comparison level is influenced by his experience, industry standards, the purchase situation, and what the supplier perceives to be the customer's comparison level. The supplier's perception influences his customer service decisions which in turn strongly influence the actual customer service level offered. The customer's response (market response) to this service level is influenced by what he perceives as the actual level and his comparison of this perception with his own (perceived) comparison level.

The same customer service package can be perceived differently by the supplier and by the customer. For the purpose of evaluating and controlling a customer service strategy, it is also important for the supplier to have some relevant information regarding the customer's perception of the current service level.

The model describes how the supplier's perception of the current level is influenced by the actual level of service and his information about the customer's perception of the current level (probably obtained through a customer service audit/evaluation). The supplier's perception of the current level should influence his customer service decisions primarily through corrective actions. The purpose of these corrective actions is to improve market response through a change in the customer's perception of the current level.

In other words, differences between the customer service perceptions of the supplier and of the customer should reduce the supplier's ability to influence the distance between the customer's current and comparison levels, which in turn should have an effect on market response. This relationship has been described in Figure 3 as the theoretical structure to be tested in this dissertation.

The theoretical structure to be tested graphically states that supplier-customer differences in the perception of customer service are indirectly linked to market response through an intervening variable represented by the difference between the customer's perception of his comparison level and his perception of the current service level.

1.5 RESEARCH METHODOLOGY

Four hypotheses were developed in order to test the theoretical structure (Figure 3) which in turn was derived from the conceptual model presented in Figure 2 (page 9). Customer service perceptions of suppliers and customers were measured within ninety one supplier-customer pairs in the grocery industry. The suppliers were manufacturers who were members of the Grocery Manufacturers of America (GMA). The customers were selected grocery wholesalers and supermarket chains whom the manufacturers identified.

Mail questionnaires were used for the collection of data. The process of data collection proceeded through three stages. At the first stage, all the grocery manufacturing companies which were listed in the 1982 Distribution and Transportation Committees of the Grocery Manufacturers of America were contacted with a request for their participation in the study. During the second stage, selected key informants were mailed questionnaires. These potential respondents were requested to identify some of their customers (preferably grocery wholesalers) and to provide information regarding their customer service relationship with each one of the identified customers separately. At the third stage, key informants of the identified customers were mailed questionnaires. They were requested to provide information regarding their customer service relationships with the individual manufacturers who had identified them.

The collected data was analyzed using PACKAGE 1980 (Hunter, et al., 1980) and SPSSx (SPSS, Inc., 1983) in order to ensure unidimensionality in the measurement of the theoretical constructs and to maintain a high level of reliability. After the purification of the measures of the relevant constructs, the research hypotheses were empirically tested by applying the causal modeling approach using the program LISREL VI (Joreskog and Sorbom, 1984).

1.6 SCOPE

The scope of this study is restricted by the following limitations:

1. Due to its focus on only one industry (in order to increase internal validity), the generalizability of its results (external validity) to other industries cannot be assumed.
2. The quality of the data collected hinges upon the quality and the suitability of the key informants. Wrong and unsuitable informants can add a considerable amount of "noise" to the data.
3. During the development of the measuring instrument, several indicators of customer service were

screened out because they did not meet the methodological requirements of this research. Even after the collection of data, some indicators of customer service were dropped from the analysis because they did not meet the necessary conditions for measure unidimensionality and reliability. The exclusion of these indicators may have adversely affected the content validity of the measures of customer service used in this research.

4. The measurement of supplier perceptions and the measurement of customer perceptions were separated by a period of a few months due to the requirements of the research design. The dynamic customer service relationship between the supplier and the customer may have undergone some changes during this period. This may have increased the measurement error.

5. The selection of potential respondents may have biased the results of this research. Responding manufacturers may have had a tendency to identify only relatively satisfied customers and those customers with whom they have good relationships. It is also possible that only those supplier-customer pairs which have good customer

service relationships continue to exist for a relatively long period of time. Thus supplier-customer pairs who participated in this study may not adequately represent a cross-section of all the successful and unsuccessful supplier-customer pairs in the grocery industry.

The limitations of this study have been discussed in greater detail in Chapter V.

1.7 IMPORTANCE

The results of this dissertation should contribute significantly towards the advancement of the theory and practice of physical distribution customer service.

1.7.1 Expected Contribution to Physical Distribution Theory and Research.

1. The focus of this research is on conceptualizing and on empirically studying a crucial relationship in physical distribution customer service. This relationship has not been conceptualized adequately in the past. It also lacked empirical support.
2. As a part of this dissertation, a model-based methodology for measuring perceptions of customer service variables and the market response to these variables was developed. In addition, a research design for testing the relationship between these

constructs was developed. This can be viewed as a contribution towards the advancement of customer service modeling and towards the advancement of measurement methodology in customer service.

3. The study of other influences on perceptions of customer service and on market response should help in understanding the influence of these factors on the management of customer service.

4. The conclusions of this research should help in identifying directions for future research.

1.7.2 Expected Contribution to Physical Distribution Management.

There are several ways in which the results of this research project may be useful to professionals in the field of physical distribution management:

1. The results of this project may influence future trends in the development and application of perception-based models of customer service evaluation.

2. The design of this research makes it possible to determine the market response implications of supplier-customer consensus or dissensus regarding selected elements of customer service (e.g. stock out level). Customer service managers will be

aided in determining those elements regarding which it is particularly important to create supplier-customer consensus by customer service evaluation and customer education. This research may influence the development of market-response based methods for customer service evaluation.

3. The results of the study should help managers in deciding <u>when</u> customer service evaluation is needed most and <u>how</u> it should be conducted.

4. A unique characteristic of this research project is its focus on supplier-customer pairs as units of analysis. The proposed model should be particularly useful to large supplier organizations in understanding the customer service relationships in their distribution channels. For instance, it may provide partial explanation for the success of some supplier-customer pairs in their channels of distribution and the lack of success of others. It may also provide them with directions for future corrective actions.

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter an effort is made to bring together different streams of literature which are relevant to this study. Figure 4 describes how empirical and theoretical literature from a variety of disciplines have been brought together, synthesized, and evaluated in this chapter.

The first section of this chapter studies the concept of customer service as it is presented in marketing and physical distribution literature. The elements and dimensions of the concept are described, and the importance of customer service to marketing strategy is discussed. The second section recognizes customer service as a perceived variable, and briefly reviews relevant concepts and literature from physical distribution, consumer behavior, and cognitive psychology. The third section studies the topic of market response to customer service variables and reviews empirical studies of this relationship. Section four discusses various methods of customer service evaluation published in physical distribution literature and positions them in a conceptual framework.

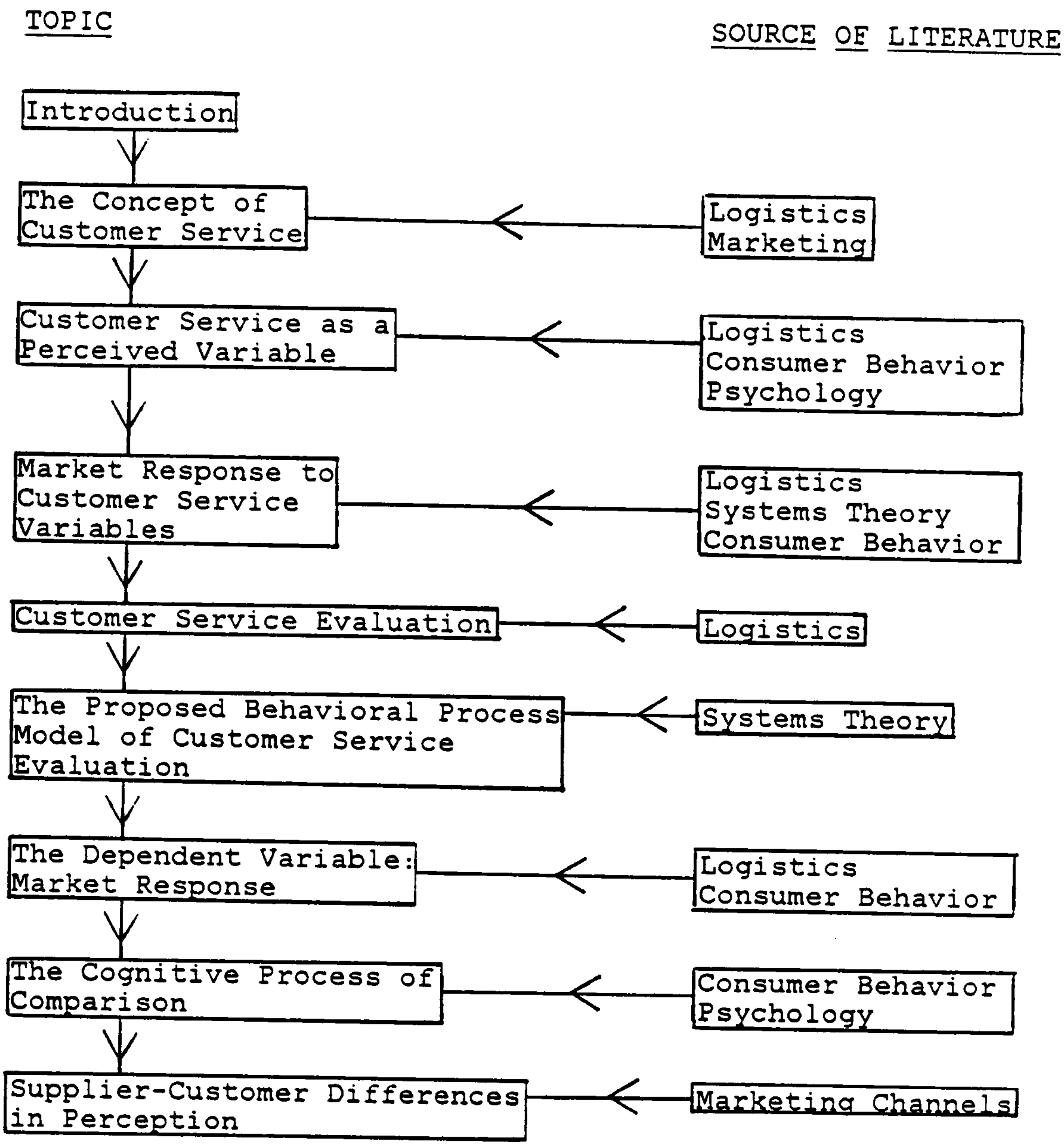

Figure 4: Framework for the review and synthesis of literature

In the fifth section the proposed behavioral process model of customer service is presented and its variables are identified. The theoretical foundations and the conceptualization of each variable and relationship described by the model is discussed in this section. The sixth and final section ties together all the other sections of this chapter and concludes the literature review.

2.2 THE CONCEPT OF CUSTOMER SERVICE

2.2.1 Introduction.

"Customer Service" has been a "catch-all" term used by industry for all its customer-satisfying efforts at its interface with its customers. While some authors have conceptualized it narrowly as "Order Processing" (A. Taff, 1978), others have defined it as broadly as a customer oriented corporate philosophy which integrates and manages all of the elements of the customer interface within a pre-determined optimum cost-service mix (LaLonde and Zinszer, 1976). For the purposes of this study, the term "customer service" will stand for physical distribution customer service. While the use of the term might reflect an underlying philosophy, "customer service" will stand for the function, activities, and variables which the logistics system strives to provide at its interface with its customers. It will also stand for the variables (services and the benefits) which the customer receives from the logistics system.

2.2.2 The Elements of Customer Service.

The concept of customer service is often associated with a number of elements. After an extensive study of the meaning and measurement of customer service, LaLonde and Zinszer categorized the elements of customer service into three groups (Figure 5):

1. Pre-transaction elements,
2. Transaction elements, and
3. Post-transaction elements (Lalonde and Zinszer, 1976).

The pre-transaction elements are those which are policy related. They facilitate good performance on the transaction elements. The transaction elements are those which are commonly viewed as the elements of customer service, and they are the most conspicuous elements at the time of purchase. The post-transaction elements provide services after the sale of the product.

The different elements of customer service differ from each other in their importance. In addition, they also vary from situation to situation. Some are easily measurable (e.g. Order cycle time, Stock-out level), while others (e.g.

CUSTOMER SERVICE

PRE-TRANSACTION ELEMENTS
1. Written statement of policy
2. Customer receives policy statement
3. Organizational structure
4. System flexibility
5. Management services

TRANSACTION ELEMENTS
1. Stockout level
2. Order information
3. Elements of order cycle
4. Expedite shipments
5. Transshipment
6. System accuracy
7. Order convenience
8. Product substitution

POST-TRANSACTION ELEMENTS
1. Installation, warranty, alterations, repairs,parts
2. Product tracing
3. Customer claims, complaints, returns
4. Temporary replacement of products

Figure 5: The Elements of Customer Service.

Source: Bernard J. LaLonde and Paul H. Zinszer, <u>Customer Service: Meaning and Measurement</u>, (Chicago: The National Council of Physical Distribution Management, 1976), 281.

Organizational structure) are very difficult to measure. Some elements (e.g. Written statement of policy, Organizational structure, etc.) are not even visible to the customer.

2.2.3 The Dimensions of Customer Service.

Customer Service has often been conceptualized as a multi-dimensional phenomenon. Several researchers have tried to model the dimensionality of the concept of customer service using empirical methods.

Schary (1970) has identified the dimensions of physical distribution as space and time. Later, this was adapted to the customer service concept by identifying the two dimensions of the concept as product availability and order cycle time (Schary, 1980). Wagner (1976-77) has identified two components of customer service: (a) customer service action (providing desired services), and (b) customer service reaction (handling the absence of, or inadequacy in services). Levy (1978) has identified seven function-oriented dimensions of customer service by factor analysis: (i) general financial aspects of physical distribution management, (ii) sales person's responsibilities, (iii) promotion, (iv) general information, (v) package identification, (vi) inventory management; and (vii) general physical distribution management.

The above review suggests that the different conceptualizations of customer service have not been very consistent with each other. In spite of the efforts of some researchers, the nature of the dimensionality of customer service remains unclear.

2.2.4 Importance of Customer Service to Marketing Strategy.

Customer service represents a major portion of the 'place' component of the marketing mix. However, its influence on consumer buying behavior is not very obvious. Farley (1964) has noted that product availability is one of the major criteria which influence buyers for retail organizations in making their selections. Since product availability is one of the most important aspects of customer service, it can be concluded that customer service is potentially a very important factor in determining the final market success of a product.

Some empirical research information regarding customer and supplier perceptions of the relative importance of customer service in the marketing mix is available in the literature. A survey of industrial purchasing officers conducted by Perreault and Russ (1976) found that distribution service was considered second in importance only to product quality as a deciding criterion for vendor selection. Moreover, more than one-third of those purchasing officers indicated that they would cancel their orders if products were not available for shipment when ordered.

The findings of a study conducted by Cunningham and Roberts (1974) further reinforced these results. Delivery reliability (which is a major element of customer service) was found to be the most important element, in the opinion of purchasers, for influencing choice of supplier. It was found to be even more important than technical advice.

LaLonde and Zinszer (1976) surveyed the opinions of supplying manufacturers on the relative importance of customer service in the marketing mix. It was found that customer service was ranked third in importance behind the marketing elements of product and price.

The results of the above empirical studies indicate that buyers apparently take the quality of customer service much more seriously than do suppliers. Christopher, Schary, and Skjott-Larsen (1979) conclude that customer service is a very important strategic weapon in the struggle to attain and maintain market position, but that it has often been neglected by suppliers.

2.3 CUSTOMER SERVICE AS A PERCEIVED VARIABLE

2.3.1 Introduction.

Customer perception of customer service has been recognized as a very important variable mediating the influence of customer service packages on customer response. Ballou (1973) defines customer service as a "complex collection of demand related factors under the control of the firm, but whose importance in determining supplier patronage is ultimately evaluated by the customer receiving the service." Schary (1980) has treated customer service as a perceived variable in his model of the sequence of customer service strategy (Figure 6).

Schary's model indicates that observation (or perception) of customer service has to occur before the customer responds to it, i.e. perception of customer service is an intervening variable between the supplier's customer service parameters (stimuli) and the customer's response.

Perceptions (especially customer perceptions) have been used in several customer service evaluation models in order to develop guidelines for developing customer service packages. This dependence on perceptions may be due to the following reasons:

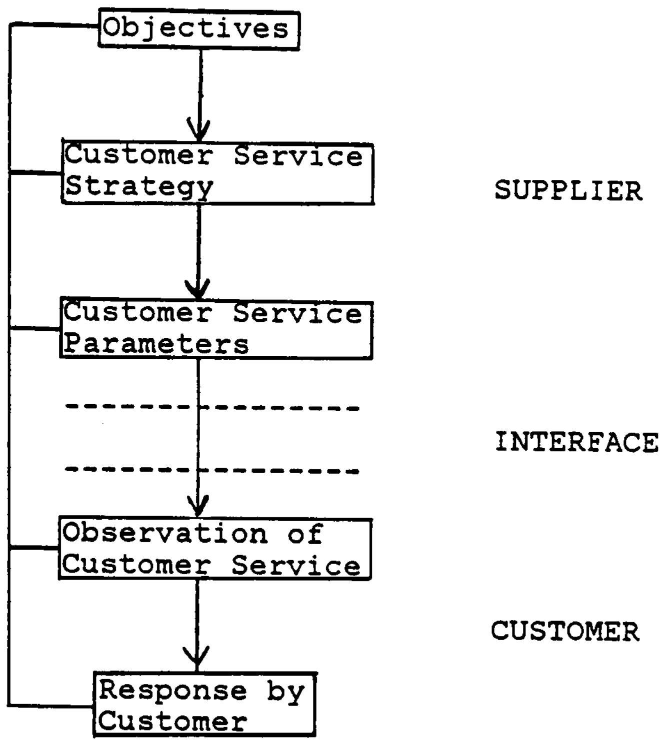

Figure 6: Sequence of Customer Service Strategy.

Source: P. B. Schary, "Management Control Over Customer Service," International Journal of Physical Distribution and Materials Management, Vol. 10, No. 4, (1980), 148.

1. Perception of customer service in the form of attributes can often be easily related to the elements of the customer service package. In several situations, it may be easier to obtain perceptual data than actual performance data about customer service elements (Christenberry, 1976). This is especially the case when recorded performance data are not available or are difficult to obtain, and when subjective dimensions of customer service have to be measured.
2. Perceptual measurement can be made of several different levels of customer service. Comparison levels, actual levels, competitive levels, and even the perceived relationship with market response can be obtained using perceptual measures (Gilmour, 1979). Hard data regarding these may be difficult or even impossible to obtain. Perceptual data can often be used as measures of intermediate response to customer service stimuli. These perceptions are more closely related to market response than the stimuli themselves. It is also relatively less difficult to measure perceptions than to measure market response in dollars or units. Hence, such perceptions are often used to determine the optimum

customer service mix. In customer service evaluation models, very often guidelines for the development of customer service packages are based on measured customer perceptions of the required levels of customer service.

There are very few studies which explore the relationship between actual customer service levels, and the perception of these levels. Most researchers in the field of physical distribution have assumed that this relationship exists, in spite of the lack of empirical studies regarding it. Willett and Stephenson (1969) have established through an empirical study that a positive link exits between actual service and a firm's perception of that service.

Although customer service has been recognized as a perceived variable, customer service literature has not attempted to explore the conceptual foundations of customer service perceptions. The behavioral foundations of product and service perceptions have been studied more extensively in consumer behavior literature.

In this section, an effort is made to briefly review the behavioral foundations of consumer decision making for the purpose of conceptualizing some of the behavioral processes underlying customer response to physical distribution customer service.

2.3.2 Behavioral Foundations.

The conceptualization of customer service as a "perceived" variable is a logical outcome of the recognition of the supplier and the customer as interacting goal oriented systems and the identification of customer service as the point of interaction between the two systems. The response of one system to the other would depend upon the information it receives from stimuli sent by the other.

In human behavior, the process of giving meaning to stimuli is referred to as perception. It is a complex process by which people select, organize, and interpret sensory stimulation into a meaningful and coherent picture of the world (Berelson and Steiner, 1964).

The relevance of the concept of perception to marketing and physical distribution management arises from the fact that products and services have to be perceived by the customer. The characteristics or features of the product or service are communicated to the customer in the form of sensory stimuli. These are perceived by the customer as attributes of the product or service. Apparently, these perceptions should influence the customer's purchase behavior.

The relationship between customer perceptions and choice of a product or service is clearly described in

Brunswik's "lens model" (Brunswik, 1952). Brunswik's lens model (Figure 7) was developed to help explain psychological effects on decision making.

Brunswik's model describes how physical features (of a product or a service) and psychosocial cues influence the formation of perceptions and how these perceptions influence the formation of preferences. Choice is influenced by preferences and by constraining factors.

Brunswik's model presents an extremely simplified picture of consumer decision making. For example, unlike the presentation in the model, the link between perception and preference might involve a complex process of alternative evaluation. An extensive review of literature on consumer decision making is beyond the scope of this dissertation. However, in the following pages, some behavioral concepts which are relevant to the proposed behavioral process model of customer service evaluation have been reviewed.

2.3.2.1 Perception of Attributes.

Consumer behavior literature has traditionally treated products and services as bundles of attributes. In his discussion of psychological structures, Sirgy (1983), defines attributes as "concepts that are used to describe the characteristics of the percept and concept in question."

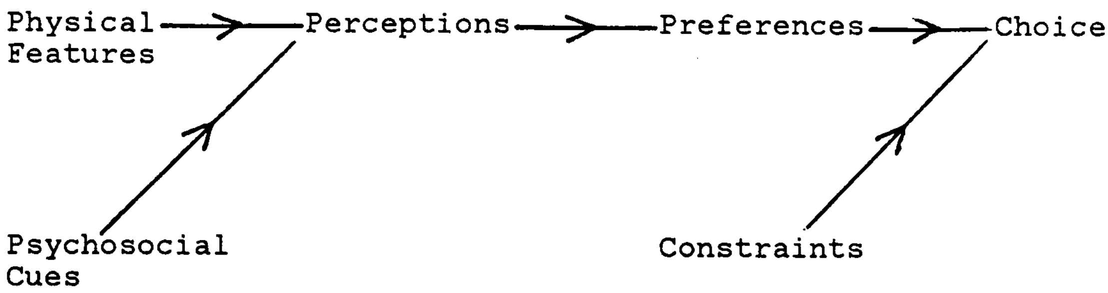

Figure 7: Brunswik's Lens Model.

Source: E. Brunswik, The Conceptual Framework of Psychology. Chicago: University of Chicago Press, 1952.

A concept is a mental representation of a set of objects or events stored in the cognitive structures or memory banks of an individual (Paivio, 1971). In the context of customer service, the representation of the meaning and components of customer service in the mind of an individual is the concept. The individual might be a member of the supplier organization or the customer organization. A percept (Sirgy, 1983), on the other hand is a concept placed in the focus of attention. A concept is said to be placed in the focus of attention when it is to be perceptually processed or evaluated in a particular context. In the context of an ongoing customer service relationship, the concept of customer service (as applicable to a specific supplier) is perceptually processed and evaluated on a continuous basis.

Sirgy (1983) has described the basic role of attributes in perceptual processing as follows.

> Percepts and concepts when placed in the "perceptual platform"(that is, in the focus of attention) are said to have certain attributes. Attributes are concepts that are used to describe the characteristics of the percept and concept in question. For example, a consumer product may be a percept when it is perceived or evaluated; however, it remains a concept when it is simply stored in the memory structures. The perception or evaluation process of a given percept is done through a comparison of the attribute value of the percept and the attribute value of the corresponding evoked concept.

Most product/service attributes may be placed into one of three major categories:.

1. Product (or service) referent, consisting of physical characteristics or properties of a product or service.
2. Task or Outcome referent, reflecting the perceived results or outcomes from using a product or service.
3. User referent, reflecting what usage of the product or service implies or says about the person who is selecting or using it (Myers and Shocker, 1975).

Physical distribution customer service, from the perspective of most buyers, may fall under the second category (i.e. Task or outcome referent attributes). Most industrial buyers are likely to view good customer service as a characteristic which will help them to meet their buying requirements at the least cost, with the least of effort, and without running into unexpected crisis situations too frequently.

Attributes of a product or a service might form all or most of the evaluative criteria used for arriving at a specific purchase decision. The buyer of a product or a service is faced with the task of combining separate and often diverse attribute information into a coherent judgement.

Consumer behavior literature has proposed several models that are used by consumers for arriving at a judgement about a product or service. These may be broadly divided into compensatory models and non-compensatory models (Engel, Blackwell and Kollat, 1978). In compensatory models, a weakness on one attribute may be compensated by strengths on others. In non-compensatory models, a weakness on one attribute is not compensated for by strength on another. Several researchers in the area of consumer behavior have explored the applicability of these models to different situations. A more detailed description of the topic of attribute evaluation models is beyond the scope of this paper.

Some researchers have applied compensatory models to evaluate customer service. In studies conducted by Simon (1965) and Cunningham and Roberts (1974), the ratings of suppliers on several customer service elements were multiplied by the importance weights of these elements to the customers. These weighted elements were then summed to obtain an overall evaluation.

In Simon's study, respondents from three different industries were required to rate the importance of a list of customer service elements on a 1 to 10 scale. It was found that although the elements were common to all the three industries, their weights differed significantly between industries. The respondents also evaluated each supplier on his performance on each service variable. A measure of total satisfaction was obtained by summing the weighted individual satisfactions for each element which resulted from a given performance.

Cunningham and Roberts asked industrial buyers to indicate the five most important factors and the importance ranking of those factors. In addition to this, an overall evaluation of each supplier was obtained by asking the buyers to evaluate each supplier's performance on each service elements using a five-point bi-polar semantic scale. The responses on this evaluation scale were then weighted by the percentage of times the service factor was ranked in the top five.

Although compensatory models of alternative evaluation have been applied in the field of distribution, no effort has been made to validate their application.

2.3.2.2 Psychological Congruity.

The theory of psychological congruity states that psychological processes involved in goal directed behavior can be explained by the simple process called congruity (Sirgy, 1983). The process of congruity points to the psychological comparison between perceptual set and an evoked frame of reference (March and Simon, 1983). A perceptual set refers to one or more perceptions related to a specific percept. The evoked set refers to those corresponding beliefs that are elicited from the person's cognitive structures for perceiving or evaluating the percept (Sirgy, 1983).

These are a number of theories in psychology which are consistent with the theory of psychological congruity. Two such theories are Thibaut and Kelley's Exchange Theory (Thibaut and Kelley, 1959) and the Adaptation Level Theory of Helson (1964).

Thibaut and Kelley (Sirgy, 1983) describe the results of interaction between individuals in the form of costs and rewards. An individual's satisfaction from a purchase transaction may be determined by the discrepancy between the outcome of the transaction and a standard for comparison known as the comparison level (an evoked frame of reference).

The Adaptation-level theory (Sirgy 1983) deals with the capacity of a stimulus to attract attention. Different stimuli have different adaptation levels. When the level of a particular stimulus is different from it adaptation level, it attracts attention. In the context of the purchase of a product or service, different product/service attributes may have different adaptation levels. Brand performance judgements may be based on how different brand attribute levels differ from their respective adaptation levels.

The widely supported confirmation/disconfirmation paradigm used in consumer satisfaction studies is consistent with the above theories. According to this paradigm, out of a persons past experiences, a person develops certain expectations and standards for different products and services. These standards are used as norms or comparison levels against which purchase and use experiences are compared. When a person purchases and uses a product or service, that particular purchase and use experience is compared against the existing norm of the customer for such purchases (i.e. for such products or brands). This process of comparison confirms or disconfirms prior expectations. The direction and the magnitude of the differences between the actual performance levels and the comparison levels determine the level of satisfaction.

The confirmation-disconfirmation paradigm is primarily used in consumer behavior to explain post-purchase processes. In any ongoing channel relationship, due to continuous nature of the supplier-customer transactions, a distinction is difficult to make between pre-purchase and post purchase evaluation processes.

The confirmation disconfirmation paradigm may be applicable to vendor service evaluation processes as well as satisfaction processes in a channel of distribution.

Woodruff, Cadotte, and Jenkins (1983) have proposed that expectations may be viewed as a process. This process provides a basis for the development of a standard against which perceived brand unit performance can be evaluated. These standards or norms serve as performance anchors for satisfaction evaluation. On the basis of the confirmation/disconfirmation paradigm, brand unit performance above the relevant performance norm leads to varying degrees of satisfaction, and performance below the norm causes dissatisfaction.

Woodruff, Cadotte, and Jenkins (1983) have proposed three kinds of norms.

1. The Best Brand Norm. In this case, the performance norm will be equivalent to the expected performance of the best brand. In the context of customer service, this should be the expected performance of the competing supplier who has the best physical distribution service.
2. The Product Norm. In this case, the norm for performance might develop from a pooling of experiences across similar brands, or in the case of physical distribution, across similar suppliers.

3. <u>The Brand Norm</u>. In this case, the consumer relies primarily upon his/her past experiences with other units of the same brand as the one purchased, or the same supplier (in the case of physical distribution).

Other researcher too have identified norms which consumers may use as comparison standards for performance evaluation. Miller (1977) has specified four such norms: the ideal, the expected, the minimum tolerable, and the deserved. The "ideal" is the performance level which the consumer desires or wishes to get. The "expected" is based on the consumer's perception of past average performance. The "minimum acceptable" is the lowest performance level which the consumer perceives to be acceptable, and the "deserved" is what the consumer feels he or she should get considering the investment (in time, money, stress, etc.) which was made to obtain the product or service. The above norms may also be applicable to the context where a customer is evaluating a supplier's physical distribution customer service.

No published literature is available on any effort that might have been made to empirically study the applicability of concepts related to the theory of Perceptual Congruity, the Exchange Theory and the Adaptation-Level Theory in the context of physical distribution systems.

2.4 MARKET RESPONSE TO CUSTOMER SERVICE

2.4.1 Introduction.

Market response may be defined as any (preferably managerially relevant) response of the market to controllable or uncontrollable factors. It is a multi-dimensional concept and may be measured using different indicators such as sales, cost, profit, back order, etc.

It is important to remember that market response is the result of the responses of individuals and organizations. Hence, the behavioral aspects of market response to customer service variables are very important areas for modeling.

2.4.2 The Stimulus-Response Model.

The concept of market response is based on the classical stimulus-response model. Stimuli such as marketing variables and physical distribution service variables act as stimuli on customers who respond to them creating customer/market response. In general, the term "customer-response" is used in the literature to represent the response variables when customers are at lower levels of aggregation and their responses are studied from a more behavioral perspective. The term "market-response" is typically used when customers are treated at higher levels of aggregation, when their responses are measured in easily quantifiable data (such as sales dollars), and when the stimulus-response relationship is mathematically tractable. In this dissertation, the terms market response and customer response are treated as synonymous terms.

A customer's response to marketing stimuli can take several forms. Table 1 presents a list of consumer response variables broken down by marketing mix elements. This list is applicable primarily to consumer behavior and not to organizational buying behavior. Hence the responses to the place component are primarily relevant to consumer purchases at stores, and not to an ongoing distribution channel relationship.

Market response also has a temporal aspect to it. Schary (1980) suggests that market response could be divided into a number of service response stages (analogous to the "Hierarchy of Effects" states), and that customer service mixes should be targeted at these stages.

2.4.3 Stimulus-Response Models of Customer Service.

Most of the decision models in customer service are based primarily on the stimulus-response perspective. In most of these models, the descriptive information about the relationship between market response and the different elements in the customer service mix is used to develop a

TABLE 1

Examples of Consumer Response Variables broken down by Marketing Mix Elements

Marketing Mix Element	Consumer Response Variables
Product decisions	Problem recognition Product image Product preference Product choice Product usage Product satisfaction Product loyalty
Pricing decisions	Price perception Price preference Price acceptance
Place decisions	Store image Store preference Store patronage
Promotion decisions	Information acquisition Media image Media preference Media choice Message awareness Message comprehension Message interest Message belief Message persuasion
Target Market Decisions	Life-style segmentation Personality segmentation Self-concept segmentation Demographic segmentation Geographic segmentation Benefit segmentation

Source: M. Joseph Sirgy, Social Cognition and Consumer Behavior, (New York: Praeger Publishers, 1983), 24.

predictive market response function. This predictive model is used within a normative framework (a prescribed procedure) to arrive at an optimum decision. A typical customer service evaluation model consists of such a predictive model and its normative framework.

Market response may be studied from two different perspectives: (a) from a negative perspective--as the response of cost (including opportunity cost) to stock-outs, or (b) from a positive perspective--as sales response or profit response to customer service variables.

The relationship between customer service and market-response has been a very popular area for modeling, and several mathematical models have been developed to describe it. However, in this chapter, only empirical studies of the relationship between customer service and market response will be studied.

2.4.3.1 Models of Market Response to Stock-outs.

The traditional models of market response to customer service levels have generally focused their attention on the effects of product stock-outs.

Shycon and Sprague (1975) analyzed the effects of the number of product days stock-out on retail grocery sales. The results indicated that lost profits increase exponentially as stock-out days increase.

Schary and Becker (1978) studied out-of-stocks that occurred as the result of a strike. They discovered a positive relationship between increase in market share and availability of brand.

Market response to stock-outs should be conceptualized as more than immediate lost sales. A stock-out leads to a chain of behavioral events. Many of the more recent stock-out models have tried to measure this.

Walter and Lalonde (1975) have empirically developed sequential descriptive stock-out models, which chart the purchase behavior (brand switching and substitution) of customers.

Market response (in the form of purchase behavior) of customers to stock-out has been modeled experimentally by Charlton and Ehrenberg (1976) and with the aid of in-store interviews by Christopher and Schary (1977).

Miklas (1978) has introduced some models from consumer behavior for the estimation of the response of customers to stock-outs. These are (1) Learning Model, (2) Markov Chain Models, (3) Negative Binomial Distribution Model, and (4) Catastrophe Theory Model. These are basically mathematical models that represent simplified behavioral relationships.

Modeling the behavioral implications of stock-out is still at a very elementary stage. Considerable effort will have to be put into the conceptual development and empirical testing of models in this area before it is possible to have managerially useful models of the above type. Development of modeling in this area, however, is of the utmost importance for the advancement of customer service as an area of study, and for the development of useful models for customer service evaluation and management.

2.4.3.2 Models of Sales Response to Customer Service Variables.

This is a relatively more rapidly developing area of customer service modeling. Several of the normative models of customer service incorporate a sales response function in them.

The sales response function has some variations. Sales may be measured in dollar sales or in units. A demand response function is very similar to a sales response function, but the demand is often greater than sales. Demand for a product or service does not always result in a sale, and when it does not, measurement of this demand is often difficult. A profit response function can be obtained from a sales response function, by deducting the cost response to various levels of customer service from the sales response function.

One of the first attempts to model the response function of sales to customer service was made by Stephenson and Willett (1968). They developed a function relating lead time to sales generation, but it did not produce a particularly good fit to reality, probably because many aspects of customer service were not considered in the function.

Ballou and Kalwani (1973) collected data for the development of a sales response function through an opinion survey. Order cycle time was taken as a proxy to represent all customer service variables. Six different forms of models (Linear, Power, Logarithmic, Logistics, and two exponential types) were tested on the data using regression analysis. The square root model was found to be the best in terms of simplicity, and was found to be acceptable in terms of statistical significance.

Perreault and Russ (1976) have estimated the function of sales response to customer service variables by measuring the perceived value (to customers) of different services offered by the supplier. This is done through an analysis of implicit trade-offs made by customers between the prices they pay and the level of service provided to them. They report the results of an investigation and comparison of three models for measuring the implicit trade-offs.

1. Multifactor Comparative Judgement (MCJ),
2. Conjoint Analysis, and
3. The Constant Sum Method.

It was found that the Conjoint Analysis Model and the MCJ model were superior to the Constant Sum Method. Conjoint Analysis was recommended as the most practical model provided that the researcher is willing to assume that a monotonic, additive, main effects model is applicable to the evaluation process, and does not feel that this assumption needs to be tested.

Gilmour (1979) has developed a two-stage method for the development of a demand response function. The first stage is the establishment of the form of the function from previous research findings, practical knowledge, sensitivity analysis, and subjective estimates made by managers regarding the parameters of the function. The second stage is that of empirical testing, when modifications are made on the function to accurately reflect reality. During this stage, subjective estimates of sales response are collected from managers and these are compared with the estimates obtained from the function to test its validity.

Levy (1981a) has related the shape of the sales response to customer service levels (diminishing returns), to power within the distribution channel. The diminishing utility of additional rewards of the same kind (beyond a certain level) is compared with a possible diminishing utility of additional customer service after a certain level. This is measured using conjoint analysis. The results indicate that diminishing returns applies to some elements of customer service, but not to all the elements.

With the recognition of the revenue generating capacity of customer service, models of sales-response (or profit-response) to customer service variables have been gaining in importance. These models are particularly useful as parts of larger customer service evaluation models.

2.5 CUSTOMER SERVICE EVALUATION

Customer Service Evaluation may be defined as the process of comparing the existing customer service level with (an approximation of) the optimum. The purpose of this process is to guide the supplier in offering the optimum customer service mix.

Several models have been developed for the determination of customer service requirements. Some of these are only minor modifications of the others. A variety of customer service evaluation models have been reviewed below:

2.5.1 Model based on Marginal Cost Analysis.

Christophides and Watson-Gandy (1973) have presented a simple mathematical method for the determination of customer service requirements. This method assumes that a curve can be modeled indicating the relationship between distribution costs and delivery service. From the shape of this curve, the level of customer service which equalizes the marginal distribution cost and the marginal savings or profits from improved customer service can be selected. In most cases this will provide an approximation of the optimum level of expenditure on customer service. However, this model does not indicate how this budgeted amount should be used.

2.5.2 Model based on the Quantification of Service Failure.

Shycon and Sprague (1975) describe a procedure for evaluating various levels of customer service and for determining the level that optimizes the contribution to profit. The strength of this method lies in its simplicity and in its ability to quantify stock-out costs. This procedure consists of three steps:

1. Establishing realistic costs for the points where losses occur although the researchers do not make it very clear; apparently a variety of measures which use hard data; opinion surveys, and observational techniques can be used;

2. Determining the odds that the losses will occur; and
3. Developing the optimal service policy.

2.5.3 Models based on Customer Perceptions.

Hutchinson and Stolle (1968), have defined six main steps which are required for successful customer service management programs. The first three lead to the determination of customer service requirements. They are:

1. Definition of the relevant customer service elements,
2. Checking customer views, and
3. Designing a "package"; this should include the following steps:
   (a) assessing the minimum requirements for meeting customer needs,
   (b) identifying the feature that will have customer impact relative to competition,
   (c) modeling possible trade-offs among alternatives, and
   (d) accurately determining all of the economic aspects.

Simon (1975) and Cunningham and Roberts (1974) have used basic multi-attribute methods to evaluate a firm's total customer service package. These multi-attribute models have already been discussed under "perception of attributes."

Perreault and Russ (1974) have developed a more sophisticated method for evaluating customer service. This method is based on the conjoint scaling model. Implicit trade-offs made by a firm's customers, when offered a package of benefits and costs, are estimated. This may be a more valid but difficult procedure for determining customer service requirements.

2.5.4 Model based on Supplier Perceptions.

Gilmour (1979) has developed a model for customer service evaluation based on the supplier's perceptions of market response to customer service variables. He utilized an interactive computer program into which suppliers input their perceptions of how they believed their market share would change as changes are made in their customer service packages. This model then developed the relationship between customer service and demand. This relationship is used as a part of a customer service evaluation model.

The greatest strengths of this model are its flexibility and its capacity to incorporate managerial judgement. However, its main drawback is that it neglects the customer. It has no mechanism to correct any misperceptions of the suppliers regarding customer service requirements.

2.5.5 Model based on Supplier and Customer Perceptions.

Levy (1978, 1981b) has developed a methodology for customer service evaluation. In this methodology discriminant analysis of supplier and customer perceptions of customer service is one of the techniques used for identifying potentially useful customer service elements. These elements, in turn, are used in a conjoint analysis model for estimating implicit trade-offs made by customers in order to choose a customer service package. Although this model uses supplier and customer perceptions, the latter plays a larger role in it.

Several of the customer service evaluation models cited above are based on the measurement of customer perceptions of customer service requirements. Most of these models have been based on oversimplified conceptualizations of the underlying psychological processes relevant to customer service evaluation. A particular measuring technique, might be measuring only one variable among several involved in the process of customer service evaluation.

A skeleton model of the process of customer service evaluation has been presented in Figure 8.

The presented skeleton model treats market response as the outcome of a comparison process. This cognitive comparison takes place in the mind of the customer. During

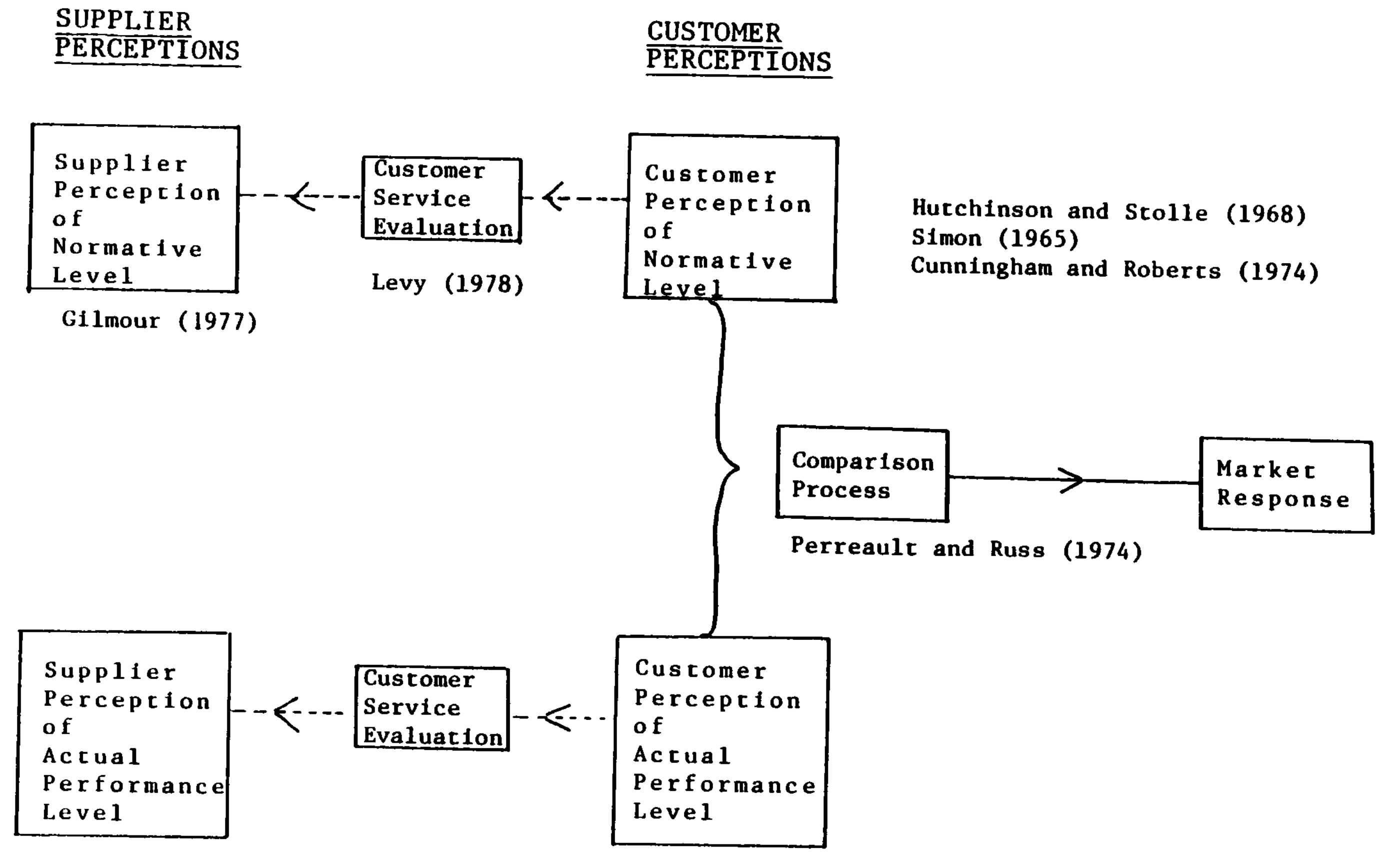

Figure 8: A Skeleton Model of the Process of Customer Service Evaluation.

this process, the customer compares the perceived actual service performance to a perceived norm (probably an industry standard). In order to influence the outcome of this comparison process, the supplier would like to know more about the customer's performance norm as well as the customer's perceptions of the supplier's performance. This is achieved through methods of customer service evaluation. <u>In this model, customer service evaluation is described as a technique to reduce supplier-customer differences in perception on relevant customer service elements</u>.

In Figure 8, the presented model has been used as a framework to position the various perception based customer service evaluation models which were reviewed earlier. These models are positioned on the basis of the specific aspects of customer service perception which they focus on measuring. As can be noted from their positioning on the framework, most of the models have focused on specific structural components presented in the skeleton model. The results of customer service evaluation would depend upon the model used for the task, and on the specific portion of the skeleton model which is being measured. The only model that tries to measure the comparison process is the conjoint analysis model developed by Perreault and Russ (1974).

A serious weakness of the area of customer service modeling is the relative scarcity of models which adequately reflect the behavioral processes underlying customer service evaluation.

Most of the published models of customer service evaluation are based on the measurement of customer perceptions regarding various relevant customer service attributes. However, very few researchers have empirically tested their perception based models of customer service evaluation.

There is only one published empirical research effort in the field of physical distribution which empirically studied the ability of perceptual measures of customer service evaluation to predict customer judgements of preference for suppliers. Perreault and Russ (1976) compared three perception based measurement methods. It was found that indirect methods of estimating trade-offs (Conjoint Scaling and a multi-factor generalization of Thurstone's Law of Comparative Judgement) proved to be more accurate than the direct (constant sum) method. A possible reason for this result is that the indirect methods measure trade-offs between different customer service elements as well as the comparison process described in Figure 8. The constant-sum method attempts to measure only the normative levels of different customer service elements.

2.6 THE PROPOSED BEHAVIORAL PROCESS MODEL OF CUSTOMER SERVICE EVALUATION

In this section, a behavioral process model of customer service evaluation is described. This dissertation is built around the presented behavioral process model.

The behavioral process model (Figure 2, page 9) was described in Chapter I. The basic framework of this model was further used in Chapter II to position various customer service evaluation models on a framework (Figure 8). Hence, the overall customer service evaluation process which the model represents will not be described in this section. The focus of this section is on the individual variables presented in the model and their relationships with other variables.

2.6.1 Market Response.

Market response is the dependent variable in the model. The concept of market response, and its treatment in customer service literature has already been reviewed in an earlier section in this chapter. For the purposes of this research, market response is treated as a variable which includes choice and post choice behavioral responses of customers. Market response, as defined above, could include variables such as performance, purchase, post-purchase satisfaction, and other post-purchase behavioral processes.

Although the proposed behavioral process model is generalizable to all marketing mix elements, the model was developed primarily to conceptualize and to empirically study the behavioral processes underlying customer response to physical distribution service.

2.6.2 <u>The Cognitive Process of Comparison</u>.

The model treats market response as an outcome of a cognitive process of comparison between what the customer perceives as the actual customer service performance of a supplier, and certain comparison levels (Thibaut and Kelley, 1959) or evoked frames of reference (Sirgy, 1983) in the customer's cognition. The comparison process takes place along a set of relevant criteria. These criteria may represent one or more attribute dimensions. The results of this comparison are combined to develop an overall judgement of preference about the customer service package. This judgement is a part of the dependent variable, i.e. market response. The model does not specify the cognitive algebra that is used by customers to form preference judgements from the results of the above cognitive comparisons.

2.6.3 Supplier-Customer Differences in Perception.

The proposed model advances the theses that the cognitive comparison described above is influenced by differences between the supplier and the customer in their perception of the actual levels of service provided by the supplier, and the comparison levels that are used as benchmarks to evaluate these levels. Larger differences between the perceptions of the supplier and the customer should lead to larger differences between comparison levels and actual performance levels as perceived by the customer.

Figure 2 (page 9) describes how the supplier's perception of the comparison levels (standards) for customer service influences his decisions. The decisions, in turn, are implemented and some actual service levels are provided to the customer. These actual service levels are perceived by the customer and they are compared with the customer's own perception of their respective comparison levels.

The model recognizes that customers and suppliers perceive the actual service levels separately leading to separate and probably significantly different supplier and customer perceptions of actual performance. Managerial control of customer service would be easier if supplier and customer perceptions of the actual service levels are similar.

Customer service evaluation is introduced in the model as a technique that is used to bring supplier perceptions of the comparison levels and the actual levels closer to customer perceptions of the same.

2.6.3.1 Contribution of Channel Conflict Literature.

Supplier-customer differences in the perception of service variables have often been used to measure conflict within channels of distribution (Mack and Snyder, 1957). Channel conflict is a situation in which one channel member perceives another channel member(s) to be engaged in behavior that is preventing or impeding him from achieving his goals. In conflict literature, supplier-customer differences in perception is often represented by the concept of domain dissensus. This concept is applicable to a wider domain of a company than its distribution channels. However, the concept is very relevant to the process of customer service evaluation. Thompson (1967) describes domain consensus, (the opposite of domain dissensus) as:

> . . . 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. It provides although imperfectly, an image of the organization's role in the larger system, which in turn serves as a guide for the ordering of action in certain directions, and not in others (Thompson, 1967).

If, as described above, domain consensus can be a useful guideline for action, the lack of it (domain dissensus) should adversely affect the ability of a firm to order it actions in preferred directions.

Differences between the perceptions of suppliers and customers have been recognized as an important contributor to channel conflict. Etgar (1979) has found through an empirical study that disagreements about channel roles, expectations, perceptions, and channel communications are the most important ones in several conflict situations. In a typical study of differing perceptions between members of a channel, critical channel issues are identified and different channel members are requested to rate them in importance. Supplier-customer differences are measured on issues and not on the actual levels of service which the supplier is providing. In the proposed behavioral process model of customer service evaluation, differences between the supplier and the customer on their perceived service levels are to be measured.

There are only a few published empirical studies on the relationship between conflict and channel performance. In general, no clear and consistent relationship has been observed between these variables (Pearson, 1973; Lusch, 1976; Brown, 1979).

2.6.4 Background Factors.

The proposed behavioral process model indicates that supplier as well as customer perceptions of comparison levels are influenced by experience, industry standards, and the purchase situation.

Researchers have conceptualized that the norm or comparison levels which consumers use for evaluating brand attributes are influenced by their past experiences with the same and similar brands (Woodruff, Cadotte and Jenkins, 1983). This conceptualization should also be applicable to the field of physical distribution. Another important factor that influences the comparison levels is the presence of published standards of performance in that industry.

It has also been recognized that the comparison levels used for product or service evaluation may differ with the nature of the situation (Woodruff, Cadotte, and Jenkins, 1983). This factor should also be important in the field of physical distribution. The comparison levels used for an urgent order might be different from those used for a regular order.

2.7 CONCLUSION OF LITERATURE REVIEW

In the above review of literature, concepts and empirical findings have been borrowed from various disciplines in order to develop a behavioral process model of customer service evaluation. The field of physical distribution has traditionally been cost-oriented. Most of the available publications in this field are either very descriptive (e.g. using case analysis), or very numerical and mathematical in orientation. Behavioral modeling in the field of physical distribution/logistics is still at a rudimentary stage.

One of the objectives of the above literature review and the behavioral process model is to incorporate behavioral thinking into the field of physical distribution/logistics.

CHAPTER III

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter is divided into five sections. In the first section, the theoretical variables and observables are identified, in the second section, the research hypotheses are stated and discussed, in the third, the theoretical variables are operationalized as scales of measurement, in the fourth section a plan for statistical analysis is introduced, and in the fifth, the research design and program are described.

3.2 IDENTIFICATION OF THEORETICAL VARIABLES AND OBSERVABLES

The behavioral process model of customer service evaluation (Figure 2, page 9) and the theoretical structure to be tested in this dissertation (Figure 3, page 10) have already been introduced in Chapter I. The <u>dependent variable</u> in the theoretical structure is market response. There are two <u>independent</u> <u>variables</u> in the theoretical structure. They are two different constructs which represent two distinct components of supplier-customer differences in customer service perception. The first construct stands for supplier-customer differences in the perception of customer service comparison levels (norms). The second construct stands for supplier-customer differences in the perception of the actual or current levels of customer service. These variables are linked to the dependent variable through an <u>intervening variable</u> represented by departure from comparison levels.

In this section, the observables of these variables are identified, but they are not operationalized in the form of measurement scales.

Measures of the <u>dependent variable</u>, i.e. market response (MR) include:

1. customers preference for supplier (MR_{pf});
2. customers satisfaction with the supplier (MR_{st});
3. customers evaluation of supplier's customer service on the basis of purchase experience with the supplier (MR_{ev});
4. past trend in the customer's purchases from the supplier (MR_{ptr});
5. future purchase intentions of the customer(MR_{fi});
6. supplier's share of customer's purchases (MR_{sh}); and
7. purchase volume (MR_{vol}).

In order to measure the <u>independent variable</u>, i.e. supplier-customer differences in perception, it was necessary to measure the customer service perceptions, of the supplier and of the customer separately. In addition to this, in the case of each respondent, and for each measure, two distinct levels of service were measured, namely the comparison level and the actual performance level. The independent variable was computed from four components:

1. supplier's perception of comparison levels $(S_c)_{1-n}$[2]
2. supplier's perception of actual performance levels $(S_a)_{1-n}$;
3. customer's perception of comparison levels $(C_c)_{1-n}$; and
4. customer's perception of actual performance levels $(C_a)_{1-n}$.

The independent variable may be computed from the above components as follows:

1. based on comparison levels $(S_c - C_c)_{1-n}$,
2. based on actual levels $(S_a - C_a)_{1-n}$, and

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[2]The number of indicators used in the measurement of each construct is represented be the letter 'n.' In the case of constructs which are measured by the computation of differences between other measures, each indicator stands for the difference between specific pairs of indicators. For instance, supplier-customer differences in perception of supplier's actual stock-out level is treated as a single indicator although it is the result of separate perceptions of the stock-out level by the supplier and by the customer.

3. a combination of the above $(S_c - C_c)_{1-n}$, $(S_a - C_a)_{1-n}$.

The intervening variable, i.e. departure from comparison levels is the computed difference between the customer's perception of the actual performance levels $(C_a)_{1-n}$ and his/her perception of the comparison levels $(C_c)_{1-n}$. It may be represented in algebraic form as $(C_a - C_c)_{1-n}$.

The variables in the theoretical structure and their measures have been presented in Figure 9. In the third section of this chapter, all the observables described in this section are operationalized in the form of scales of measurement.

3.3 STATEMENT AND DISCUSSION OF THE HYPOTHESES

The specific hypotheses to be tested in this dissertation have been presented below in the form of hypotheses statements.

H_1: There is a significant relationship between departure from comparison levels and market response. This relationship is hypothesized to be positive in direction.

H_2: There is a significant relationship between supplier-customer differences in the perception of comparison levels, and departure from comparison levels. This relationship is hypothesized to be positive in direction.

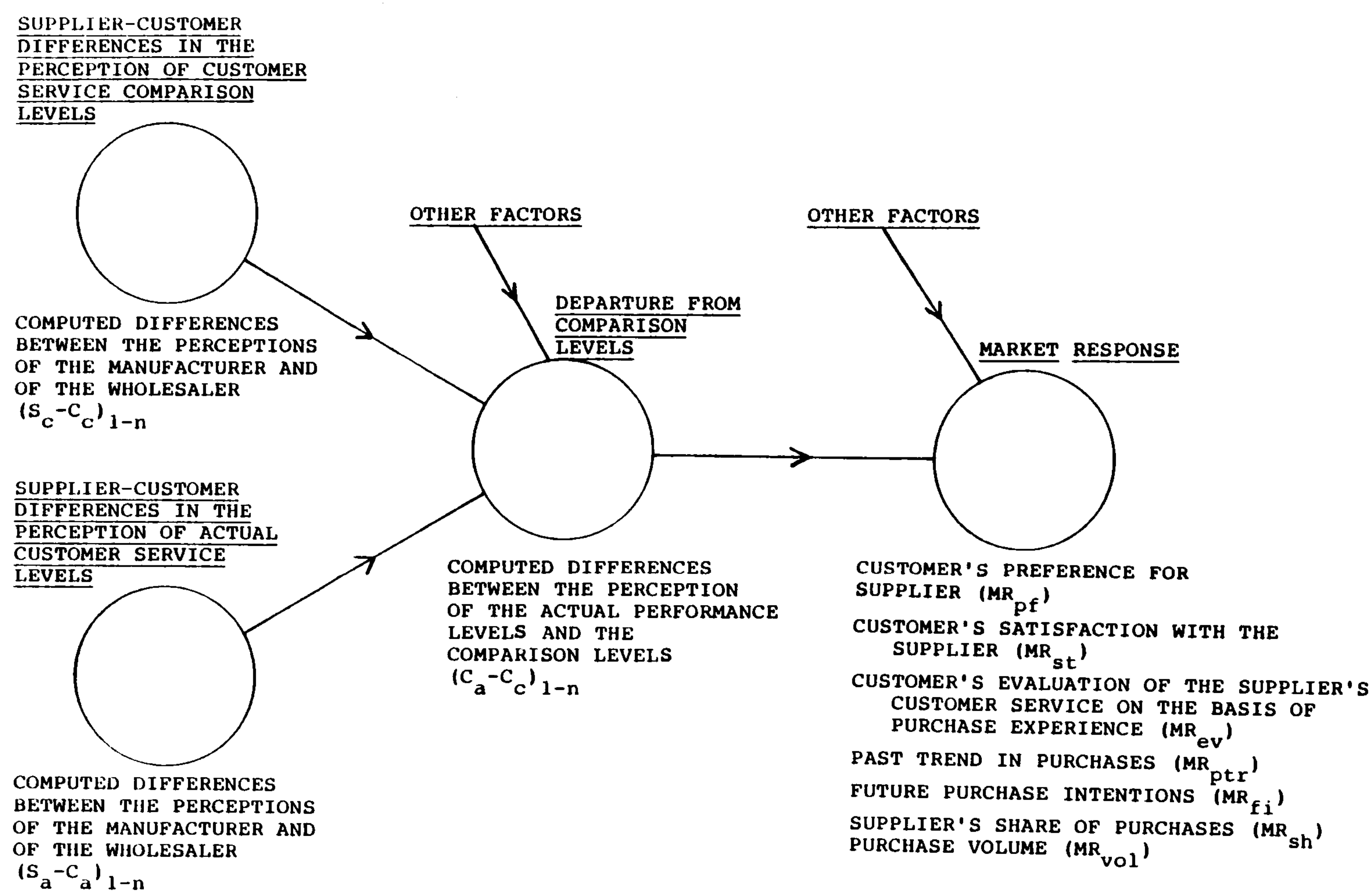

Figure 9: Theoretical Structure to be Tested (describing measures).

H_3: There is a significant relationship between supplier-customer differences in the perception of actual performance levels, and departure from comparison levels. This relationship is hypothesized to be negative in direction.

H_4: There is a significant relationship between supplier-customer differences in the perception of customer service levels (comparison actual performance) and departure from comparison levels. The relationship between supplier-customer differences in the perception of the comparison levels and departure from comparison levels is hypothesized to be positive in direction, while the relationship between supplier-customer differences in the perception of the actual service levels and departure from comparison levels is hypothesized to be negative in direction. The net relationship between supplier-customer differences in the perception of customer service levels and departure from comparison levels is hypothesized to be positive in direction.

3.3.1 Discussion of Hypothesis 1

Hypothesis 1 states that "there is a significant relationship between departure from comparison levels and market response," and that this relationship is hypothesized to be positive in direction. Departure from comparison levels is the difference between the perceptions of the actual customer service performance levels and their cognitive comparison levels. Market response represents the customer's choice and post-choice responses to a customer service package.

The hypothesis may be described in functional form as follows:

$$MR = fn\ (C_a - C_c)_{1-n}\ ,\ \text{where}$$

MR = Market Response.

C_a = Customer's perception of actual service level.

C_c = Customer's perception of comparison level.

n = Number of relevant indicators.

The differences computed on all the different indicators are not to be summed to compute a total score of departure from comparison levels. Rather, a few reliable and unidimensional items are to be selected (through statistical analysis) and during the application of causal modeling, they are to be used as different observables of the same theoretical construct.

The functional relationship specified above is based on the theory of psychological congruity (Sirgy,1983) discussed in chapters I and II. It is also consistent with the Exchange Theory of Thibaut and Kelley (Thibaut and Kelley, 1959), and the Adaptation Level Theory (Helson, 1964).

The comparison levels specified in the research model are not the "ideal" levels of attributes. Woodruff, Cadotte, and Jenkins (1983), have proposed that the performance norms used as a frame of reference by a consumer for evaluating product performance are derived from a consumer's experience with the familiar array of brands and product types within a class of alternatives perceived as relevant for a given need or want. One of the types of norms proposed by the above researchers is the product norm. The product norm is developed by a customer on the basis of the customer's purchase experiences with products of a particular product type. A similar viewpoint has been applied to physical distribution in the proposed model. The comparison levels are the typical levels of customer service provided by suppliers of the same product type. These form the benchmarks against which actual performance levels are compared. The <u>hypothesized direction of the relationship is positive</u>. It can be described as follows.

1. Low comparison level--High performance → Positive market response
2. Low comparison level--Low performance → Neutral market response
3. High comparison level--High performance → Neutral market response

4. High comparison level--Low performance $\longrightarrow$ Negative market response

It should be noted that the scale from low to high is continuous and not categorical as it appears in the above illustration.

3.3.2 Discussion of Hypothesis 2

Hypothesis 2 stages that "there is a significant relationship between supplier-customer differences in the perception of comparison levels, and departure from comparison levels." This relationship is hypothesized to be positive in direction.

The above hypothesis may be described in functional form as follows:

$$\text{Departure from comparison levels} = \text{fn} \left\{ \begin{array}{l} \text{Supplier-customer} \\ \text{differences in the} \\ \text{perception of} \\ \text{comparison levels} \end{array} \right.$$

$$(C_a - C_c)_{1-n} = \text{fn}\ (S_c - C_c)_{1-n}.$$

The theoretical foundation and logic underlying this hypothesis have already been discussed in chapters I and II. The direction of the relationship is <u>hypothesized to be positive</u>. The functional form presented above indicates that an increase in the supplier's comparison level (S_c) will move departure from comparison level (C_a - C_c) in the positive direction. An increase in the customer's comparison level (C_c) will have the opposite effect.

3.3.3 Discussion of Hypothesis 3

Hypothesis 3 states that "there is a significant relationship between supplier-customer differences in the perception of actual performance levels, and departure from comparison levels." This relationship is hypothesized to be negative in direction.

The above hypothesis may be presented in functional form as follows:

$$\text{Departure from comparison levels} = fn \left\{ \begin{array}{l} \text{Supplier-customer} \\ \text{differences in the} \\ \text{perception of actual} \\ \text{performance levels} \end{array} \right.$$

$$(C_a - C_c)_{1-n} = fn\ (S_a - C_a)_{1-n}$$

The theoretical foundations and the logic underlying this hypothesis have been discussed in Chapters I and II. Although the direction of the relationship is not very clear, it is <u>hypothesized to be negative</u>. An increase in the customers perception of actual performance (C_a) moves the dependent variable $(C_a - C_c)_{1-n}$ in the positive direction and the independent variable $(S_a - C_a)_{1-n}$ in the negative direction. The influence of an increase in the supplier's perception of the actual performance is not so obvious. However, its increase could move the dependent variable in the negative direction. The above statement is based on the reasoning that if the supplier perceives his performance level (S_a) to be quite high (when it really is not so), he will not take any corrective action to increase the customer's perceived performance level (C_a).

3.3.4 Discussion of Hypothesis 4

Hypothesis 4 states that "there is a significant relationship between supplier-customer differences in the perception of customer service levels (comparison levels + actual performance levels) and departure from comparison levels." The relationship between supplier-customer differences in the perception customer service comparison levels and departure from comparison levels is hypothesized to be positive in direction. The relationship between supplier-customer differences in the perception of actual customer service levels and departure from comparison levels is hypothesized to be negative in direction. The net relationship between supplier-customer differences in the perception of customer service levels (comparison levels actual performance levels) and departure from comparison levels is hypothesized to be positive in direction.

This relationship described by Hypothesis 4 may be specified in functional form as follows.

$$\text{Departure from comparison levels} = fn \begin{cases} \text{Supplier-customer} \\ \text{differences in the} \\ \text{perception of customer} \\ \text{service levels} \end{cases}$$

$$(C_a - C_c) = fn\ (S_c - C_c)_{1-n},\ (S_a - C_a)_{1-n}$$

This relationship is <u>hypothesized</u> <u>to</u> <u>be</u> <u>positive</u> because the differences in the perception of <u>comparison</u> <u>levels</u> $(S_c - C_c)_{1-n}$ are expected to have a stronger influence on customer service decisions than differences in the perception of <u>actual</u> <u>performance</u> <u>levels</u> $(S_a - C_a)_{1-n}$. This is indicated by the relative positions of the above variables in the proposed behavioral process model (Figure 2, page 9 and Figure 3, page 10).

3.4 <u>OPERATIONALIZATION</u> <u>OF</u> <u>VARIABLES</u>

3.4.1 <u>Introduction</u>.

The observables of the theoretical variables have already been identified in section I of this Chapter. This section will describe the basis upon which the observables were selected, and the procedure which was followed to develop the various measures which have been included in the pre-test questionnaires.

3.4.2 Identification of the Domain of Constructs.

Churchill (1979) has recommended that the development of a measuring instrument should begin with the identification of the domain of the constructs used in the model which is to be tested. The theoretical structure to be tested in this dissertation consists of three constructs.

1. Supplier-customer differences in customer service perceptions;
2. Departure from comparison level; and
3. Market-response.

Among these, (c) has a domain independent of the domain of (a) and (b). The constructs (a) and (b), however, are both based on the same underlying concept--the concept of customer service. Measures of (a) and (b) are computed from measures of customer service. Hence (a) and (b) can be said to have a common domain with the concept of customer service.

3.4.3 The Domain of Customer Service.

The term customer service is defined differently by different individuals. This lack of a clear definition becomes particularly conspicuous when the concept is compared across industries. If the concept is to be measured in a particular industry, it is necessary to find out how individuals in that industry perceive that concept.

During the development of their questionnaires, researchers have sometimes developed a channel-specific list of customer service elements and questionnaire items (Levy,1978)

A review of published literature in the field of physical distribution resulted in the selection of two lists of customer service elements applicable to the grocery industry, one was developed by Christopher, Schary, and Skjott-Larsen (1979), and the other by LaLonde and Zinszer (1976).

In the study by Christopher, Schary, and Skjott-Larsen (1979), seven retail head office buyers in the food products industry were requested to rank suppliers as well as the criteria on which the suppliers were judged. The actual evaluations of suppliers were compared to performance on elements which the respondent said were important. Table 2 presents a rank ordering of factors perceived by head office buyers as important in the evaluation of customer service. This ranking was developed by identifying the number of times each factor was mentioned and its rank.

LaLonde and Zinszer (1976) have identified the important elements of customer service in the food industry using the constant sum method of scaling. Individuals from the management of 26 food manufacturers were presented a list of customer service elements. They were requested to

TABLE 2

Rank Ordering of Factors Perceived by Head Office Buyers as Important in the Evaluation of Customer Service

Variable	Index Value
Product availability	60
Promotional activity	45
Representation	35
Order status	24
Distribution: direct or via depot	24
Delivery time	16
Pricing	16
Merchandising	15
Product positioning	15
Invoice accuracy	4
New product introduction	3
Advertising	1

Source: Martin Christopher, Philip Schary, and Tage Skjott-Larsen, Customer Service and Distribution Strategy, (New York: John Wiley & Sons, 1979), 53.

provide relative ranking of those measures of customer service which were important to their business in generating sales. The relative ranking was to be done by distributing 100 points among the presented list of customer service elements. The results of this particular study are presented in Table 3.

Upon the examination of the above two studies, it was decided to use the results of the study by LaLonde and Zinszer as the foundation from which to continue the development of the questionnaire. The results of the study by Christopher, Schary, and Skjott-Larsen were found to be less appropriate for this dissertation because:

1. The above study was conducted in U.K. Its relevance to U.S.A. might be low. On the other hand, the study by LaLonde and Zinszer was conducted at a national scale in U.S.A.
2. This dissertation has its focus on physical distribution customer service. The definition of customer service used in the study by Christopher, Schary, and Skjott-Larsen is too general and broad for this dissertation; and
3. The development of an ordinal or interval scale for supplier-customer differences in perception by a process of subtracting one scale value from the

TABLE 3

Importance of Customer Service Elements in the Food Industry

	Relative ranking (Total points = 100) Column 1	Column 2
PRODUCT AVAILABILITY	37.1	
ORDER CYCLE TIME	21.4	
Order Entry		4.3
Order Processing		5.2
Order Picking and Shipping		4.7
Transit Time		7.2
DISTRIBUTION SYSTEM FLEXIBILITY	12.9	
Expedite Order		6.0
Backorder Product		2.1
Substitute Product		1.8
Faster Transportation		2.2
Other		0.8
DISTRIBUTION SYSTEM INFORMATION	14.8	
Inventory Status		5.5
Order Status		4.3
Data Base for Forecasting		4.2
Other		0.8
DISTRIBUTION SYSTEM MALFUNCTION	10.3	
Administrative Errors		3.0
Picking Errors		1.7
Shipping Errors		1.6
Warehouse Damage		1.4
Company--Shipping Damage		1.3
Carrier--Shipping Damage		1.1
Other		0.2
POST SALE PRODUCT SUPPORT	2.3	
Repair Parts Availability		0.1
Repair Service		0.3
Technical Advice		1.4
Other		0.5
OTHER	1.2	
	100 pts	100 pts

Source: B. J. LaLonde and P. H. Zinszer, Customer Service: Meaning and Measurement, (Chicago: NCPDM Publications, 1976), 316.

other requires that customer service perceptions be interval or ratio scaled. A large proportion of elements in the list developed by Christopher, Schary, and Skjott-Larsen cannot be measured by suppliers and customers on a ratio scale (using perceptions of actual service levels instead of ratings).

3.4.4 The Domain of Market Response.

In this dissertation, market response has been defined as the choice and post-choice responses of customers to customer service packages. The stage of alternative evaluation ends with the formation of a preference judgement about a supplier. Choice is conceptualized as a stage in the purchase decision process which begins with preference and advances on to the formation of purchase intentions which may in turn lead to actual purchase. Engel, Blackwell, and Kollat (1978) have identified two post-purchase phenomena: satisfaction and dissonance. In this dissertation, an effort is made to measure market response through the measurement of preference, purchase intentions, actual purchase, and satisfaction. The measurement of dissonance is beyond the scope of this dissertation.

It should be noted that in an ongoing channel relationship, the above variables included in market response cannot clearly be categorized into choice, and post-choice stages. The above categorization is made here only for conceptual purposes and for relating the variable to the context of consumer behavior.

3.4.5 The Measuring Instrument.

The data required for the dissertation was collected using mail questionnaires. Two questionnaires were developed. One was developed in order to collect responses from grocery manufacturers. The other was developed for the purpose of collecting responses from grocery wholesalers and supermarket chains.

During the development of the questionnaires, a conscious effort was made to follow the guidelines laid down by Don Dillman (1977) for the construction of mail questionnaires.

The items in the questionnaires were ordered by grouping questions that are similar in content together (Dillman, 1977). This ordering principle was followed because it reduces mental effort and encourages well thought-out answers. An effort was also made to order the questions in order to take advantage of cognitive ties that respondents are likely to make among groups of questions.

As recommended by Dillman (1977), demographic questions and some of the questions which respondents might prefer not to answer due to reasons of confidentiality (e.g. purchase volume), were placed towards the end of the questionnaires.

Most of Dillman's guidelines (Dillman 1977) were followed while formulating the pages of the questionnaires. Questions were printed in lower case letters and multiple-choice answers were printed in upper case letters. Answer categories were identified on the left using numbers, rather than blanks or boxes. Care was taken to ensure that answers are registered in a vertical line on each page. This guideline may have reduced item non-response. Wherever necessary, clear directions were given on how to provide answers (e.g., please circle number of correct answer).

The final format and copy of the questionnaire followed the guidelines of Dillman (1977) regarding booklet format and printing procedures. The questionnaires were printed as a booklet on white paper. No questions were printed on the front or back pages. The questionnaire pages were printed in a photographically reduced form. Each page was photographically reduced to seventy-nine percent of its original size.

3.4.6 Selection of Items.

The items included in the questionnaires may be broadly classified into items for measuring customer service variables, items for measuring market response variables, and items for measuring selected other variables. The procedure by which questionnaire items required for measuring the constructs of customer service and market response were generated and selected are described below.

3.4.6.1 Items for Measuring Customer Service.

The items for measuring customer service were identified using the following procedure:

1. The findings of LaLonde and Zinszer (1976) regarding the importance of various physical distribution elements in food manufacturing were used to identify the components and categories of physical distribution service which had to be measured for this research;
2. The survey items and findings from the 1981 survey of customer service levels conducted by the Grocery Manufacturers of America (1981) were used to identify suitable elements to be measured and items which could be used in the questionnaires;
3. An in-house customer service survey conducted for Kellog Company by Consumer Pulse, Inc. was used to help in the selection of items.

4. A few of the participants in the executive development program for distribution managers conducted at the University of Tennessee (in April 1983), were interviewed. One participant responded to an initial draft of the questionnaire;
5. Relevant published literature on customer service (LaLonde and Zinszer, 1976) and a relevant unpublished dissertation (Bennion,1980) were reviewed in order to identify suitable questionnaire items.
6. Some items of customer service were included while others were modified or discarded on the basis of the comments and responses during the pretest stage.

Only customer service items which met the following criteria were accepted for inclusion in the questionnaire:

1. the responses to items measuring customer service elements had to be measurable on a ratio scale or on an interval scale (e.g. order cycle time in days),
2. the elements which were being measured had to be visible to the supplier as well as to the customer (e.g. data base for forecasting had to be excluded because it was not visible easily to the customer), and

3. the elements had to be important for customer service in the grocery industry.

The measures of customer service included in the manufacturer questionnaire and the measures included in the wholesaler questionnaire, are almost identical to each other and they are meant to measure the same service levels. However, the items in the manufacturer questionnaire are addressed to the manufacturer while the items in the wholesaler questionnaire are addressed to the wholesaler. Each customer service item requests the respondent to provide his (her) responses regarding the industry's typical level of customer service, and the manufacturer's actual service level to the wholesaler in a particular manufacturer-wholesaler pair.

During the development of the questionnaires, special care was taken to help the manufacturer respondent and the wholesaler respondent adopt a similar frame of reference for responding to different questionnaire items. In each questionnaire, directions are given to clarify some of the terms used in it (e.g. industry's typical level). Besides, each manufacturer is requested to identify the primary product group which it supplies to each individual wholesaler it identifies. The manufacturer is requested to base its responses on service levels for the primary product group alone, and not for other product groups which it might be selling.

At the very beginning of the wholesaler questionnaire, the respondent is informed of the product group which its manufacturer has already identified and used as a frame of reference. The wholesaler is requested to use an identical frame of reference while responding to the customer service items and the market response items, as well as many of the items measuring other variables.

The format of the questionnaire makes it possible for a single manufacturer to provide responses regarding its customer service relationship with four different grocery wholesalers. This format was designed in order to increase the amount of information obtained from each manufacturer and also to make it possible to include more supplier-customer pairs in the sample.

The customer service items are placed in the following five groups on the basis of similarity of content:

1. Product Availability;
2. Order Cycle Time;
3. Distribution System Flexibility;
4. Distribution System Reliability; and
5. Distribution System Information.

Product Availability deals with the ability of the manufacturer to supply the wholesaler with the goods ordered within a reasonable period of time after they are ordered. The first product availability item (Q-1) is a measure of the stock-out level. The second item (Q-2) is a measure of order completion, a different aspect of product availability. The third item (Q-3) measures product availability as the supplier's ability to meet the customer's delivery date. Responses with lower values represent higher levels of customer service in the case of the first item, while higher values represent higher levels of customer service for the second and third items.

Order Cycle Time stands for the time taken from the placement of an order by the customer to the time when the order is received by the customer (Ballou, 1985). The elements of Order Cycle Time which are listed in Table 3 (page 83) were collapsed into two steps or parts. The steps from Order Entry to shipping were combined into a single step called "Order Entry to Shipment" (Q-4) because it was felt that customers would not be able to distinguish between the different elements since the activities associated with these elements occur within the supplier's company. The second part of Order Cycle Time is Transit Time (Appendix A: Q-7; Appendix B: Q-5). Each part of Order Cycle Time contains a measure of Average Time and a measure of Consistency. Measurement of Consistency involves the measurement of the high and low time frames for each part of Order Cycle Time, and the computation of the difference between them by subtracting the "low" from the "high."

Distribution System Flexibility stands for the ability of the distribution system to adapt itself to the unexpected demands created by unanticipated situations. Measures of four elements of flexibility (namely expedite order, back order, substitute order, and faster transportation at request) had been included in the pre-test questionnaire. However, the pretest results indicated that substitute orders were rarely acceptable to customers. The pretest also indicated that faster transportation at request was only very rarely applicable to grocery distribution because the majority of grocery manufacturers already used the fastest available land carriers (motor carriers) for shipping goods to their customers. The response time for expedite orders is measured by Q-8B (Appendix A) and Q-6B (Appendix B). The response time for back orders is measured by Q-9B (Appendix A) and Q-7B (Appendix B).

Distribution System Reliability includes measures of errors and malfunction in the operations of the distribution system. Three items are listed in this category. The first item is a measure of billing/invoice errors. The second item is a measure obtained by combining picking errors and shipping errors which LaLonde and Zinszer (1976) have listed as separate elements. The third item is a measure of warehouse damage and shipping damage. This item was obtained by combining warehouse damage with company-shipping damage and carrier-shipping damage which are also listed by LaLonde and Zinszer (1976) as separate elements.

The second and third items listed under Distribution System Reliability were developed by combining separate customer service elements because it was felt that the differences between the separate elements would not be visible to the customer.

LaLonde and Zinszer (1976) have listed three elements of Distribution System Information--Inventory Status, Order Status, and Data Base for Forecasting. All other information system elements which are not a part of the above three have been grouped under a category titled "Other." Inventory Status and Data Base for Forecasting are factors which may be visible to be manufacturer, but they cannot be expected to be visible to the wholesaler. Hence, they were excluded from the questionnaire. The element listed by LaLonde and Zinszer (1976) as Order Status was measured using measures of Order Status Request Response

Time (in hours or days) and measures of Order Status Handling Completion (as a percentage of all requests for order status information).

Comments received during the pretest indicated that a company's ability to provide order status information may be dependent on whether the order had already been shipped. Hence, separate measures for Order Status Request Response Time were developed for the situation when the request is made before order shipment and for the situation when the request is made after order shipment (Appendix A: Q-13; Appendix B: Q-11). Similarly separate measures were developed for Order Status Handling Completion for the situation when the request is made before order shipment and for the situation when the request is made after order shipment (Appendix A: Q-14; Appendix B: Q-12).

The category of customer service elements titled Post Sale Product Support presented in Table 3 (page 83) were excluded from the questionnaire partly because most of the elements included in it are not important in the grocery industry (LaLonde and Zinszer, 1976) and partly because none of the elements included in it can be measured using an interval scale or a ratio scale.

3.4.6.2 Items for Measuring Market Response.

All the items for measuring market response are in the wholesaler questionnaire (Appendix B).

The following measures were used in this research as measure of market response.

1. Annual volume of the wholesaler's purchases of the specified product category from manufacturer (Appendix B: Q-20);
2. Manufacturer's share of the wholesaler's purchases (Appendix B: Q-21);
3. Past trend (of the past two years) in the wholesaler's purchases from the manufacturer (Appendix B: Q-22, Q-22A);
4. Expected future trend (of the next two years) in the wholesalers purchases from the manufacturer (Appendix B: Q-23, Q-23A);
5. Wholesaler's evaluation of the manufacturer's customer service (Appendix B: Q-24);
6. Wholesaler's selective preference for the manufacturer (Appendix B: Q-28);
7. Wholesaler's satisfaction with the manufacturer's distribution customer service (Appendix B: Q-25).

The wholesaler's annual volume of purchases from the manufacturer (Appendix B: Q-20) is the indicator which is most similar to sales volume among the measures of market response. Purchase volume is measured in cases (or other relevant store units) because some pre-test respondents indicated that they tend to think more in terms of such units rather than in dollar units. A drawback of this measure is that it would be influenced by the size of the wholesaler's operations. A relatively minor supplier of a large wholesaler may have a larger purchase volume than a major supplier of a small wholesaler.

The manufacturer's share of the wholesaler's purchase (Appendix B: Q-21) is a measure of market response which is expected to correct for size differences between different wholesalers.

The past trend in the wholesaler's purchases from the manufacturer (Appendix B: Q-22, Q-22A) is measured on a twelve point scale ranging from "increased by sixteen percent or more" to "decreased by sixteen percent or more." The purpose of this measure is to indicate whether and to what extent there has been an increase or decrease in the wholesaler's purchases from the manufacturer in the two years before the completion of the questionnaire.

The expected future trend in the wholesaler's purchases from the manufacturer (Appendix B: Q-23, Q-23A) is a measure which is quite similar to a measure of behavioral intentions. The design and format of this measure are identical to those of the measure of past trend in purchases.

The wholesaler's evaluation of the manufacturer's customer service (Appendix B: Q-24) was based on an in-house questionnaire developed for Kellog Co. by Consumer Pulse, Inc. Nine selected components of the manufacturer's customer service package are evaluated on a seven point scale ranging from "outstanding" to "terrible."

The measurement of the wholesaler's relative preference for the supplier required the development of a new scale. There are several ways by which preference for a supplier can be measured. Typically, a method of ranking (variability method), a method of rating (rating methods), or a method of quantitative judgement may be used (Green and Tull, 1978).

For the purposes of this dissertation, a ranking of suppliers (grocery manufacturers) participating in this research could not be used to measure preference because it was felt that different customers (grocery wholesalers) might have different sets of suppliers and different numbers of suppliers. For instance, it may be inappropriate for the researcher to rate the fourth ranking cereal manufacturer below the third ranking manufacturer of ethnic sauces.

The same drawback also applies to some quantitative judgement methods such as the constant sum method and the fractionation method since these methods require similar sets of suppliers. A direct rating method does not face this problem. However, there is a possibility that a direct rating of preference on a scale would actually lead to the direct measurement of satisfaction with the supplier rather than preference.

In order to measure preference for the purpose of this research, a ten point scale was developed (Appendix B, Q-28). This scale permits the wholesalers to compare the supplier's customer service levels to the levels provided by all grocery manufacturers of that product class (e.g. dry groceries, dairy products, etc.). Such a scale would evoke a larger set for comparison, and with it there is a greater probability that different wholesalers would use similar anchors for comparison purposes.

The wholesaler's satisfaction with the manufacturer's distribution service (Appendix B: Q-25) is measured on a five point scale ranging from extremely satisfied to not at all satisfied.

3.4.6.3 Items for Measuring Selected Other Variables.

In addition to the measures of customer service, and the measures of market response, the questionnaires also include several items for measuring selected other variables which may have a direct or indirect influence on the hypothesized relationships or which may be related to the variables conceptualized in the proposed model (Figure 2, page 9). The reasons for the inclusion of these items in the questionnaires are the need:

1. To explain the nature of the hypothesized relationships in greater detail;
2. To find out possible reasons for the occurance of the empirical relationships; and
3. To explore alternative hypotheses for observed relationships.

3.5 STATISTICAL ANALYSIS

A description of the statistical analysis conducted as a part of this research is given in this section. An outline of the procedure followed for statistical analysis has been presented in the form of a flowchart in Figure 10.

3.5.1 Data Preparation.

3.5.1.1 Initial Steps.

The responses collected using mail questionnaires were manually edited and were transferred to summary sheets. The responses were coded in numerical form whenever possible.

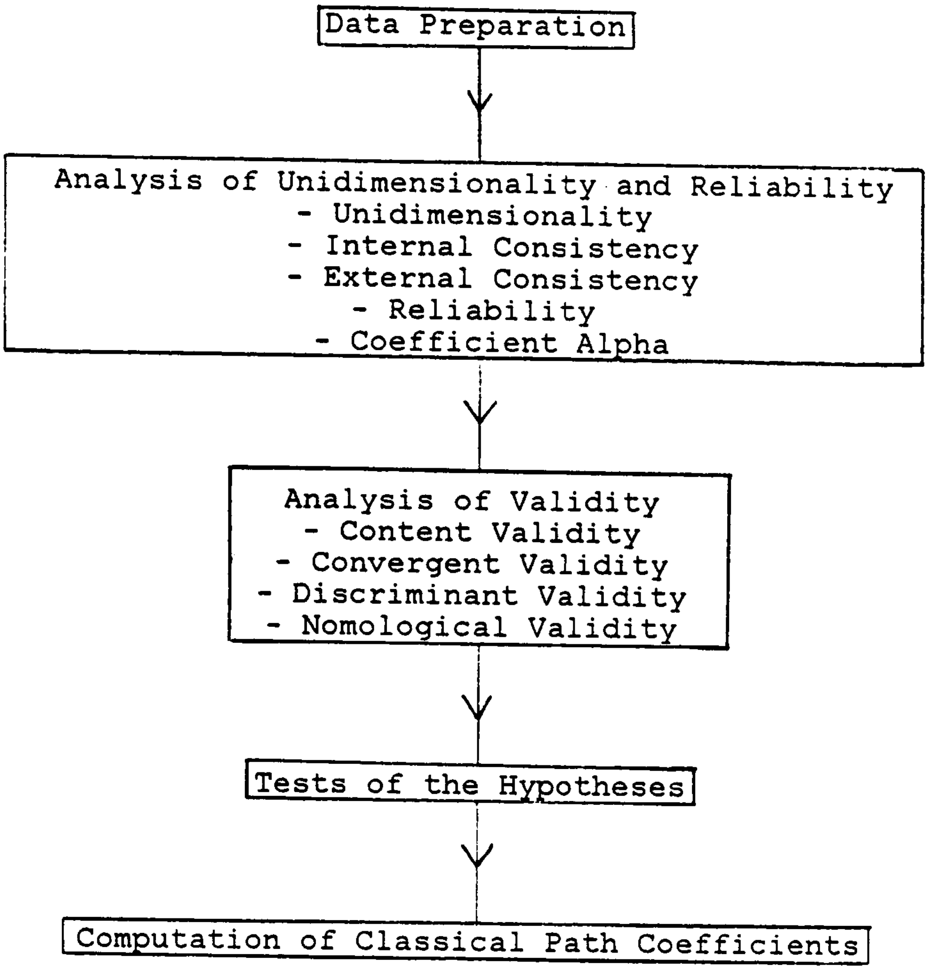

Figure 10: Flowchart of the Procedure for Statistical Analysis.

However, qualitative comments made by respondents (which could not be transformed into numerical form) were also recorded on the summary sheets. The data was then entered into a CMS file in free form format. Each case or record on the file contain the response of a matched manufacturer-wholesaler pair.

The data was then checked for inconsistencies in logic. Inconsistencies in logic were located using SAS programs and by the visual scanning of data summary sheets and computer printouts of data values. An example of such an inconsistency is a questionnaire in which a grocery manufacturing company indicates that it does not handle back-orders, and at the same time gives its back-order response time. An effort was made in such instances to resolve the inconsistency by making a telephone call to the respondent. Unresolved inconsistencies were treated as missing values.

3.5.1.2 Missing Value Routine.

The number of missing values of each variable was checked using frequency distributions. Missing values which were the result of an item being not applicable to the respondent were distinguished from those which appeared to have been caused by other factors. Only missing values of the latter type were assigned data values using a missing data routine. Missing values of the former type were left untouched.

The missing data routine used on this dissertation is known as "random assignment within groups." Hertel (1976) has described this routine as a statistically superior procedure which can be expected to yield relatively unbiased estimates of correlation coefficients for the full sample. The strength of this procedure lies primarily in its ability to build into the completed data set an appropriate amount of variance that results in unbiased estimates of Pearson's r.

In order to apply the routine of randomized assignment within groups, the manufacturer-wholesaler pairs were classified into five different product types on the basis of the product group regarding which they responded. The categorization of grocery products was based on the classification used by the distribution centers of a major national supermarket chain. The five product categories are:

1. Dry Groceries (Food);
2. Supplies and Cleaning items (Non-food);
3. Frozen food;
4. Produce and Perishables; and
5. General Merchandise.

The mechanics of the routine of randomized assignment within groups requires that the cases are first sorted into categories or groups. Each missing value is then replaced by the value for the nearest preceding available nonmissing score for that item and group (Hertel, 1976).

The missing value routine was applied only on the measures of the constructs which were to be used in the tests of the hypothesis. In other words, the routine was applied only on the measure of customer service and the measures of market response.

3.5.1.3 Data Transformation.

After the application of the missing value routine, the data set was used for computing the values of the computed difference measures. The intervening variable, Supplier-customer differences in the perception of comparison levels, was computed by subtracting the customer's perception of the comparison levels from the supplier's perception of the comparison levels for the same elements of customer service $(S_c - C_c)_{1-n}$. Supplier-customer differences in the perception of the actual levels of customer service were computed by subtracting the customer's perception of the actual service levels from the supplier's perception of the same service levels $(S_a - C_a)_{1-n}$. Departure from comparison levels was computed by subtracting the customer's perception of the comparison level from the customer's perception of the actual service levels for the same customer service elements $(C_a - C_c)_{1-n}$.

The difference measures computed above retain direction. These measures were not transformed into absolute differences, because most of them were distributed in at least moderately bell-shaped form, with negative values on one tail and positive values on the other. Transforming them into absolute differences would have led to measure values which are distributed in a form that is very different from a normal distribution. For instance, transforming a relatively normally distributed variable with a mean of zero into absolute values would be like folding a bell shaped curve vertically on the middle. A variable with such a distribution can lead to large deviations from the assumption of multivariate normality required by the maximum likelihood method in LISREL.

During the stage of data collection, distribution system information had been measured separately for the situation when the request for information is received before shipment and for the situation when the request is received after shipment. The above "before shipment" and "after shipment" measures were combined in each case by adding and averaging their values.

The directions of the items in the computed measures of customer service were adjusted so that higher positive values indicate higher levels of customer service. As the result, the directions of the items measuring Stock-Out Level, Order Cycle Time (both length and consistency), Distribution System Reliability, and Order Status Request Response Time were reversed. Similarly the directions of the items measuring market response were also adjusted so that higher values represent higher (and better) levels of market response.

3.5.2 Exploratory Data Analysis.

The nature and the distribution of the data was explored using frequency distributions. The relationships between different measures were studied by computing Pearson's product moment correlations and Spearman's coefficients. The shapes of the relationships between selected measures were studied using scatter plots in order to examine relationships which could have been missed due to the inability of bivariate correlation to describe non-linear relationships. The purpose of the above steps was to gain a better understanding of the data.

Since the hypothesized relationships were to be tested using variance-covariance matrices of the relevant observable variables, it was particularly important to remove outliers. Variances and covariances are statistics which are particularly sensitive to outliers.

Outliers were identified using Tukey's stem-and-leaf plot (Tukey, 1977) and Tukey's box-and-whisker plot (Tukey, 1977). The above techniques rely more heavily on measures of location and spread that have the property of resistance to outliers. They also make use of visual summaries of the distribution of variable values.

The actual cut-off points for outliers was determined using Tukey's box-and-whisker plot. The two edges of the box represent the locations of the upper hinge and the lower hinge of the distribution. The upper hinge is that point above which lies one fourth of the values (upper quartile) and the lower hinge is that point above which lies three fourths of the values and below which lies one fourth of the values (bottom quartile). The distance between the lower hinge and the upper hinge is called the "interquartile range" or the "midspread" (Hartwig and Dearing, 1979).

In a normal distribution, almost exactly 2.5 percent of all values lie below the lower hinge minus one midspread and almost 2.5 percent of all values lie above the upper hinge plus one midspread. A distribution with much more than five percent of the values outside this range begins to depart from normality (Hartwig and Dearing, 1979).

During exploratory data analysis cut off points were set at the upper hinge plus one and a half midspreads and at the lower hinge minus one and a half midspreads. These points are identical to Tukey's "inner fences" (Tukey, 1977). Values beyond the inner fences were moved to the cut-off point defined by the closest "inner fence."

3.5.3 Analysis of Unidimensionality and Reliability.

The concepts of unidimensionality and reliability can be explained using a model which is usually referred to as classical test theory. According to Lord and Novick (1968), the value of an observation may be assumed to be the sum of two values--a true score and an error score--as presented below:

$$T_{observed} = t_{true} + e_{error}$$

If a measure is unidimensional, the error score consists of purely random measurement error and the true score is a perfect measure of the trait or construct which the observation is supposed to measure. The value of the observation is influenced by no non-random factor other than the underlying trait or construct. If the trait or underlying construct is the sole non-random influence on the indicators, then the errors in their observations should be mutually uncorrelated. Correlated errors are not allowed in unidimensional measurement.

Reliability can be broadly defined as the degree to which measures are free from error and therefore yield consistent results (Peter, 1979). The concept of reliability is also based on the classical test theory model. The classical test theory model can be described in the form of variances of scores. The variance of the values of an indicator is assumed to consist of two components--a true component and an error component (Peter, 1979).

$$V_{observed} = V_{true} + V_{error}$$

The true variance component includes all systematic variance. The error variance consists of only random measurement error variance. The reliability coefficient (coefficient alpha) is a measure of the ratio of true variance to observed variance or it is a measure of the percentage of total variance which is of the systematic type. Since it is very difficult to estimate the true variance directly, true variance is computed by subtracting the error variance from the observed variance.

$$\text{Reliability coefficient} = \frac{V_{observed} - V_{error}}{V_{observed}}$$

The above discussion helps to explain some of the differences between unidimensionality and reliability. Reliability is preoccupied with the quantity of error while unidimensionality is more concerned about the nature of the errors--whether they are correlated or not and whether they are really non-random. It is possible to have a unidimensional measure which has large random error scores and thus a low reliability.

The focus of unidimensionality is on the issue of whether or not a measure measures one and only one underlying construct, while the focus of reliability, and especially the reliability coefficient is on the percentage of variance explained by non-random factors (which could be more than one in number) and the consistency in the score values, apparently caused by the same non-random factors.

Conceptually, both unidimensionality and reliability require that the error score be random in nature. However, coefficient alpha, the most commonly used reliability coefficient, does not indicate the presence of correlated errors between indicators. Coefficient alpha can also be raised by adding indicators to a multiple indicator measure of a construct even though the addition of indicators don't contribute to unidimensionality.

The objective of statistical analysis during this stage was to obtain unidimensional and reliable measures of the constructs to be used in the tests of the research hypotheses. An effort was made to obtain unidimensional measures of the constructs using oblique multiple group factor analysis (cluster analysis). The measures of the constructs were analyzed for reliability with the help of Cronbach's coefficient alpha. Measures of item-to-total correlation were used as guidelines for improving the coefficient alpha of the constructs used in the tests of the hypotheses.

Churchill (1979) has recognized that a single coefficient alpha is not a good indicator of the reliability of a multidimensional construct. He has recommended that the indicators be classified into separate groups measuring different dimensions and that separate coefficient alphas be computed for each such group. An iterative procedure which recommends the dropping of items with low item-to-total correlations for improving coefficient alpha and the use of factor analysis to empirically verify the dimensions of the conceptualized constructs was described in his paradigm for the development of better measures of marketing constructs (Churchill, 1979).

Although the above method can lead to reliable measures, it does not contribute significantly to the development of unidimensional or homogeneous measures. Coefficient alpha is an internal consistency estimate of multiple-item measure reliability. Often internal consistency and homogeneity (unidimensionality) have been confused with each other in research literature and this has led to the misuse of coefficient alpha as an index of item homogeneity in the construction of multiple-item measures (Green, Lissitz, and Mulaik, 1977). Originally, coefficient alpha (Cronbach, 1951) was never intended to be an index of item homogeneity in the construction of such composite measures.

Exploratory factor analysis has often been used for the development of unidimensional scales, but its usefulness for such a purpose is questionable. Hunter and Gerbing (1982) have indicated in the following words that exploratory factor analysis may be a poor tool for the construction of unidimensional scales.

> Our experience with exploratory factor analysis has shown it to be a poor ending point for the construction of unidimensional scales. Typically, exploratory factor analysis "underfactors," that is, it produces fewer factors than there are underlying variables in the data. This is particularly true for causally oriented studies because causal models deliberately include variables that are hypothesized to be highly correlated. Factor analysis tends to throw all highly correlated variables into the same factor. Thus factor analytic clusters usually must be subclustered. A second problem is that

exploratory factor analysis has no "residual cluster," that is, no "garbage can" for bad items. Because every item must ultimately have its highest loading on some factor, the unwary user may include bad items in the clusters. For the worst cases, the varimax factors may bear little resemblance to the natural cluster in the data. For example, the presence of a central cluster highly correlated with the remaining clusters causes the rotation to place factors far away from the correlated centroids.

Three conditions have been identified as useful criteria for creating, testing, and evaluating a set of unidimensional indicators of a construct (Hunter, 1977b; Danes and Mann, 1984). The three criteria are:

1. Internal consistency;
2. External consistency (Parallelism); and
3. Homogeneity of content.

The <u>internal consistency</u> of indicators is a criterion which stipulates that the correlations of the indicators meet a certain "product rule" for internal consistency. If X_i and X_j are two items in the same unidimensional construct and if T is the cluster true score, then the correlation between the items should satisfy the following product rule (Hunter and Gerbing, 1982):

$$r_{X_iX_j} = r_{X_iT}r_{X_jT}$$

In other words, the correlation between two indicators of an underlying trait should be the product of their correlations with the underlying trait.

While the criterion of internal consistency stipulates how the items composing a unidimensional cluster should correlate with one another, the criterion of _external consistency_ (parallelism) specifies how these items should correlate with variables outside the cluster (Hunter and Gerbing, 1982). The criterion of external consistency requires that items in a unidimensional multiple indicator measure of a construct have similar patterns or correlations (to within sampling error) with items in other multiple indicator measures of constructs.

The criterion of _homogeneity of content_ requires that the latent meaning of all the items in a multiple-indicator measure of a trait or construct be the same (Danes and Mann, 1984). In other words, all the indicators of a trait should measure that trait itself and no other. This property is not a statistical one. It is dependent primarily on the face validity and the content validity of the set of indicators. Hunter (1977b) rates the criterion of homogeneity of content as the most important condition for unidimensionality.

In this dissertation unidimensional measure of constructs have been developed using the program PACKAGE 1980 (Hunter, et al., 1980). PACKAGE uses a matrix of Pearson's product moment correlations between all the indicators (which have to be analyzed for unidimensionality) in a data set. Before analyzing the data using PACKAGE, the data set was partitioned into clusters on the basis of a priori content analysis. All the indicators of a single construct were placed in one cluster. As the result of this step, the data set was partitioned into the following four clusters.

1. Supplier-customer differences in the perception of customer service levels;
2. Supplier-customer differences in the perception of the actual service levels;
3. Departure from comparison levels in the customer's perception; and
4. Market response.

The procedure used for the development of the research model and for the operationalization of the measures of the different constructs can be assumed to have contributed to the content validity of the indicators of the constructs used in this research. It can thus be assumed that the indicators included in the four clusters meet the criterion of <u>homogeneity of content</u>.

PACKAGE is a system of several computer routines. One of the routines is called MGRP and it performs oblique multiple groups factor analysis with or without iterated communality. MGRP can estimate the parameters of the measurement model using "confirmatory factor analysis" or "cluster analysis." In this analysis, oblique multiple groups factor analysis was performed for a solution with communalities in the diagonal.

One of the outputs of MGRP is a matrix called "Factor Intercorrelations and Loading Matrix." This output contains the following:

1. Correlations between the different items (or indicators in the data set);
2. The "communalities" or reliabilities of these items as measures of the factor underlying their cluster;
3. The Spearman factor loadings of each item on each factor; and
4. The loadings of each factor on each other factor.

Another output of MGRP routine is a matrix of indicator correlations with the latent score or true score partialed out. MGRP also produces a matrix of "similarity coefficients" of the items in the input data matrix.

In this research, the Factor Intercorrelations and Loading Matrix and the matrix of indicator correlations were used to analyze the indicator sets of the different constructs for <u>internal consistency</u>--the first test of unidimensionality.

If the indicators of a construct are to meet the test of internal consistency, they have to meet the product rule for internal consistency. Their inter-item correlations, as seen in the Factor Inter-correlations and Loading Matrix, should be the result of their loading on the same underlying factor. If the loading of an item on its underlying factor is low, this should be reflected in low inter-item correlations with the other items in the same cluster. If the condition of internal consistency holds, the matrix of inter-item correlations will have the same pattern of gradation as the factor loadings. Deviations from this rule indicate the presence of correlated errors. Such deviations beyond what can be expected due to sampling error indicate lack of internal consistency.

The internal consistency of a set of indicators can also be evaluated by looking at the residual inter-item correlations after the latent score or true score is partialed out. If the indicators of a trait meet the product rule of internal consistency, when their trait true score is partialed out, their inter-item correlations should be reduced to zero (to within sampling error).

The <u>external consistency</u> of each indicator cluster was evaluated by studying the matrix of similarity coefficients calculated by the MGRP routine. The similarity coefficient is an index of the "similarity" of two indicators in terms of the extent to which they serve as alternate indicators of the same factor (Anderson and Gerbing, 1982). Similarity coefficients are summary descriptions of the external consistency criterion for unidimensional measurement. The similarity coefficients between the items on a unidimensional multiple item scale should be as high as is possible. The highest possible value of a similarity coefficient is one.

In this dissertation, the following guidelines were used in order to develop unidimensional multiple indicator measures of the research constructs.

1. The factor intercorrelations and loading matrix was studied in order to identify relatively sharp deviations from the product rule. Depending upon the size and pattern of such deviations, the indicators in a cluster were either partitioned into smaller clusters, or the indicators associated with such deviations were dropped.
2. Indicators of a construct which seemed to be associated with relatively larger non-zero values after the latent score had been partialled out were noted. The indicators were then either reclustered or dropped.

3. The similarity coefficients were studied to ensure that all coefficients between the indicators of a construct had high values. Indicators within a construct which seemed to be associated with sharply lower values were noted. Whenever a subset of indicators among those measuring a construct had higher similarity coefficients between themselves, but lower similarity coefficients with the rest of the indicators of the same construct, the indicators in that subset were separated out as a different cluster. Indicators associated with low similarity coefficients were also identified as those which may have to be dropped.

During this phase of data analysis, items were dropped or reclustered step by step. The PACKAGE output of each step was evaluated for unidimensional measurement. The data was also analyzed simultaneously for reliability with the help of the reliability statistics computed by SPSS. The reliability statistics which were used for identifying poor indicators were the statistics labeled as "corrected item-total correlations" and "alpha if item deleted." Poor items were indicated by low values of the former statistic and high values of the latter. Coefficient alpha and standardized coefficient alpha were used as statistics for the evaluation of multiple indicator reliability during the analysis of the measurement model.

At a later stage in data analysis, during the testing of the linear structural equations, the reliabilities of the measures of the research construct were again checked using two reliability statistics generated by LISREL VI--squared multiple correlations and the total coefficient of determination. Squared multiple correlations show how well the observed variables serve separately as measurement instruments of the latent variable. The total coefficient of determination shows how well the observed variables serve jointly as measurement instruments for the latent variable.

In general, poor indicators according to one of the tests for unidimensional measurement or scale reliability were found to be poor according to all the other tests. Whenever there was a conflict between the different tests, the conflict was resolved by giving first priority to the tests for internal consistency, second priority to the test for external consistency followed by the reliability statistics. Unidimensionality was given priority over reliability because of the need to obtain an unbiased estimate of coefficient alpha. Coefficient alpha provides an unbiased estimate of the reliability of a multiple indicator scale only if the scale is unidimensional (Hunter and Gerbing, 1982).

3.5.4 Analysis of Validity.

Validity refers to the extent to which any measuring instrument measures what is intended to measure (Carmines and Zeller, 1979). It indicates the degree to which an instrument measures the construct which is under investigation (Bohrnstedt, 1970).

3.5.4.1 Content Validity.

Content validity refers to the degree to which the score or scale being used represents the concept about which generalizations are about to be made (Bohrnstedt, 1970). According to Churchill (1979), specifying the domain of a construct, generating items that exhaust the domain, and subsequently purifying the resulting scale (for reliability) should produce a measure which is content or face valid and reliable.

The procedure which was followed in this research for operationalizing the research constructs was aimed at maintaining a high degree of content validity. The procedure for the analysis of unidimensionality and reliability was, however, in conflict with the objective of maintaining a very high degree of content validity. The purification of the measures for unidimensionality and reliability required that poor indicators be dropped thus reducing the content validity of the measures. In order to maintain a high level of content validity, special care was taken to avoid dropping indicators unless such a step was absolutely necessary to maintain measure unidimensionality or reliability.

3.5.4.2 Construct Validity.

Construct validity is most directly related to the question of what a measuring instrument is in fact measuring--what construct, trait, or concept underlies the scores on a measure (Churchill, 1979). Usually construct validity is analyzed only after the evaluation and analysis of content validity and reliability. This is because both content validity and reliability are recognized as prerequisites for construct validity.

The process of construct validation is necessarily theory laden. Strictly speaking, it is impossible to "validate" a measure of a concept in this sense, unless there exists a theoretical network that surrounds the concept (Carmines and Zeller, 1979). Three dimensions of construct validity, namely convergent validity, discriminant validity, and nomological validity can be studied only when each construct to be studied exists within a theoretical framework specifying the relationships between concepts (or constructs).

Convergent validity is the degree to which two or more attempts to measure the same concept through maximally different methods are in agreement; discriminant validity is the degree to which a concept differs from other concepts (Campbell and Fiske, 1959; Bagozzi, 1980). In order to evaluate convergent and discriminant validity using the multitrait multimethod matrix (Campbell and Fiske, 1959) it is necessary that each construct in the matrix be measured using more than one method. In this research no two (or more) different measurement methods have been used to measure more than one research construct. Hence, the data cannot be analyzed using the multitrait-multimethod matrix.

Although the data does not meet a stringent requirement for the analysis of convergent and discriminant validity, namely the presence of two or more independent measurement methods, the data was analyzed for validity with the help of:

1. Matrices of inter-item correlation;
2. Item-factor loadings obtained during the analysis for unidimensionality; and
3. Similarity coefficients obtained during the analysis for unidimensionality.

Matrices of inter-item correlation may be indicators of validity. A set of items or indicators of a construct are more valid if they correlate more highly between themselves than with indicators of other constructs. Bohrnstedt (1970) treats this as a method for analyzing content validity. However, if the indicators of a construct are quite different from each other, this method can also be used to evaluate convergent validity. In this research, during the analysis of validity, the average inter-item correlations between indicators of each construct was compared against the average inter-item correlations of the same indicators with the indicators of all the other constructs. Higher values of the former were recognized as indicators of higher convergent validity and content validity.

The item factor loadings obtained during analysis for unidimensionality using PACKAGE 1980 were also be used to study convergent and discriminant validity. If items measuring a construct load more highly on its own factor than on any other factor, convergent validity is supported. Lower loadings on other factors support discriminant validity.

Similarity coefficients were also used to study convergent validity and discriminant validity. High similarity coefficients between indicators of the same construct were recognized as support for convergent validity. Lower similarity coefficients between indicators of different constructs were recognized as support for discriminant validity.

The item-factor loadings, and the similarity coefficients which were used for evaluating the convergent validity and the discriminant validity of the measures of the research constructs were also used during the analysis of the measures for unidimensionality. The use of the same tests for analyzing unidimensionality and construct validity (especially discriminant validity) is supported by Kenny (1979) as an argument which is especially strong for the case in which all the measures were obtained by the same method.

3.5.4.3 Nomological Validity.

Nomological validity is the degree to which predictions from a formal theoretical network containing the concept under scrutiny are confirmed (Campbell, 1960). Nomological validity was evaluated at this stage of data analysis by looking at the factor-factor loadings which can be seen at the bottom right hand corner of the Factor Incorrelations and Loading Matrix obtained during the analysis for unidimensionality using PACKAGE 1980. If the direction of any loading supported the research hypothesis, it was recognized as an indication of nomological validity.

The tests of the hypotheses using LISREL VI can also be looked upon as tests for the nomological validity of the constructs and the model hypothesized in this research.

3.5.5 Analysis of the Proposed Theoretical Structure.

The relationships between the constructs on the theoretical structure were analyzed by testing the hypotheses discussed earlier in this Chapter. The hypotheses were tested through the causal modeling approach using the statistics generate by the program LISREL VI (Joreskog and Sorbom, 1984). Although a detailed description of the causal modeling approach and of the program LISREL VI is beyond the scope of this dissertation, a brief overview has been given below.

3.5.5.1 The Causal Modeling Approach.

Causal modeling attempts to resolve questions about possible causes by providing explanations of phenomena (effects) as the result of previous phenomena (causes). Causal modeling is a technique for selecting those variables that are potential determinants of the effects--and then for attempting to isolate the separate contributions to the effects made by each cause (Asher, 1976).

Formal statement of theory requires the modeling of causal connections between theoretical variables. The total pattern or structure of causal connections among ordered variables is the essence of a theoretical model (James, Mulaik, and Brett, 1982). The capability of causal modeling to determine the relationships between effects and their causes, makes it a very useful technique for testing theoretical models.

The behavioral sciences are characterized by the very frequent use of theoretical models in which most or all of the theoretical variables are latent variables. A latent variable is defined as a hypothetical or theoretical construct, which is an unobservable variable presumed to exist within a structural model but for which direct measurements are not available (James, Mulaik, and Brett, 1982).

The analysis of such theoretical models, which are very common in the behavioral sciences, requires the development of models which explicitly model the relationship between the unobservable theoretical variables and their observable indicators, and the relationship between the different unobservable theoretical variables. The former is called the measurement model, and the latter is called the structural model. One of the strengths of the causal modeling approach is its ability to model errors in the measurement model as well as errors in the structural model.

Joreskog (1970, 1973) has developed a method for estimating the parameters and errors in a causal model. This method requires that the measurement model and the structural model be represented in the form of a general linear model. This approach is variously known as the restricted covariance structure model, the LISREL model, the confirmatory factor analytic model, or the analysis of covariance structures. Joreskog and Van Thillo (1972) have developed a program named LISREL (Analysis of Linear Structural Relationships by the Method of Maximum Likelihood), for estimating and testing causal models.

The information provided by LISREL can be broadly categorized into two types. The first type consists of estimates of parameters and errors. The second type consists of measures of goodness of fit for the whole model (measurement and structural) as specified for the test. The whole model is tested through a chi-square goodness of fit statistic.

3.5.5.2 Testing the Research Hypotheses.

In order to test the research hypotheses, it is necessary to represent each hypothesis in the form of a causal model. To specify the measurement model for each hypothesis, it is necessary to determine the number of indicators for each construct. According to the research plan of this dissertation, the analysis of the measurement model for unidimensionality, reliability and validity was to determine whether the constructs in the theoretical structure should be partitioned into other constructs and which indicators to be retained as measures of each individual construct. Hence, the specific models for testing each hypothesis have not been presented in this section. They are presented in next Chapter along with the results of data analysis.

The first step in the procedure for testing each hypothesis was to represent a causal model of the hypothesis in the form of a causal diagram. After the causal diagram was specified, the next step was to describe the model in the form of structural equations.

The general model for representing a set of recursive or simultaneous linear structural relationships is given below:[3]

$$\eta_1 = \beta_i \, \eta_i + \gamma_i \, \xi_i + \zeta_i$$

where η_i is a random vector of true unobservable dependent variables; ξ_i is a random vector of true unobservable independent variables; γ_i is a matrix of structural parameters between unobservable independent and dependent

[3]A selected list of terms and symbols which are commonly used in causal modeling are described in Appendix R.

variables; β_i is a matrix of structural parameters between unobservable dependent variables; and ζ_i is a random vector of errors in the structural equations (Bagozzi, 1980, Joreskog and Sorbom, 1984).

The general form of the measurement model is given below:

$$x = \lambda_x \xi + \delta$$

and

$$y = \lambda_y \eta + \varepsilon$$

where x and y are, respectively, vectors of the observed independent and dependent variables; λ_x and λ_y are regression (factor) matrices of x on ξ and of y on η respectively, and δ and ε are vectors of errors of measurement in x and y, respectively.

After representing the causal model in the form of equations, and before analyzing the data, the model was checked to find out whether it meets a necessary condition for the identification of all its parameters. The condition is specified by the following equation:

$$s < (1/2)(p + q)(p + q + 1)$$

where (p + q) represents the number of indicators in the model and s represents the number of independent free parameters.

The next step was to test the hypothesis using LISREL VI. The Maximum Likelihood method was used to estimate the parameters and statistics. The main strength of the maximum likelihood method of estimation is that it can calculate the standard error of each parameter estimate and also the correlations of parameter estimates. The size of the standard error and the t-value (derived from it) can be used to assess the significance of the LISREL parameter estimate. The main weakness of the maximum likelihood method is that it is based on the assumption that the data is distributed on the form of a multivariate normal distribution. This assumption requires that the sample size be large enough to give asymptotic properties to the distribution.

The research hypotheses were evaluated on the basis of the following LISREL estimates

1. Estimates (unstandardized and standardized) of the parameters of the measurement model and the parameters of the structural equations. The size of each parameter estimate and its direction were examined carefully. In a two variable model, the size of the unstandardized structural coefficient indicates the number of units by which the dependent variable will change if the independent variable is changed by one unit holding everything

else constant (Long, 1983b). The standardized structural coefficient indicates the number of standard deviations by which the dependent variable will change if the independent variable is changed by one standard deviation (holding everything constant).

The direction of a coefficient indicates the direction of the relationship which it represents. The direction of each structural coefficient was compared against the direction hypothesized in the theoretical model.

2. Standard Errors of the Parameter Estimates and T-values: The standard errors and the t-values generated by LISREL were examined in order to determine how good the maximum likelihood parameter estimates were as approximations of the parameters of the population from which the observations had been sampled. The t-value for a parameter is defined as the parameter estimate divided by its standard error. Parameters whose t-values were larger than two in magnitude were judged to be different from zero (or significant).

In order to obtain larger t-values, it is necessary to have low standard errors. Large standard errors indicate inaccurate parameter estimates.

3. Normalized Residuals: The normalized residuals were examined to judge the fit of the model and to detect lack of fit. Normalized residuals which were larger than two in magnitude were recognized as an indication that the causal model does not account for the covariation between that particular pair of observables sufficiently well.

4. Q-plot of Normalized Residuals. This is an effective summary of the fit as judged by all the normalized residuals jointly. The Q-plot of normalized residuals was evaluated by visual inspection. A straight line was fitted through the points plotted by the normalized residuals. If the line was seen to have a slope greater than 45 degrees, it was considered to be an indication of good fit. A slope close to 45 degrees was considered to be an indication of moderate fit, and a slope of less than 45 degrees was considered to be an indication of poor fit.

5. Squared Multiple Correlations and Total Coefficient of Determination: The squared multiple correlation of any observable is a measure of its reliability

and the coefficient of determination of the indicators of an unobservable variable is a generalized measure of the reliability for the whole measurement model (Joreskog and Sorbom, 1984).

The total coefficient of determination of an unobservable variable is the percentage of its total variance explained by all its observable indicators together. LISREL also computes a total coefficient of determination for the entire structural equation. This statistic represents the percentage of the variance in the endogenous variable (dependent variable) explained by the structural equation.

The indicators of each construct were evaluated using the computed squared multiple correlations and coefficients of determination. Values of the above statistics which were close to one were considered to be high values.

The overall fit of the model to the data was evaluated using the chi-square measure of goodness of fit generated by LISREL. This is a test of the hypothesis H_0 that the observed covariance matrix was generated by the Hypothesized model, against the alternative hypothesis H_1 that the covariance matrix is an unrestricted covariance matrix. Rejecting this hypothesis (H_0) indicates that the model does not adequately represent the observed covariance matrix. Large values of chi-square relative to degree of freedom indicate that the model does not adequately fit the data.

The use of the chi-square statistic for the purpose of testing hypotheses has some limitations. Joreskog and Sorbom (1984) point out that such a use of the chi-square generated by LISREL is not valid in most cases for several reasons. The first reason which they give is that in most empirical work, the model is only tentative. It is only regarded as an approximation of reality. The statistical problem is usually not one of testing a given hypothesis but rather one of fitting the model to the data in order to decide whether the fit is adequate or not. The second reason given by Joreskog and Sorbom (1984) is that even if one assumes that the model is true in the total population, chi-square can be considered to be a valid test statistic only if the input data is in the form of a covariance matrix, the indicator values have a multivariate normal distribution, and the sample size is fairly large.

Instead of regarding the chi-square as a test statistic, in this dissertation, it is regarded more as an indicator of goodness (or badness) of fit. LISREL analysis using the maximum likelihood method generates the chi-square value for the overall model, its associated degrees of freedom and a probability level statistic. A probability of 0.10 or greater was considered an indication that the model fits the data.

In addition to the chi-square statistic, the fit of the model to the data was also evaluated using other indicators of goodness of fit such as the adjusted goodness of fit index and the root mean square residual.

1. The Goodness of Fit Index and the Adjusted Goodness of Fit Index. The goodness of fit index is a measure of the relative amount of variances and covariances jointly accounted for by the model. The adjusted goodness of fit index is the goodness of fit index adjusted for degrees of freedom (Joreskog and Sorbom, 1984). Both of these measures usually have values between zero and one, higher values indicating higher goodness of fit.

   Unlike the chi-square, the goodness of fit index is independent of the sample size and is relatively robust against departures from normality. The main weakness of these statistics is that their statistical distribution is unknown even under idealized assumptions. Hence, there is no standard to compare them against.

2. The Root Mean Square Residual. The root mean square residual is a measure of the average of the residual variances and covariances (Joreskog and Sorbom, 1984). Larger values of the root mean square residual indicate a poorer fit of the model to the data. However, this statistic can be interpreted only in relation to the sizes of the observed variances and covariances in the input analyzed data matrix.
3. Modification Indices. The value of the modification index equals the expected decrease in chi-square if a single constraint in the structural equation model is relaxed and all estimated parameters are held fixed at their estimated values (Joreskog and Sorbom, 1984). The reduction in chi-square is guaranteed to be at least as large as the modification index. Joreskog and Sorbom (1984) have recommended a practical procedure for identifying and relaxing constrained parameters. The first step in this procedure is to identify the largest modification index. If this is larger than five and if there is a substantive reason for relaxing the corresponding fixed parameter, it is to be relaxed. Only one parameter is to be relaxed

at each step. In this research, the above procedure is followed.

Modification indices can also be used as indicators of the extent to which a model is misspecified (subject to substantive considerations). The presence of a very large modification index indicates that the researcher should at least consider the possibility of respecifying the model.

3.5.5.3 Calculation of Classical Path Coefficients.

In this dissertation, the research hypotheses were tested using LISREL VI (Joreskog and Sorbom, 1984). In order to solve the problem of scale indeterminacy, the loading (measurement coefficient) on one observable of each construct was fixed at one. The purpose of this was to establish the metric or scale of the latent variable (Long, 1983a). This practice of fixing the loading of one of the indicators of a latent variable to one results in an arbitrary and meaningless metric which is usually different for each latent variable in a model (Gerbing and Hunter, 1982). Since many of the parameter estimates generated by LISREL are dependent upon the metric of the latent variables, the above practice produces parameter estimates which are often arbitrary and far different in value from their classical counterparts for multiple indicator path analysis. Such estimates make it difficult to understand the relationships in a causal model.

Classical path coefficients can be very useful for understanding a model since they are readily interpretable. This is because classical path analytic procedures base all variables on the same metric. Danes and Mann (1983) have described a method which can be used for converting LISREL coefficients to their classical counterparts in the analysis of path models with composite true scores. This method has been used in this dissertation for the calculation of the classical path coefficients for the causal model developed for each hypothesis.

Calculation of Unstandardized Path Coefficients. The following steps were followed in order to calculate unstandardized classical path coefficients from the unstandardized parameter estimates generated by LISREL.

1. Each hypothesis was tested using LISREL VI as directed by Joreskog and Sorbom (1984) after the measurement coefficient (lambda) of one indicator of each construct was fixed at one. The error variance of each indicator was recorded. The error variances are not affected by the metric of the latent variable (Danes and Mann, 1983).

2. The variance of the composite true score of each construct or latent variable was calculated using the formula given below:

   Variance of a latent variable =

   (Sum of the values in a variance-covariance matrix of its indicators) -

   (Sum of the error variances of the same indicators as obtained by LISREL analysis)

3. The corrected measurement parameters were calculated using a formula developed by Gerbing and Hunter (1982). The Gerbing-Hunter correction formula is given below.

   Corrected measurement parameter of observable X =

   $$\frac{(\text{Variance of X}) - (\text{LISREL estimate of error var of X})}{\text{Variance of latent variable of which X is an indicator}}$$

4. After the calculation of the corrected measurement parameter, the LISREL models for testing each hypothesis were rerun with the measurement coefficients fixed at their corrected parameter values. This step resulted in the computation of corrected values of the structural parameters.

The corrected measurement parameters and the corrected structural parameters are the same as those which have been obtained from classical path analytical procedures.

The above method was used only to estimate the classical path coefficients. The LISREL goodness-of-fit statistics obtained after fixing the measurement parameters at the values of their classical coefficients were not used as tests of the hypothesis. This was because the parameters had been calculated from the same data set as that which was used for the LISREL reruns.

Calculation of Standardized Path Coefficients. The standardized values generated by LISREL and the standardized estimates computed by classical path analysis differ only in the values of the measurement coefficients and the measurement errors associated with the indicators of each construct. The standardized measurement parameter estimates from LISREL can be converted to their classical counterparts by using the following correction formula developed by Danes and Mann (1983):

Corrected standardized measurement parameter of indicator X

$$= \frac{\text{Standardized LISREL parameter of X}}{\text{Variance of X}}$$

3.5.6 Plan for the Analysis of the Influence of Selected Variables on the Proposed Theoretical Structure.

The purpose of this analysis was to explore how some selected variables were empirically related to the constructs and the relationships described in the proposed theoretical structure (Figure 3, page 10). It should be noted that this analysis is not a study of causality. Rather, it is a study of empirical association.

A list of variables was selected. While some of these variables were obtained directly from the research data, others had to be computed from the data.

The responses to the selected variables which were not already coded in the form of two or three nominal categories were recoded into a "High" group and a "Low" group for each variable. An effort was made to include an equal number of observations in the two groups (subject to the characteristics of the distribution of variable values).

A method was also developed to classify observations into "High" and "Low" categories by a summation of the standardized values of the good indicators of each research construct. The placement of an observation in the "High" category or the "Low" category for any particular construct was determined on the basis of the above summated value.

The relationships between the selected list of variables and the research constructs were tested using two-way chi-square tests. The probability level for significance was set at 0.05. If a computed probability level was found to be lower than 0.05, it was considered to be an indication that the two variables being tested are probably related to each other.

The relationships of the selected list of variables with the relationships in the theoretical structure were tested similarly by using three-way chi-square tests.

3.6 THE PROPOSED RESEARCH DESIGN

3.6.1 The Sample.

The model proposed in this dissertation can be generalized to be relevant to all channels of physical distribution in some way or other. However, probability sampling from such a population poses immense problems of measurement and cost. In order to increase the internal validity of this research at the expense of some degree of external validity, only a specific distribution channel relationship in a specific industry was studied. On the basis of convenience and suitability, the manufacturer-wholesaler link in the grocery industry was selected.

The manufacturer-wholesaler link was selected because it was felt that the participants in this link would be more interested and better informed about physical distribution customer service levels than the participants in links such as the manufacturer-retailer link and the wholesaler-retailer link. The inclusion of small retailers of grocery products would have added a large amount of heterogeneity to the sample. Besides, the inclusion of small retailers would have made the task of contacting respondents and obtaining responses from them much more difficult. A greater degree of cooperation in the research was expected from the selected link, namely the manufacturer-wholesaler link.

As a result of the pretest, the definition of wholesaler was expanded to include the buying organizations of large supermarket chains which operate in a manner almost identical to grocery wholesalers. It was found that many manufacturers could not distinguish such operations from those of organizations which call themselves grocery wholesalers or wholesale grocers. This was also reflected in the lists of grocery wholesalers published by industry associations as well as private directories. For instance, many companies are listed under supermarkets as well as under grocery wholesalers in the Thomas Grocery Register (Thomas Publishing Company, 1983), the 1984 Directory of Supermarket, Grocery, and Convenient Store Chains (Business Guides, Inc., 1983a) and the 1984 Directory of Cooperative Chains, Voluntary Chains, and Wholesale Grocers (Business Guides, Inc., 1983b).

The grocery industry was selected because of the following of its characteristics:

1. the distribution channels in this industry include a large number of manufacturers and wholesalers; and
2. physical distribution customer service is a particularly important component of the marketing mix of the grocery industry.

Each unit of analysis consists of a manufacturer-wholesaler pair (or dyad) from the grocery industry.

There has been some debate in published literature regarding the sample size requirements for structural equations modeling. Aaker and Bagozzi (1979) have recommended a sample size of at least 50+ the number of observables for the analysis of structural equations using causal modeling. Other researchers have recommended more strict criteria. Boomsma (1982) has recommended that the sample size for LISREL analysis should be at least 100.

Bearden, Sharma, and Teel (1982) have studied the effects of sample size on the overall fit statistic provided by the LISREL program. As a part of their study, a simple two-construct model and a more complex four construct model were analyzed using LISREL. It was found that relatively small sample sizes were sufficient for the use of the chi-square statistic on the simple model. However, results from the analysis of the complex model indicated that a large sample size is required in order to reduce the risk of drawing erroneous conclusions. The researchers recommended that for such models samples of less than 200 should not be used.

In this research, a effort was made to obtain the largest sample size possible within the constraints faced by the researcher due to the limited population frame, the problem of non-response at any state in the multi-stage collection of data, and the constraints of time and funds. As the result, a sample size of 91 usable units of analysis was obtained.

The number of observables in the causal models for testing the hypothesis range from nine (H_3) to twelve (H_4). Hence, according to the criterion of Aaker and Bagozzi (1979), the sample size is more than adequate for testing the four hypotheses. However, the sample size is slightly smaller than the criterion specified by Boomsma (1982).

The models used for testing the four hypotheses are not complex models. Hence, it was assumed that the sample size is adequate for the tests of the proposed hypotheses.

3.6.2 Data Collection.

The process of collection of the data required for this dissertation has been described in the form of a flowchart in Figure 11. The process can be broadly divided into three stages:

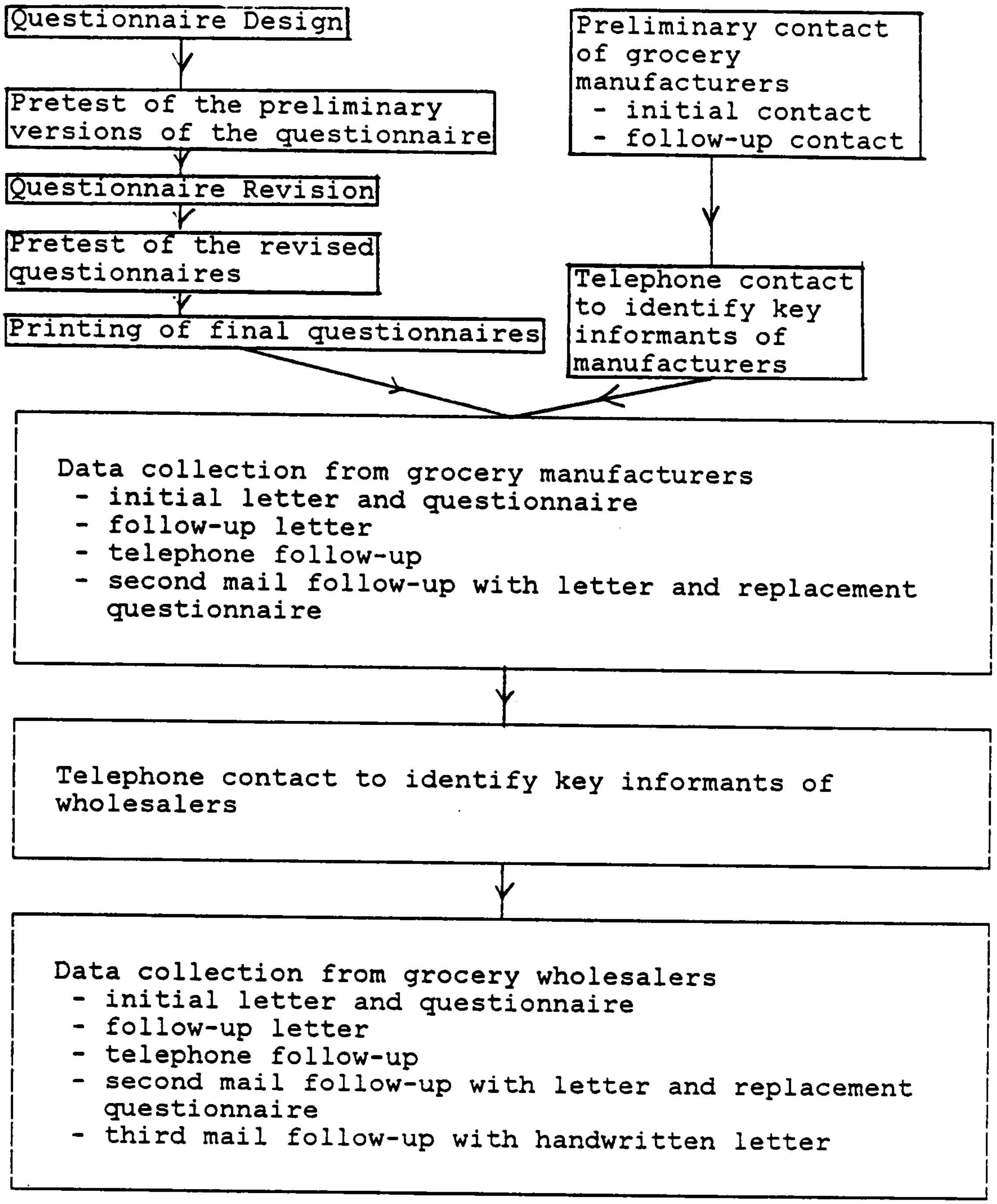

Figure 11: The Process of Data Collection

a) the pretest stage,

b) data collection from manufacturers, and

c) data collection from wholesalers.

3.6.2.1 The Pretest Stage.

The questionnaires were pre-tested on a sample of potential respondents.

One of the primary objectives of the pre-test was to re-examine the concept of customer service as it applies to the grocery industry. Although the identification of the domain of customer service and the selection of items had been conducted earlier in considerable detail, the pre-test was expected to help in recognizing additional relevant customer service elements and items. The pre-test attempted to answer the following questions identified by Dillman (1977).

> Is each of the questions measuring what it is intended to measure?
> Are all the words understood?
> Are questions interpreted similarly by all respondents?
> Does each close-ended question have an answer that applies to each respondent?
> Does the questionnaire create a positive impression, one that motivates people to answer it?
> Are questions answered correctly? (Are some missed, and do some elicit uninterpretable answers?)
> Does any aspect of the questionnaire suggest bias on the part of the researcher?

Pretest interviews were conducted in November 1983 with two grocery manufacturers and four grocery wholesalers located in Virginia. Preliminary versions of the manufacturer questionnaire and the wholesaler questionnaire were used in order to collect pretest responses and comments. The preliminary questionnaires were also pretested by mail. Two mail pretest responses were received. One was from a grocery industry association official and the other was from a major Virginia grocery manufacturer. During the same month the questionnaire was also presented to four academicians in the fields of logistics and marketing, and comments were received.

On the basis of the pretest results obtained in November 1983, revised versions of the questionnaires were prepared. The revised version of the manufacturer questionnaire was pretested by mail with a Virginia grocery manufacturer in the month of February 1984. The revised version of the wholesaler questionnaire was pretested in April 1984 through personal interviews with a Virginia wholesaler and the warehouse manager of a national supermarket chain. The revised version of the wholesaler questionnaire also reflected an earlier finding that the distinction between a grocery wholesaler and a supermarket chain's buying organization which operates like a wholesaler is not very clear either in the minds of grocery manufacturers or in the listings provided by industry associations and private agencies. Hence, the revised wholesaler questionnaire used the word "customer" (of the manufacturer) rather than the word "wholesaler" wherever it was found suitable.

The comments received during the pretest of the revised manufacturer questionnaire did not indicate the need for a new revision and the revised version was printed. Some minor comments were received during the pretest of the revised wholesaler questionnaire. These points were incorporated into a second revised version which was printed.

3.6.2.2 Data Collection from Manufacturers.

The 1982 Distribution/Transportation Committee membership list of the Grocery Manufacturers of America was used initially to identify potential respondent companies and individuals within these companies who could be contacted for identifying key informants within their companies. The above list of contacts was expanded using the 1983 NCPDM membership roster, and the names of some individuals from the grocery industry who attended an executive development program for distribution executives at the University of Tennessee in April 1983.

The individuals listed in the expanded list of contacts were contacted by mail. During the preliminary contact stage, two letters were sent to each person listed in the expanded list of contacts. One letter was sent by the chairman of the dissertation committee (Appendix G), and one was sent by the research (Appendix H). A reply postage paid postcard (Appendix I) was attached to the letter from the researcher. The purpose of this card was to make it convenient for the contacted individual to indicate his/her interest or lack of interest in the project. Participating companies were promised a summary of the research project's findings and recommendations if they indicated an interest in such a summary. The participants were also informed that their responses would be kept strictly confidential.

Individuals in the preliminary contact list of manufacturers who indicated their willingness to participate in the study were contacted by telephone. They were requested to identify an individual or individuals in their organizations (key informants) who would have enough information about the customer service levels being provided by their company to specific wholesalers.

The identified potential respondents (key informants) from organizations which indicated their willingness to take part in the project, were contacted in the second week of March 1984. Mail questionnaires (manufacturer version) were mailed to them on March 8, 1984. The mail-out package also contained a covering letter which was typed under the letterhead of the Department of Marketing, Virginia Polytechnic Institute and State University, and a postage paid reply envelope (Appendix J).

Each respondent was requested to clearly identify the grocery wholesalers in the selected manufacturer-wholesaler (own company) pairs regarding which they were responding. Each respondent was also encouraged to provide responses regarding their customers service relationship with more than one wholesaler and to identify a key informant (if possible) from each wholesaler. Strict confidentiality of all responses was promised.

On April 2, 1984, nearly four weeks after the initial mail-out, those potential respondents who had not yet responded were mailed a follow-up letter (Appendix K). A waiting period of this duration was deemed necessary between mail-outs because of the length of the questionnaires and the detailed nature of the requested information.

In order to further increase the response rate, telephone calls were made to each non-respondent in the first week of May 1984. On May 30, 1984, a second follow-up letter was mailed to each potential respondent who had not responded by then (Appendix L). A replacement questionnaire and a postage paid reply envelope were attached to the second follow-up letter as recommended by Dillman (1977).

3.6.2.3 Data Collection From Wholesalers.

The wholesalers identified by the manufacturers were contacted by telephone in the second and third weeks of July 1984. The purpose of this telephone contact was to identify individuals who could be the key informants of the wholesalers. In most cases, one of the buyers was identified as the key informant.

The key informants of the wholesalers were contacted by mail. The mail-out package included a covering letter dated July 28, 1984 under the letterhead of the Department of Marketing, Virginia Polytechnic Institute and State University (Appendix M), a copy of the wholesaler questionnaire, and a postage paid reply envelope.

On August 23, 1984, nearly four weeks after the initial mail-out, non-respondents at that stage were mailed a follow-up letter (Appendix N). This was followed by a telephone follow-up in the second week of September 1984, and a second mail follow-up after nearly another two weeks. The second mail-out package contained a follow-up letter dated September 21, 1984 (Appendix O), a replacement copy of the wholesaler questionnaire, and a postage paid reply envelope.

In order to increase the response rate for the wholesaler questionnaire further, a handwritten follow-up letter was mailed to each remaining non-respondent on October 16, 1984 (Appendix P).

During the period of data collection, the researcher often answered questions raised by potential respondents. In several instances, the researcher had to persuade potential respondents to respond to the questionnaires by emphasizing the promise of confidentiality.

3.6.3 Response Analysis.

The objective of response analysis was to determine whether questionnaire non-response is likely to have affected and biased the results of this research. Two methods were used to analyze the possibility of such a bias.

The first method required that an important demographic characteristic of each potential respondent be used to test whether respondents differed significantly from non-respondents on this characteristic. In this research, annual dollar sales (1983) was used as the demographic characteristic to be tested.

A effort was made to obtain the annual sales figures (if published and available) of all the manufacturers and all the wholesalers who were contacted as a part of this research.

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[4]Before conducting each t-test, the assumption that the variances of the two groups are equal was tested by

Separate t-tests[4] were conducted between the following pairs of groups to test differences in the mean values of their annual sales.

1. Between grocery manufacturers who indicated on the preliminary contact card that they were willing to participate in the research against those who did not indicate their willingness to participate;
2. Among the manufacturers who were mailed questionnaires, between those who responded and those who did not respond; and
3. Among the grocery wholesalers and supermarket chains who were mailed questionnaires, between those who responded and those who did not respond.

The probability level of 0.05 was chosen as the level of significance of the t-tests of difference between two independent means.

T-tests were similarly conducted to test differences in the means of selected indicators of the respondents who responded before the first follow-up and the respondents who responded after the first follow-up. The probability level

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conducting a two-tailed F-test. The null hypothesis for each F-test was that the two groups being tested have equal variances. The probability level of 0.05 was selected for significance. Whenever the null hypothesis was rejected, it was assumed that the two groups have unequal variances, and accordingly the corresponding test of difference of means was conducted under that assumption. Otherwise it was assumed that the variances of the two groups were equal.

of 0.05 was accepted as of the level of significance for the t-tests difference between two independent means. Separate tests were conducted on the manufacturer respondents and on the wholesaler respondents.

CHAPTER IV

ANALYSIS

4.1 INTRODUCTION

This chapter is divided into eight sections. Following the introductory section, the second section is a review of the results of response analysis. The third section describes the results obtained from the analysis of measures for undimensionality and reliability. The results of validity analysis are discussed in the fourth section. The fifth section describes the results from the test of each research hypothesis. In the sixth section, the LISREL parameter estimates obtained during the tests of the hypotheses are converted into classical path coefficients. This section is followed by the seventh section in which the influence of selected variables on the hypothesized relationships is studied. The final section is a summary of the results discussed in the earlier sections of the chapter.

Some of the constructs in the proposed theoretical structure (Figure 3, page 10) and their indicators have very lengthy names. In order to make it easier to discuss the analysis and the results of this research, the research constructs and their indicators have been given shorter but meaningful names. The abbreviated names have been presented in Appendix Q.

The name of the construct discussed earlier as supplier-customer differences in the perception of comparison levels has been shortened to "Difference in Norms" (DIFNORM). This name was considered to be suitable because the levels hypothesized in this research are functionally similar to the "experience-based Norms" conceptualized by Woodruff, Cadotte, and Jenkins (1983).

The name of the construct discussed earlier as supplier-customer differences on the perception of actual service levels has been shortened to "Difference in Actual" (DIFACT).

According to the behavioral process model of customer service evaluation proposed in the dissertation, the customer in a supplier customer pair evaluates the actual customer service offering of a supplier against some comparison levels (norms). The construct representing this comparison process was discussed earlier as departure from comparison levels. This name has been shortened to "Evaluation against Norms" (EVALNORM).

The shortened names of the different indicators are presented in Appendix Q.

4.2 RESPONSE ANALYSIS

The objective of response analysis was to determine whether questionnaire non-response is likely to have affected and biased results of this research. In this dissertation, response analysis was conducted on three groups of responses received during the data collection process. The first group consisted of responses to the preliminary request made to grocery manufacturers for their participation in this research. The second group consisted of responses to the manufacturer questionnaire and the third group consisted of responses to the wholesaler questionnaire. A flowchart of the overall response to the data collection process has been described in Figure 12.

4.2.1 Response Rates.

Preliminary contact letters were mailed to 353 distribution executives[5] from 112 grocery manufacturing companies. In response to the preliminary contact, 160 replies (45.33 percent of individuals contacted) were received from 94 companies[6] (83.93 percent of companies

[5]The number of individuals contacted is larger than the number of companies contacted because an effort was made in this research to maximize the number of participating companies by contacting more than one individual per company whenever possible. In this section, two separate response rates have been calculated at each step in the data collection process--one based on the number individuals contacted and the other based on the number of companies contacted.

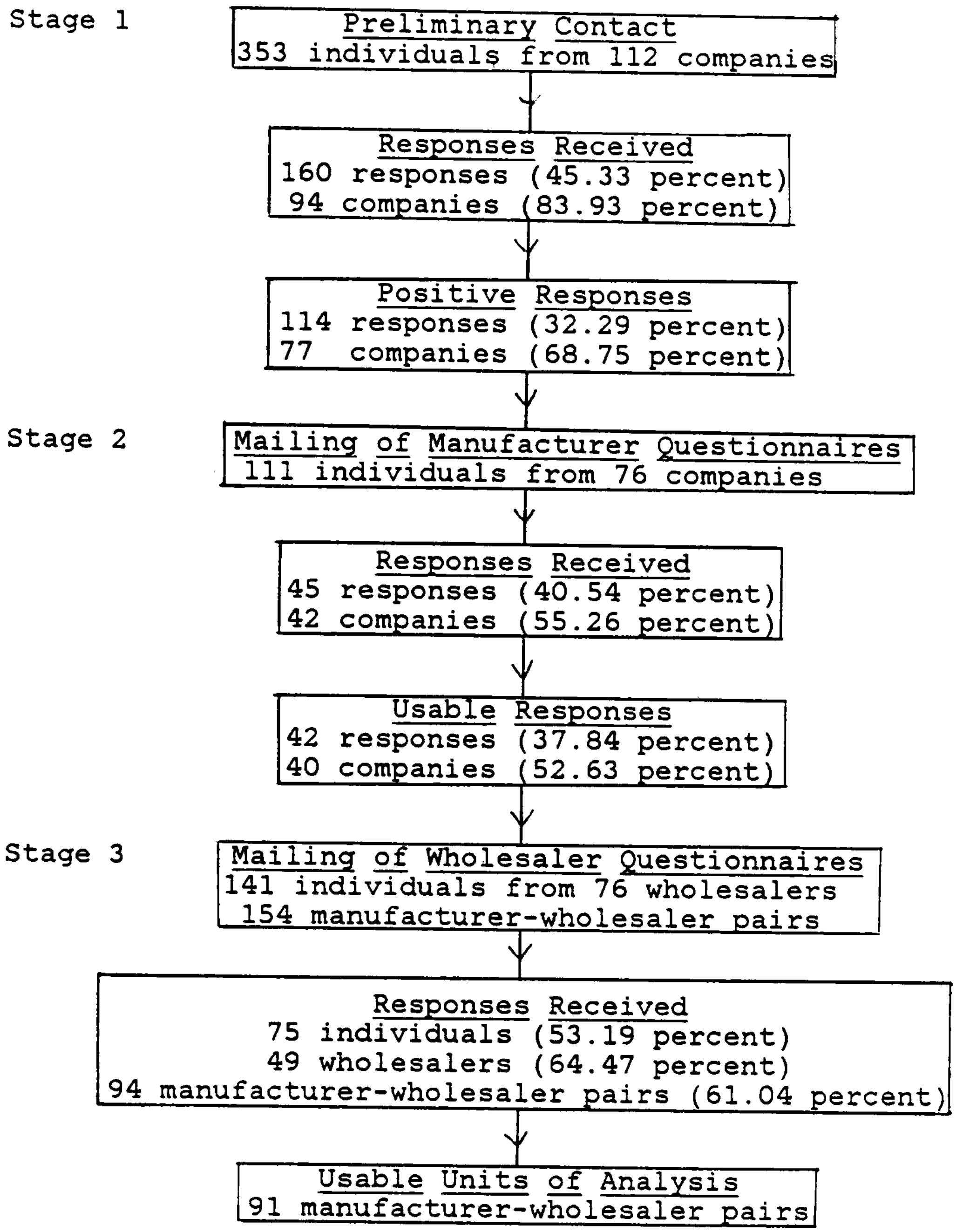

Figure 12: A Flowchart of Overall Response to the Process of Data Collection.

contacted). Out of the 160 responses, 114 were positive responses (32.29 percent of individuals contacted) indicating that the respondents were interested in participating in this research. These 114 positive responses came from 77 companies (68.75 percent of the companies contacted).

After the identification of key informants, 111 potential respondents from 76 companies were mailed copies of the manufacturer questionnaire. A total of 45 responses (40.54 percent of individuals contacted) were received from 42 companies (55.26 percent of companies contacted). Three of the responses were found to be of no practical value because of the lack of willingness on the part of the manufacturers to identify their wholesalers. The remaining questionnaires were made up of 42 responses from 40 grocery manufacturing companies.

Copies of the wholesaler questionnaire were mailed to 141 potential respondents from 76 grocery wholesalers. These respondents represented the wholesaler's side in 154 manufacturer-wholesaler pairs (potential units of analysis). Responses were received from 75 respondents (53.19 percent

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[6]The number of companies counted during the calculation of response rate is an underestimate of the number of organizations which participated in this research. This apparent inconsistency is because in several instances a number of responding organizations were found to belong to a single company.

of potential respondents) from 49 grocery wholesaling companies (64.47 percent of wholesalers contacted) representing 94 manufacturer-wholesaler pairs (61.04 percent of manufacturer-wholesaler pairs contacted). Three responses were found to be of little use to this research due to an excessive amount of item non-response in them. The data collection procedure resulted in 91 usable manufacturer-wholesaler pairs which are the units of analysis in this research.

4.2.2 Comparison of Respondents against Non-respondents.

Respondents were compared against non-respondents with the help of t-tests of difference of means. The results of the t-tests have been presented in Table 4. The t-tests were based on differences in the annual sales figures of the groups being compared. Annual sales was used as the criterion variable for the comparison because the only useful data which could be obtained about the non-respondents was their published annual sales.

The companies contacted in this research were grouped into respondents and non-respondents in a number of different ways. Separate t-tests were conducted. The results of these t-tests have been presented in Table 4. The results indicate that respondents and non-respondents do not differ significantly ($p = 0.05$) in all the listed

TABLE 4

Comparison of Annual Sales of Respondents versus Non-respondents (t-test results)

Grouping Variable	Mean[a] of Respondents	Mean[a] of Non-respondents	Two-tail Probability
Preliminary contact positive response versus negative and non-response	3485.917	1165.021	0.0001[b]
Among the manufacturers who were mailed questionnaires those who responded versus those who did not	3385.073	3736.662	0.6829[c]
Manufacturers who returned mail questionnaires versus all the others in the preliminary contact list	3385.073	2370.570	0.1213[c]
Among the wholesalers who were mailed questionnaires, those who responded versus those who did not	2164.340	2505.207	0.7778

[a]Annual Sales figures given in millions of dollars.

[b]Significant at 0.05.

[c]T-tests conducted under the assumption of unequal variances.

comparisons except in the case of the manufacturers who were contacted at the preliminary contact stage. The results indicate that manufacturers who responded differ significantly from those who did not ($p = 0.05$).

4.2.3 Comparison of Respondents Before Follow-up against Respondents After Follow-up.

Companies who responded before the first follow-up were compared with those who responded after the first follow-up using t-tests of difference of means. The results of the comparisons are presented in Table 5. The criterion variables were selected on the basis that they were measured on an interval or ratio scale.

The results presented in Table 5 indicate that the before follow-up and the after follow-up groups of grocery manufacturers do not differ significantly on any of the criterion variables listed in Table 5. The lowest two-tail probability estimate computed by the t-tests is 0.1266 which is not significant at a significance level of 0.05.

4.3 ANALYSIS OF UNIDIMENSIONALITY AND RELIABILITY

The indicators of each construct were analyzed for their unidimensionality and reliability. The procedures described in Chapter III were closely followed.

After the partitioning of the indicators into initial clusters a priori on the basis of the underlying constructs

TABLE 5

Comparison of Before Follow-up Respondents versus After Follow-up Respondents (t-test results)

Criterion Variable	Mean[a] of before follow-up group	Mean[a] of after follow-up group	Two tail Probability
Manufacturer			
Annual Sales.........	2987.956	3722.622	0.4860[b]
Number of Distribution Centers.	19.300	17.400	0.7820[bc]
Price per case of highest volume product in product category.....	36.023	32.816	0.8874[b]
Number of Competitors	5.325	12.229	0.1266[bc]
Wholesaler			
Annual Sales.........	2296.220..	2001.431	0.7494[b]
Days of inventory usually carried..	14.676	13.411	0.6459[b]
Purchase volume..	269.850	228.199	0.4545[bc]
Manufacturer's share of purchases	33.424	33.263	0.9767[b]

[a]Annual Sales figures given in millions of dollars.

[b]Not significant at $p = 0.05$.

[c]T-test conducted under the assumption of unequal variances.

which they were expected to measure, the correlation matrix of indicators was analyzed for unidimensionality.

The Factor Intercorrelations and Loading Matrix produced as the result of the MGRP routine of PACKAGE 1980 (Hunter, et al., 1980) was studied in order to identify whether the loadings of each item appeared to follow the product rule. The residual inter-item correlations after the cluster true scores are partialed out were also studied to find out the presence of correlated errors between items in each cluster. The matrix of similarity coefficients, also generated by PACKAGE, was studied to determine whether the items on each cluster met the requirement of external consistency.

Along with the analysis of inter-item correlations using PACKAGE, an inter-item variance-covariance matrix was analyzed using SPSSx (SPSS, Inc., 1983) in order to study the reliability of each set of indicators. The possibility of dropping poor indicators and the possibility of reclustering the earlier clusters were studied. As the result of the analysis of unidimensionality and reliability, a set of indicators was identified for each construct. These indicator sets meet the criteria for unidimensionality and reliability described in Chapter III.

The results of PACKAGE analysis of unidimensionality are presented in the Appendix. The Factor Inter-correlations and Loading Matrix is presented in Appendix C. The matrix of residual inter-item correlations after the latent score or true score has been partialed out is presented in Appendix D. The matrix of similarity coefficients is presented in Appendix E. Table 6 presents the list of indicators which were selected after the analysis of unidimensionality and reliability. Table 6 also specifies the variable number by which each indicator is identified in Appendices C, D, and E.

During the analysis of the indicator sets for unidimensionality and reliability, several poor items were identified. In general, customer service items which measure the underlying construct in units of time (e.g. Transit time) were found to be inferior to items which measure the underlying construct in percentages (e.g. stock-out percent). This finding is probably the result of the tendency of respondents to provide relatively more discrete responses when asked to respond in time units. Responses to item which measure the underlying construct in percentages tend to be more continuous in nature and tend to result in a more continuous distribution. All the items which elicit responses in time units (Entry to Shipment,

TABLE 6

List of Selected Indicators and Underlying Factors

Variable Number[a]	Indicators and Underlying Constructs[b]
	List of Selected Indicators
1	Stock-out percent (DIFNORM)
3	Delivery percent (DIFNORM)
11	Shipping errors (DIFNORM)
12	Damage (DIFNORM)
82	Info. Handling Completion (DIFNORM)
17	Stock-out percent (DIFACT)
19	Delivery percent (DIFACT)
27	Shipping errors (DIFACT)
84	Info. Handling Completion (DIFACT)
49	Stock-out percent (EVALNORM)
51	Delivery percent (EVALNORM)
52	Entry to Ship.-Av.-Time (EVALNORM)
59	Shipping Errors (EVALNORM)
88	Info. Handling Completion (EVALNORM)
78	Satisfaction
80	Preference
90	C. S. Evaluation
67	Past Trend
68	Future Trend
65	Purchase Volume
66	Manufacturer's Share
	List of Underlying Factors
501	Difference in Norms
502	Difference in Actual
503	Evaluation against Norms
504	Market Response(Dimension 1)
505	Market Response(Dimension 2)
506	Market Response(Dimension 3)
507	Market Response(Dimension 4)

[a]As printed in Appendix C, Appendix D, and Appendix E.

[b]As given in Appendix Q.

Transit Time, and Information Response Time) except for one were dropped from the analysis. The only such indicator retained is Entry-to-Ship-Av. Time (EVALNORM).

Order completion and billing error were also found to be poor indicators of the research constructs.

The indicators of market response were reclustered into two subclusters. Each subcluster represents a separate dimension. The first subcluster consists of three indicators which are essentially measures of the customer's post-purchase attitude and feelings towards the purchase experience with the supplier. The indicators in this cluster are C.S. Evaluation, Satisfaction, and Preference. The second subcluster consists of two indicators which measure the purchase trend. These indicators are Past Trend and Future Trend. Two other important indicators of market response (Purchase Volume and Manufacturer's Share of purchases) did not fit into any subcluster. Hence, they were recognized as two different dimensions of market response, each with one indicator.

The matrices in Appendices C, D, and E are partitioned into boxes which represent indicator clusters. The indicator clusters in the Factor Intercorrelations and Loading Matrix are rectangular sub-matrices. The diagonal values in each submatrix represents the communality of each indicator with the set of indicators in the same cluster. On the upper right hand side of the Factor Intercorrelations and Loading Matrix, the loadings of each item on each underlying factor can be seen. Each factor is identified by a number in the 500 series (501, 502, ...). The pattern of values in each subcluster in Appendix C closely follows the corresponding loading of the same items on the underlying factor (represented by the appropriate column of item-factor loadings). This observation is consistent with the product rule for internal consistency.

The indicator clusters are represented in Appendix D as symmetric submatrices. The diagonal values in each submatrix are the communalities of each indicator with the set of indicators in the same cluster. The remaining values in each cluster are the residual correlations after the cluster true score is partialled out. All the residual correlations within the clusters defined in Appendix D are very small. Most of the values are between 0.10 and -0.10. The largest deviation from zero is -0.152. The results indicate a high degree of internal consistency. The deviations of the residuals from zero may be the result of sampling error.

The indicator clusters are grouped in Appendix E into symmetric submatrices. The diagonal values in each submatrix are the communalities of each indicator with the set of indicators on the same cluster. The remaining values in each cluster are the similarity coefficients between indicators. All the within cluster similarity coefficients in Appendix E are very high and above 0.95. Immediately outside the boundary of each cluster, a sudden drop can be seen in the values of the computed similarity coefficients. The high within cluster inter-item similarity coefficients indicate that the indicators within each cluster have a high degree of external consistency.

The reliability coefficients of the final clusters of indicators selected after the analysis of unidimensionality and reliability are presented in Table 7.

The lowest coefficient alpha presented in Table 7 is 0.7942 for Market Response - Dimension 1 and the highest is 0.9153 for Evaluation against Norms. The lowest Standardized Item Coefficient Alpha is 0.8287 for Market Response - Dimension 2 and the highest is 0.9364 for evaluation against Norms. Except for one coefficient alpha which is marginally lower than 0.8, all the rest are above 0.8. The coefficients of reliability indicate a high level of reliability for each construct and dimension.

TABLE 7

Reliability Coefficients of Indicator Clusters after the Analysis of Unidimensionality and Reliability

Indicator Cluster	Coefficient Alpha	Standardized Item Coefficient Alpha
Difference in Norms	0.8220	0.8488
Difference in Actual	0.8333	0.8678
Evaluation against norms	0.9153	0.9364
Market Response: Dimension 1 (Eval. of Purchase Experience)	0.7942	0.9164
Market Response: Dimension 2 (Purchase Trend)	0.8205	0.8287
Market Response:Dimension 3 (Purchase Volume)	-[a]	-[a]
Market Response: Dimension 4 (Manufacturer's Share)	-[a]	-[a]

[a]Latent variable measured using a single indicator. Hence coefficient alpha and standardized coefficient alpha cannot be calculated.

4.4 ANALYSIS OF VALIDITY

The inter-item correlations of all the indicators which were selected after the analysis of unidimensionality and reliability were studied to determine the extent to which they supported measure validity. The correlation matrix which was used for this purpose is presented in Appendix F.

The average of the correlations between the indicators of each construct was compared against the average of all the other correlations presented in Appendix F. The results of this computation are summarized in Table 8. The results presented in Table 8 indicate that the indicators of each construct possess a high degree of content validity. The results also seem to indicate that the indicators of each construct possess a high degree of convergent validity.

Similar support to the content validity and to the convergent validity of the indicators is given by the Factor Intercorrelations and Loading Matrix (Appendix C). Each indicator has a higher loading on the factor underlying its own cluster than on factors underlying other clusters of indicators.

The similarity coefficients presented in Appendix D also indicate that the indicator set of each construct possesses a high degree of convergent validity and discriminant validity. The very high similarity

TABLE 8

Average Inter-Item Correlation

Name of Construct Underlying Cluster	Average Inter-item Correlation[a] Within Cluster	Between Clusters
Difference in Norms	0.528	0.184
Difference in Actual	0.620	0.188
Evaluation against Norm	0.746	0.173
Market Response: Dimension 1 (Eval. of Purchase Experience)	0.787	0.192
Market Response: Dimension 2 (Purchase Trend)	0.707	0.198
Market Response: Dimension 3 (Purchase Volume)	-[b]	0.200
Market Response: Dimension 4 (Manufacturer's Share)	-[b]	0.200

[a]The values in the diagonal were excluded from the calculation of inter-item correlation.

[b]Latent variable measured using a single indicator. Within-cluster inter-item correlation cannot be calculated.

coefficients between the indicators of each construct imply that the responses elicited by these indicators are very similar and that each indicator can be considered to be a very good alternative indicator for the others. This supports the convergent validity of the indicators of each construct. At the boundary of each cluster, a sharp drop in similarity coefficient values can be observed. This indicates that the indicators of each construct are more similar to other indicators of the same construct than to indicators of other constructs. This observation indicates that the indicators of each construct have a high degree of discriminant validity.

A brief preliminary evaluation of the nomological validity of the theoretical structure to be tested (Figure 3, page 10) was carried out by looking at the factor-factor loadings at the lower right hand corner of the Factor Intercorrelations and Loading Matrix (Appendix C). The directions of the factor loadings are consistent with the directions hypothesized. "Difference in Norms" has, as hypothesized, a positive loading with "Evaluation against Norms," while "Difference in Actual" has a negative loading with "Evaluation against Norms." "Evaluation against Norms" has a positive loading with all the four dimensions of "Market Response."

The above observations support the nomological validity of the constructs included in the theoretical structure to be tested. The nomological validity of the constructs in the theoretical structure is tested more thoroughly in the section of this chapter titled 'tests of the hypotheses.'

4.5 A DISCUSSION OF SOME FINDINGS FROM THE ANALYSIS OF UNIDIMENSIONALITY, RELIABILITY, AND VALIDITY

The results of this analysis indicated that measures of customer service which elicit responses in percentages are superior to the measures which elicit responses in time units. This may be the result of the tendency of respondents to provide answers which fall into a relatively discrete distribution whenever they are asked to respond to a question in time units (e.g., one day, two days, etc.). Responses in percentages tend to form a more continuous distribution.

The relatively high levels of reliability, unidimensionality, and validity of the measures which were developed by empirical analysis and selection indicate that quite good measures can be developed for the constructs in the theoretical structure of this research. This is a particularly important finding because two of the research constructs--Difference in Norms and Difference in Actual--are inter-personal and inter-organizational in nature.

However, the measures of customer service which were developed in this research have a weakness. During the purification of these measures to make them reliable and unidimensional, some measures of customer service which are usually viewed by practitioners as very important measures had to be dropped from the analysis. For instance, most of the indicators of order cycle time had to be dropped from the analysis. According to the findings of LaLonde and Zinszer (1976), distribution executives from the grocery industry rank measures of order cycle time as the second most important measures of customer service (that is, after the measures of product availability). According to the findings of Cunningham and Roberts (1974), delivery reliability (which is represented in this dissertation by measures of consistency of order cycle time), is the most important element for influencing the choice of supplier.

This apparent weakness is not necessarily the result of inadequacies in the measurement of customer service during the data collection phase of this research. Rather than that, it may be viewed as a weakness of the main analytical technique used in this dissertation. Causal modeling and analysis using LISREL requires that the measures of each latent variable in the causal model be unidimensional. However, logistics and marketing literature have not clearly indicated the nature of the dimensionality of customer service. Customer service may be a construct which is essentially multidimensional in nature. In order to capture the dimensionality of such a construct it is necessary to develop a measuring instrument with a large number of indicators. Even if such measuring instruments can be developed, the need to treat each dimension as a separate latent variable (to ensure the unidimensionality of each unobservable variable) before analyzing a causal model using LISREL can lead to the development of complicated models even for the study of apparently simple hypotheses.

The analysis of unidimensionality and reliability which was conducted as a part of this research did not clarify the dimensionality of customer service. Several indicators were found to be lacking in unidimensionality and had to be dropped. Their lack of unidimensionality may be due to any of the following reasons.

1. Customer service may be a construct which is essentially multidimensional in nature.
2. The heterogeneity of the sample may have added a large amount of random and systematic error to some indicators and thus made them weak in reliability and in unidimensionality. For instance, the distance between the supplier and the customer in a

dyad is not uniform across dyads. This heterogeneity itself can lead to enough error in some measures (such as in measures of order cycle time length and consistency) to make it necessary to drop some of them from the analysis.

3. It is also possible that some indicators are unable to capture the perceptions of respondents regarding certain elements of customer service.

4.6 TESTS OF THE HYPOTHESES

The four research hypotheses stated in Chapter III were tested using the computer program LISREL VI (Joreskog and Sorbom, 1984). A variance-covariance matrix of the selected observable variables was used as the input to the program. Separate causal models were developed for testing each hypothesis and the four hypotheses were tested separately. After each test, the LISREL parameters obtained as the result of the tests were used to estimate the structural and measurement coefficients which would have been obtained if the data had been analyzed using classical path analytic procedures.

4.6.1 Statistical Test of Hypothesis 1.

Hypothesis 1 states that there is a significant relationship between departure from comparison levels (Evaluation against Norms) and market response. This relationship is hypothesized to be positive in direction.

During the analysis of unidimensionality and validity, it was discovered that the indicators of market response do not form a unidimensional cluster. The indicators were partitioned into four dimensions. Each dimension is treated as a latent variable in the causal model.

The causal model for testing Hypothesis 1 is presented in Figure 13. The following structural equations were developed for testing this hypothesis.

$$\eta_1 = \gamma_{11}\xi_1 + \zeta_1$$
$$\eta_2 = \gamma_{21}\xi_1 + \zeta_2$$
$$\eta_3 = \gamma_{31}\xi_1 + \zeta_3$$
$$\eta_4 = \gamma_{41}\xi_1 + \zeta_4$$

The measurement equations follow the basic measurement model described in Chapter III. η_1 has three observable variables (indicators) and η_2 has two observable variables. η_3 and η_4 are latent variables with only one indicator each. ξ_1 has five observable variables.

In order to solve the problem of scale indeterminacy, the factor loading of the first observable of η_1, η_2, and ξ_1 were fixed at 1.0 and their errors were defined as free

Figure 13: Causal Model for the Test of Hypothesis 1.

UNOBSERVABLE VARIABLES

η_i Endogenous variables: Dimensions of Market Response

η_1 Dimension 1: Evaluation of Purchase Experience

η_2 Dimension 2: Purchase trend

η_3 Dimension 3: Purchase volume

η_4 Dimension 4: Manufacturer's share

ξ Exogenous variable: Evaluation agains Norms

OBSERVABLE VARIABLES (INDICATORS)

y_1 : Satisfaction

y_2 : Preference

y_3 : C. S. Evaluation

y_4 : Past Trend

y_5 : Future Trend

y_6 : Purchase Volume

y_7 : Manufacturer's Share

x_1 : Stock-out percent (EVALNORM)

x_2 : Delivery percent (EVALNORM)

x_3 : Entry to Ship.-Av. Time (EVALNORM)

x_4 : Shipping Errors (EVALNORM)

x_5 : Info. Handling Completion (EVALNORM)

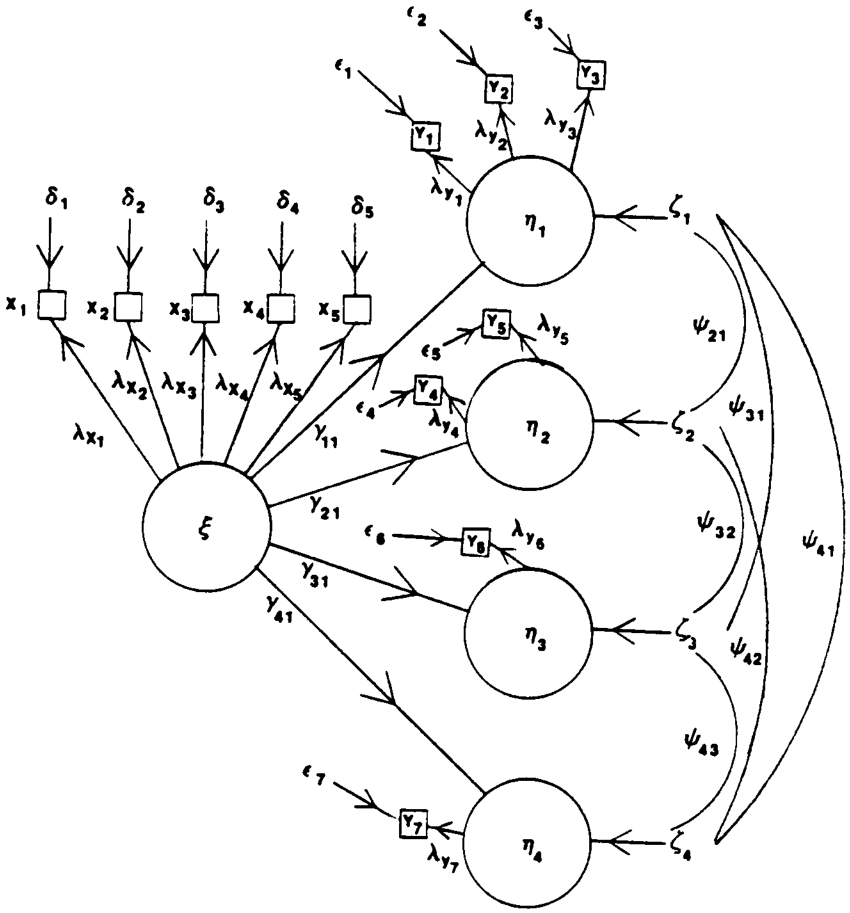

Figure 13 (continued)

parameters. The selection of those particular observables was an arbitrary decision. Since the indicators had been selected after an analysis of their unidimensionality and reliability, it was felt that any particular indicator among the indicators of a latent variable was as good as any other for determining the metric of its underlying latent variable.

The test of Hypothesis 1 requires that 32 unknown parameters be estimated. The total number of equations in the model is 78 (Table 9). Since the former number is smaller than the latter, the model meets a necessary condition for the identification of all its parameters (Bagozzi, 1980).

Since η_3 and η_4 are single indicator constructs, the factor loadings of their only indicators were initially fixed at one and their errors at zero. The initial efforts to test Hypothesis 1 using LISREL VI led to the error message that the matrix of θ_ε's is not positive definite. This error message was obtained when a covariance matrix was used as well as when a correlation matrix was used.[7]

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[7]According to Mislevy (1985), this error message is most probably the result of the use of single indicator constructs in the causal model. Mislevy (1985) is of the opinion that if the use of the single indicator constructs in the causal model is theoretically justifiable, then the estimates generated by LISREL analysis of the model may be acceptable in spite of the error message.

TABLE 9

Test of a Necessary Condition for the Identification of all Parameters

Model	Number of Unknowns to be estimated	Number of Equations in the model[a]
Test of Hypothesis 1	32	78[b]
Test of Hypothesis 2	21	55[b]
Test of Hypothesis 3	19	45[b]
Test of Hypothesis 4	34	105[b]

[a]Calculated as follows:
Number of equations =
1/2 (total no of observables)(total no of observables + 1).

[b]Number of unknowns is less than number of equations. Hence the model meets the necessary condition for the identification of all parameters.

In order to obtain an output without such an error message, a procedure was followed which required that an assumption be made regarding the percentage of error variance in the total variance of the observable of each single indicator construct. Since η_3 and η_4 are single indicator latent variables, their coefficient alphas cannot be calculated and their error variances cannot be estimated statistically. Hence it was assumed that 20 percent of the variance of the observables of η_3 and η_4 was error variance.

The error variances of λ_{y6} and λ_{y7} were computed from the variance covariance matrix of observables, and the corresponding θ_ε's were fixed at these values. The resulting model was analyzed using LISREL VI and the results of the analysis have been reported in this dissertation as the results of the test of Hypothesis 1. No error message was generated by LISREL during this analysis.

A sensitivity analysis was conducted to find out how the results would have been affected if the error variance of the observable of each single indicator construct was assumed to be 15 percent or 25 percent of its total variance instead of 20 percent. The model for the test of Hypothesis 1 was reanalyzed under these different assumptions. Most of the LISREL estimates generated were found to be identical under the different assumptions[8] except for some statistics

[8]This observation was found to be valid even when these

(ψ estimates, squared multiple correlations, and total coefficients of determination) directly associated with η_3 and η_4.

The squared multiple correlations and the coefficients of determination computed by LISREL VI are presented in Table 10. These statistics are measures of reliability. It can be seen that the squared multiple correlation of each observable variable (x and y variables) is quite high. Their values range from 0.638 to 0.857. The total coefficients of determination of the y variables and the x variables are very high. The results presented in Table 10 indicate that the measurement model used for the test of this hypothesis has a very high reliability.

Table 10 also presents the squared multiple correlations of the endogenous variables. The estimates of η_1 (Evaluation of Purchase Experience) and η_2 (Purchase Trend) explain a larger proportion of the variance in their observables than do estimates of η_3 (Purchase Volume) and η_4 (Manufacturer's Share). The total coefficient of determination of the structural equation is 0.702 which is a very high value for a model with four dependent variables.

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estimates were compared with the estimates obtained when the error variance of the observable of each single indicator constructs was fixed at zero.

TABLE 10

Squared Multiple Correlations and Coefficients of Determination (Hypothesis 1)

Variable/ Model	Squared Multiple Correlation	Total Coefficient of Determination
Y_1	0.788[a]	-
y_2	0.817	-
y_3	0.746	-
y_4	0.696[a]	-
y_5	0.719	-
y_6	0.800[b]	-
y_7	0.800[b]	-
Total Coefficient of Determination for y variables	-	0.996
x_1	0.794	-
x_2	0.846	-
x_3	0.638	-
x_4	0.655	-
x_5	0.857	-
Total Coefficient of Determination for x variables	-	0.947

TABLE 10 (continued)

Variable/ Model	Squared Multiple Correlation	Total Coefficient of Determination
η_1	0.664	-
η_2	0.523	-
η_3	0.204	-
η_4	0.221	-
Total Coefficient of Determination for Structural Equation[c]	-	0.702

[a]Factor loading was fixed at the value of 1.0 to solve the problem of scale indeterminacy.

[b]Factor loading was fixed at the value of 1.0 to solve the problem of scale indeterminacy and the error variance was fixed at 20 percent of the total variance of the observable.

[c]The chi-square for the test hypothesis 1 with 46 degrees of freedom = 45.59 (prob. level = 0.489).

The chi-square test of goodness-of-fit of the entire model supports the hypothesis. The value of chi-square with 46 degrees of freedom is 45.59. It has a probability level of 0.489 which is larger than the minimum (0.10) for supporting the hypothesis.

The goodness of fit index of 0.925 and the adjusted goodness of fit index of 0.873 indicate a good fit of the model to the data. The root mean square residual has a value of 8.913 which appears to be large. The root mean square residual can, however, be evaluated only in relation to the magnitudes of the variances of the indicators in the analyzed data. In order to correct for the influence of the variance size, the causal model for the test of Hypothesis 1 was analyzed using a correlation matrix of the input data (instead of a covariance matrix). This step resulted in the estimation of a lower value (0.028) for the root mean square residual. The low value of the root mean square residual computed from the correlation matrix indicates that the average value of the residual variances and covariances is actually very low and that the model fits the data well.

The largest modification index generated by LISREL analysis of the causal model for testing Hypothesis 1 is 3.33. The low value of the modification index indicates that relaxing no particular fixed parameter will lead a major improvement of the fit of the model to the data. In other words, the modification indices do not recommend that the model be respecified.

The parameter estimates generated by LISREL VI are given in Table 11. All the freed parameter estimates of γ, λ_x, λ_y, θ_δ, and θ_ε have t-values which are larger than two and are hence significant ($p = 0.05$). Most of the estimated values in the variance-covariance matrix of the errors in the structural equations (Ψ) are also significant except for the covariance between the structural equation error associated with η_2 (Purchase Trend) and two other structural equation errors associated with η_3 (Purchase Volume) and η_4 (Manufacturer's Share). The estimate of the variance (ϕ) of the exogenous variable is significant at a probability level of 0.05.

Table 11 also presents the standardized estimates of the structural and measurement coefficients. Standardized estimates of the errors are not generated by LISREL VI. If the standardized estimates of the measurement coefficients are correct, it is possible to estimate the standardized estimates of the errors by using the following formula.

Standardized estimate of error variance =

1 - (square of standardized estimate of corresponding measurement coefficient).

TABLE 11

LISREL Parameter Estimates (Hypothesis 1)

	Unstandardized Parameter Estimate	T-value	Standardized Parameter Estimate
γ_{11}	0.221	8.834[c]	0.815
γ_{21}	0.423	6.786[c]	0.723
γ_{31}	23.811	3.976[c]	0.451
γ_{41}	3.330	4.163[c]	0.470
λ_{y1}	1.000[a]	0.000	0.859
λ_{y2}	2.163	12.895[c]	1.858
λ_{y3}	0.678	11.668[c]	0.582
λ_{y4}	1.000[a]	0.000	1.857
λ_{y5}	0.846	9.234[c]	1.571
λ_{y6}	1.000[a]	0.000	167.334
λ_{y7}	1.000[a]	0.000	22.475
λ_{x1}	1.000[a]	0.000	3.171
λ_{x2}	1.754	13.677[c]	5.561
λ_{x3}	0.593	10.107[c]	1.880
λ_{x4}	1.281	10.366[c]	4.061
λ_{x5}	1.313	13.895[c]	4.163
$\theta_{\varepsilon 1}$	0.199	5.271[c]	-[e]
$\theta_{\varepsilon 2}$	0.773	4.958[c]	-[e]

TABLE 11 (continued)

	Unstandardized Parameter Estimate	T-value	Standardized Parameter Estimate
$\theta_{\varepsilon 3}$	0.115	5.587[c]	-[e]
$\theta_{\varepsilon 4}$	1.507	4.693[c]	-[e]
$\theta_{\varepsilon 5}$	0.964	4.416[c]	-[e]
$\theta_{\varepsilon 6}$	7000.128[b]	0.000	-[e]
$\theta_{\varepsilon 7}$	126.128[b]	0.000	-[e]
$\theta_{\delta 1}$	2.616	5.416[c]	-[e]
$\theta_{\delta 2}$	5.629	4.845[c]	-[e]
$\theta_{\delta 3}$	2.006	6.126[c]	-[e]
$\theta_{\delta 4}$	8.676	6.079[c]	-[e]
$\theta_{\delta 5}$	2.892	4.679[c]	-[e]
ψ_{11}	0.248	4.409[c]	0.336
ψ_{21}	0.524	4.364[c]	0.329
ψ_{31}	34.521	3.030[c]	0.240
ψ_{41}	5.873	3.717[c]	0.304
ψ_{22}	1.646	3.892[c]	0.477
ψ_{32}	45.538	1.569[d]	0.147
ψ_{42}	6.610	1.703[d]	0.158
ψ_{33}	22300.441	5.054[c]	0.796
ψ_{43}	1253.810	2.864[c]	0.333

TABLE 11 (continued)

	Unstandardized Parameter Estimate	T-value	Standardized Parameter Estimate
ψ_{44}	393.648	5.022[c]	0.779
ϕ	10.053	5.377[c]	1.000

[a]Fixed factor loading.

[b]Fixed indicator error variance.

[c]Significant t-value (p. = 0.05).

[d]Non-significant t-value (p. = 0.05).

[e]Not reported by LISREL VI.

Applying the above formula to the standardized measurement coefficients (λ_x's and λ_y's) in Table 11 will yield some error estimates which are negative. This observation is supported by the findings of Danes and Mann (1983). Negative error variances are meaningless, and their presence indicates that at least some of the estimated measurement coefficients are inaccurate. Danes and Mann (1983) have described a method which can be used to correct the standardized estimates generated by LISREL to obtain their classical counterparts. This method was described in Chapter III. The standardized measurement coefficients and the corrected standardized estimates of their error variances are presented in Table 12. The corrected standardized estimates of the measurement coefficients and their error variances are the same as the standardized estimates which can be obtained by the analysis of the data using classical path analytical procedures. The remaining standardized estimates were generated by LISREL. Their values are the same as those of their corresponding classical path estimates.

The standardized path estimates presented in Table 12 indicate that the standardized estimate of the error variance of each indicator is quite low when compared against its corresponding standardized measurement

TABLE 12

Classical Path Estimates (Hypothesis 1)

	Unstandardized Estimates	Standardized Estimates
γ_{11}	0.143	0.815
γ_{21}	0.132	0.723
γ_{31}	4.009	0.451
γ_{41}	0.561	0.470
λ_{y1}	0.260651	0.8878[c]
λ_{y2}	0.564106	0.9039[c]
λ_{y3}	0.176777	0.8637[c]
λ_{y4}	0.541652	0.8343[c]
λ_{y5}	0.458324	0.8480[c]
λ_{y6}	1.0[a]	0.8944[c]
λ_{y7}	1.0[a]	0.8944[c]
λ_{x1}	0.168369	0.8908[c]
λ_{x2}	0.295299	0.9197[c]
λ_{x3}	0.099836	0.7986[c]
λ_{x4}	0.215647	0.8094[c]
λ_{x5}	0.221032	0.9258[c]
$\theta_{\varepsilon 1}$	0.199	0.2118[d]
$\theta_{\varepsilon 2}$	0.773	0.1829[d]
$\theta_{\varepsilon 3}$	0.115	0.2539[d]
$\theta_{\varepsilon 4}$	1.506	0.3039[d]
$\theta_{\varepsilon 5}$	0.964	0.2808[d]
$\theta_{\varepsilon 6}$	7000.128[b]	0.1999[d]

TABLE 12 (continued)

	Unstandardized Estimates	Standardized Estimates
$\theta_{\varepsilon 7}$	126.285[b]	0.2000[d]
$\theta_{\delta 1}$	2.616	0.2063[d]
$\theta_{\delta 2}$	5.629	0.1540[d]
$\theta_{\delta 3}$	2.006	0.3621[d]
$\theta_{\delta 4}$	8.676	0.3447[d]
$\theta_{\delta 5}$	2.892	0.1428[d]
ψ_{11}	3.640	0.336
ψ_{21}	3.710	0.329
ψ_{31}	132.390	0.240
ψ_{41}	22.523	0.304
ψ_{22}	5.609	0.477
ψ_{32}	84.075	0.147
ψ_{42}	12.203	0.158
ψ_{33}	22300.440	0.796
ψ_{43}	1253.807	0.333
ψ_{44}	393.648	0.779
ϕ	354.663	1.000

[a]Fixed factor loading.

[b]Fixed indicator error variance.

[c]Computed as below:
Corrected Standardized Measurement Coefficient:

$$= \frac{\text{LISREL Standardized Coefficient}}{\text{Corresponding observed score standard deviation}}$$

[d]Computed as below:
Corrected Standardized Error Estimate =
1 - (square of corresponding corrected standardized measurement coefficient)

coefficient. All the standardized measurement coefficients in Table 12 are larger than their corresponding standardized estimates of indicator error variance.

Table 12 also presents unstandardized classical path estimates calculated from unstandardized parameter estimates generated by LISREL VI. The LISREL estimate of each indicator factor loading (except of λ_{y6} and λ_{y7}) was converted to its classical counterpart by using a method described by Danes and Mann (1983). This method has been discussed in Chapter III. The indicator factor loading were later fixed at the values of these corrected estimates, and the model was reanalyzed using LISREL. The values of the remaining unstandardized estimates presented in Table 12 (except for the values of λ_{y6}, λ_{y7}, $\theta_{\varepsilon 6}$, and $\theta_{\varepsilon 9}$) were computed by LISREL VI during this rerun.

The standardized structural coefficients (γ's) between the exogenous variable and the endogenous variable are equivalent to standardized regression coefficients of "beta weights." Their values can be used to understand the relative magnitude of relationships between the latent variables. This information is not communicated by the unstandardized coefficients (Dwyer, 1983). The standardized structural coefficient between an exogenous variable and an endogenous variable indicates the number of standard deviations by which (the mean value of) the endogenous variable will change if (the mean value of) exogenous variable changes by one standard deviation.

The standardized γ coefficients presented in Table 12 indicate that when the exogenous variable Evaluation against Norms is changed by one standard deviation the first dimension of Market Response (Evaluation of Purchase Experience) will change by 0.815 standard deviations, the second dimension (Purchase Trend) will change by 0.723 standard deviations, the third dimension (Purchase Volume) will change by 0.451 standard deviations, and the fourth dimension (Manufacturer's Share) will change by 0.470 standard deviations.

The above discussion indicates that Purchase Volume and Manufacturer's Share are less closely related to Evaluation against Norms than are the other two dimensions of Market Response. This observation also indicates that Purchase Volume and Manufacturer's Share are probably influenced quite strongly by factors not included in theoretical model proposed in this research.

The normalized residuals computed by LISREL VI during the test of Hypothesis 1 indicate a good fit of the model to the data. No normalized residual value is larger than two (absolute) in size. The Q-plot of normalized residuals

(Figure 18, page 375, Appendix U) has a slope of approximately 72 degrees to the horizontal axis. This is an indication of good fit.

As described earlier, during the analysis of the causal model for the test of Hypothesis 1, the error variances of two indicators of market response (Purchase Volume and Manufacturer's Share) were fixed at 20 percent of their corresponding indicator variances. In order to determine the sensitivity of the results of the test of Hypothesis 1 to changes in the fixed proportion of the indicator variances, the model was re-analyzed after fixing the error variances of Purchase Volume and Manufacturer's first at 15 percent and then at 25 percent of their indicator error variances. No changes were observed in the values of the parameter estimates, error estimates, squared multiple correlations of the x variables, the total coefficient of determination of the x variables, and in the chi-square and other indices of goodness of fit. The total coefficient of determination of the y variables, and the total coefficient of determination of the structural equation were found to change, but only marginally (by approximately 0.002 when the fixed portion of the total variances of Purchase Volume and Manufacturer's Share was increased to 25 percent or decreased to 15 percent from the earlier level 20 percent).

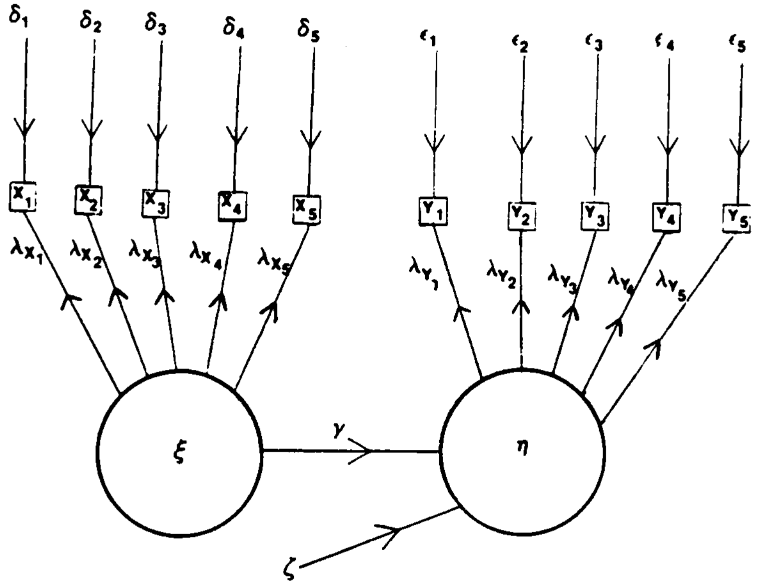
The results of the test of Hypothesis 1 indicate that there is a significant positive relationship between Departure from Comparison Levels (Evaluation against Norms) and Market Response. The model which was developed for testing this hypothesis was supported by the chi-square test of goodness of fit. It is also supported by other indicators of goodness of fit such as the goodness of fit index, the adjusted goodness of fit index, and the root mean square residual. All the latent variables and observable in the model have high reliabilities, and the structural equations explain a large percentage of the total variance of the endogenous variable. All the structural and measurement parameters are significant and are positive as hypothesized.

4.6.2 <u>Statistical Test of Hypothesis 2</u>.

Hypothesis 2 states that there is a significant relationship between supplier-customer differences in the perception of comparison levels (Difference in Norms) and departure from comparison levels (Evaluation against Norms). The direction of this relationship is hypothesized to be positive.

The causal model for testing Hypothesis 2 is presented in Figure 14. The following structural equation was developed for testing this hypothesis.

$$\eta = \gamma\xi + \zeta$$



<u>UNOBSERVABLE</u> <u>VARIABLES</u>

η : Endogenous variable: Evaluation against Norms

ξ : Exogenous variable: Difference in Norms

<u>OBSERVABLE</u> <u>VARIABLES</u> (INDICATORS)

y_1 : Stock-out percent (EVALNORM)

y_2 : Delivery percent (EVALNORM)

y_3 : Entry to Ship - Av Time (EVALNORM)

y_4 : Shipping Errors (EVALNORM)

y_5 : Info Handling Completion (EVALNORM)

x_1 : Stock-out percent (DIFNORM)

x_2 : Delivery percent (DIFNORM)

x_3 : Shipping Errors (DIFNORM)

x_4 : Damage (DIFNORM)

x_5 : Info. Handling Completion (DIFNORM)

Figure 14: Causal Model for the Test of Hypothesis 2.

The measurement equations follow the basic measurement model described in Chapter III. The endogenous variable (η) and the exogenous variable (ξ) have five observables each. In order to solve the problem of scale indeterminacy, the factor loadings of the first observables of η and ξ were fixed at 1.0. Since the set of observables of each construct had been selected after an analysis of unidimensionality, it was felt that it was acceptable to select any observable in a set for determining the metric of the underlying latent variable.

The results presented in Table 9 (page 183) indicate that there are more equations in the model (55) than unknowns to be estimated (21). Hence, the model meets a necessary condition for the identification of all of its parameters (Bagozzi, 1980).

The squared multiple correlations and the coefficients of determination computed by LISREL VI during the test of Hypothesis 2 are presented in Table 13. The squared multiple correlations of all the observables of the endogenous variables (y variables) are high. Their squared multiple correlations range from 0.643 to 0.860 and they have a total coefficient of determination of 0.947 which indicates a very high reliability. The reliabilities of the observables of the exogenous variable (x variables) are

TABLE 13

Squared Multiple Correlations and Coefficients of Determination (Hypothesis 2)

Variable/ Model	Squared Multiple Correlation	Total Coefficient of Determination
y_1	0.800[a]	-
y_2	0.837	-
y_3	0.643	-
y_4	0.651	-
y_5	0.860	-
Total Coefficient of Determination for y variables	-	0.947
x_1	0.655[a]	-
x_2	0.511	-
x_3	0.457	-
x_4	0.410	-
x_5	0.628	-
Total Coefficient of Determination for x variables	-	0.849
Total Coefficient of Determination for Structural Equation[b]	-	0.668

[a]Factor loading was fixed at the value of 1.0 to solve the problem of scale indeterminacy.

[b]The chi-square for the test of Hypothesis 2 with 34 degrees of freedom is 49.05 (prob. level = 0.046).

lower. Their squared multiple correlations range from 0.410 to 0.655 and they have a total coefficient of determination of 0.849.

Although the total coefficient of determination of the x variables is lower than that of the y variables, it is above 0.80 and can be considered to be acceptable. However, the squared multiple correlations of some particular x variables (especially x_4, x_3, and x_2 in that order) are low. This indicates that these indicators probably have relatively large error variances. The total coefficient of determination of the structural equation indicates that 66.8 percent of the variance of the endogenous variable (η) is explained by the structural equation.

The chi-square test of goodness-of-fit for testing Hypothesis 2 does not support the hypothesis. The value of chi-square with 34 degrees of freedom is 49.05. It has a probability level of 0.046 which is smaller than the minimum acceptable level (0.10) for supporting the hypothesis.

The goodness of fit index of 0.908 and the adjusted goodness of fit index of 0.851, however, indicate a good fit of the model to the data. The root mean square residual has a value of 0.534. In order to correct for the influence of variance size on the value of the root mean square residual, the causal model for the test of Hypothesis 2 was analyzed using a correlation matrix of the input data (instead of a covariance matrix). This step resulted in the estimation of a lower value (0.034) for the root mean square residual. The low value of the root mean square residual computed from the correlation matrix indicates that the average value of the residual variances and covariances is actually low and that the model fits the data quite well.

The largest modification index generated by LISREL analysis of the causal model for testing Hypothesis 2 is 4.10. Joreskog and Sorbom (1984) have recommended that only modification indices above five need be studied for the possibility of improving the fit of the model to the data by freeing a fixed parameter. The low value of the modification index indicates that relaxing no particular fixed parameter will lead a major improvement of the fit of the model to the data. In other words, the modification indices do not recommend that the model be respecified.

The parameter estimates generated by LISREL VI are presented in Table 14. All the freed parameter estimates have t-values which are larger than two, and hence are significant at a probability level of 0.05.

The structural coefficient (γ) is significant and has a positive value. This indicates that an increase in the value of the exogenous variable (Difference in Norms) will

TABLE 14

LISREL Parameter Estimates (Hypothesis 2)

	Unstandardized Parameter Estimate	T-value	Standardized Parameter Estimate
γ	1.137	7.564[b]	0.817
λ_{y1}	1.000[a]	0.000	3.184
λ_{y2}	1.737	13.639[b]	5.531
λ_{y3}	0.593	10.234[b]	1.887
λ_{y4}	1.271	10.361[b]	4.047
λ_{y5}	1.309	14.099[b]	4.169
λ_{x1}	1.000[a]	0.000[b]	2.290
λ_{x2}	1.673	7.127[b]	3.830
λ_{x3}	0.809	6.660[b]	1.852
λ_{x4}	0.890	6.245[b]	2.038
λ_{x5}	1.124	8.088[b]	2.574
$\theta_{\varepsilon 1}$	2.529	5.336[b]	-[c]
$\theta_{\varepsilon 2}$	5.960	4.940[b]	-[c]
$\theta_{\varepsilon 3}$	1.981	6.105[b]	-[c]
$\theta_{\varepsilon 4}$	8.787	6.082[b]	-[c]
$\theta_{\varepsilon 5}$	2.839	4.604[b]	-[c]

TABLE 14 (continued)

	Unstandardized Parameter Estimate	T-value	Standardized Parameter Estimate
$\theta_{\delta 1}$	2.757	5.051[b]	-[c]
$\theta_{\delta 2}$	14.017	5.805[b]	-[c]
$\theta_{\delta 3}$	4.072	5.984[b]	-[c]
$\theta_{\delta 4}$	5.965	6.111[b]	-[c]
$\theta_{\delta 5}$	3.919	5.237[b]	-[c]
ψ	3.368	4.105[b]	0.332
ϕ	5.242	4.459[b]	1.000

[a]Fixed factor loading.

[b]Significant t-value (p = 0.05).

[c]Not reported by LISREL VI.

be associated with an increase in the value of the endogenous variable (Evaluation against Norms).

The parameter estimates generated by LISREL VI were converted to their corresponding classical path estimates using the methods described in Chapter III. These classical path estimates are presented in Table 15.

A review of the standardized path estimates presented in Table 15 support the earlier conclusion that some of the indicators of the exogenous variable have large error variances. Although all the standardized measurement coefficients presented in Table 15 are larger than the corresponding standardized estimates of indicator error variances, it can be seen that some x variables (especially x_4, x_3, and x_2 in that order) have noticeably large error variances.

The normalized residuals computed by LISREL VI during the test of Hypothesis 2 indicate a good fit of the model to the data. No normalized residual value is larger than two (absolute) in size. The Q-plot of normalized residuals (Figure 19, page 375, Appendix U) has a slope of approximately 70 degrees to the horizontal axis. This is an indication of quite a good fit.

TABLE 15

Classical Path Estimates (Hypothesis 2)

	Unstandardized Estimates	Standardized Estimates
γ	1.221	0.817
λ_{y1}	0.169162	0.8945[a]
λ_{y2}	0.293829	0.9147[a]
λ_{y3}	0.100228	0.8016[a]
λ_{y4}	0.215004	0.8066[a]
λ_{y5}	0.221456	0.9271[a]
λ_{x1}	0.181761	0.8096[a]
λ_{x2}	0.304023	0.7151[a]
λ_{x3}	0.147049	0.6761[a]
λ_{x4}	0.161783	0.6407[a]
λ_{x5}	0.204336	0.7926[a]
$\theta_{\varepsilon 1}$	2.529	0.1998[b]
$\theta_{\varepsilon 2}$	5.960	0.1631[b]
$\theta_{\varepsilon 3}$	1.981	0.3573[b]
$\theta_{\varepsilon 4}$	8.787	0.3492[b]
$\theta_{\varepsilon 5}$	2.839	0.1403[b]

TABLE 15 (continued)

	Unstandardized Estimates	Standardized Estimates
$\theta_{\delta 1}$	2.757	0.3444[b]
$\theta_{\delta 2}$	14.017	0.4885[b]
$\theta_{\delta 3}$	4.072	0.5428[b]
$\theta_{\delta 4}$	5.965	0.5894
$\theta_{\delta 5}$	3.919	0.3716[b]
ψ	117.689	0.332
ϕ	158.669	1.000

[a]Computed as below:
Corrected Standardized Measurement Coefficient

$$= \frac{\text{LISREL Standardized Coefficient}}{\text{Corresponding observed score standard deviation}}$$

[b]Computed as below:
Corrected Standardized Error Estimate =
1 - (square of corresponding corrected standardized measurement coefficient)

The results of the test of Hypothesis 2 are mixed. The chi-square test of goodness-of-fit does not support Hypothesis 2. In spite of this finding, however, the goodness of fit index, the adjusted goodness of fit index, and the root mean square residual appear to support the hypothesis. The direction and the significance of the structural coefficient (γ) indicate that there is a significant positive relationship between supplier-customer differences in the perception of comparison levels (Difference in Norms) and departure from comparison levels (Evaluation against norms). Besides, the total coefficient of determination of the structural equation indicates that a large proportion of the variance of the endogenous variable is explained by the structural equation. The indicators of the endogenous variable (Evaluation against Norms) have a high level of reliability while the indicators of the exogenous variable (Difference in Norms) have only an acceptable level of reliability.

4.6.3 Statistical Test of Hypothesis 3.

Hypothesis 3 states that there is a significant relationship between supplier-customer differences in the perception of actual customer service levels (Difference in Actual) and departure from comparison levels (Evaluation against Norms). The direction of this relationship is hypothesized to be positive.

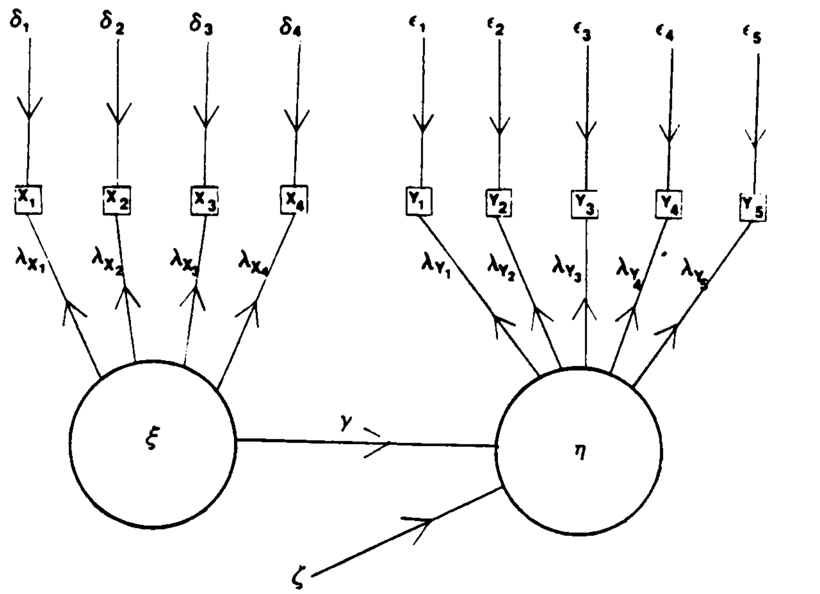
The causal model for testing Hypothesis 3 is presented in Figure 15. The following structural equation was developed for testing this hypothesis.

$$\eta = \gamma\xi + \zeta$$

The measurement equations follow the basic measurement model described in Chapter III. The endogenous variable (η) has five observables and the exogenous variable (ξ) has four observables. In order to solve the problem of scale indeterminacy, the factor loadings of the first observables of η and ξ were fixed at 1.0.

The results presented in Table 9 (page 183) indicate that there are more equations in the model (45) than unknowns to be estimated (19). Hence the model meets a necessary condition for the identification of all its parameters.

The squared multiple correlations and the coefficients of determination generated by LISREL VI during the test of Hypothesis 3 are presented in Table 16. The squared multiple correlations of all the observables of the endogenous variable (y variables) are high. The squared multiple correlations of the y variables range from 0.632 to 0.864. These estimates are very close to those obtained for the same latent variable and indicator set during the test of Hypothesis 2 (Table 13, page 202) and the differences



UNOBSERVABLE VARIABLES

η : Endogenous variable: Evaluation against Norms

ξ : Exogenous variable: Difference in Actual

OBSERVABLE VARIABLES (INDICATORS)

y_1 : Stock-out percent (EVALNORM)

y_2 : Delivery percent (EVALNORM)

y_3 : Entry to Ship - Av. Time (EVALNORM)

y_4 : Shipping Errors (EVALNORM)

y_5 : Info Handling Completion (EVALNORM)

x_1 : Stock-out percent (DIFACT)

x_2 : Delivery percent (DIFACT)

x_3 : Shipping Errors (DIFACT)

x_4 : Info. Handling Completion (DIFACT)

Figure 15: Causal Model for the Test of Hypothesis 3.

TABLE 16

Squared Multiple Correlations and Coefficients of Determination (Hypothesis 3)

Variable/ Model	Squared Multiple Correlation	Total Coefficient of Determination
y_1	0.795[a]	-
y_2	0.843	-
y_3	0.632	-
y_4	0.652	-
y_5	0.864	-
Total Coefficient of Determination for y variables	-	0.948
x_1	0.739[a]	-
x_2	0.527	-
x_3	0.546	-
x_4	0.668	-
Total Coefficient of Determination for x variables	-	0.870
Total Coefficient of Determination for Structural Equation[b]	-	0.591

[a]Factor loading was fixed at the value of 1.0 to solve the problem of scale indeterminacy.

[b]The chi-square for the test of Hypothesis 3 with 26 degrees of freedom is 57.81 (prob. level = 0.000).

between the estimates can be attributed to use of the full information method by LISREL for the estimation of model parameters. With a full information method, estimates of all the parameters in a model are computed simultaneously from the covariance (or correlation) matrix of observables. Thus the parameter estimates of the endogenous variable are influenced by the specification of the exogenous variable. The total coefficient of determination for the y variables is 0.947, which indicates a very high level of reliability.

The squared multiple correlations of the x variables range from 0.527 to 0.739. Two of the x variables (x_3 and x_4 in that order) appear to have a relatively larger amount of error. The total coefficient of determination of the x variables is 0.870 which can be considered to be an acceptable level. The total coefficient of determination of the structural equation indicates that 59.1 percent of the variance of the endogenous variable (η) is explained by the structural equation.

The chi-square test of goodness-of-fit for testing Hypothesis 3 does not support the hypothesis. The value of chi-square with 26 degrees of freedom is 57.81. It has a probability level of 0.000 which is below the minimum acceptable level for supporting the hypothesis.

The goodness of fit index of 0.887 and the adjusted goodness of fit index of 0.805 indicate a good fit of the model to the data. The root mean square residual has a value of 0.636. In order to correct for the influence of variance size on the value of the root mean square residual, the causal model for the test of Hypothesis 3 was analyzed using a correlation matrix of the input data (instead of a covariance matrix). This step resulted in the estimation of a lower value (0.041) for the root mean square residual. The low value of the root mean square residual computed from the correlation matrix indicates that the average value of the residual variances and covariances is actually very low and that the model fits the data well.

The largest modification index generated by LISREL analysis of the causal model for testing Hypothesis 3 is 4.46. Joreskog and Sorbom (1984) have recommended that only modification indices above five need be studied for the possibility of improving the fit of the model to the data by freeing a fixed parameter. The low value of the modification index indicates that relaxing no particular fixed parameter will lead a major improvement of the fit of the model to the data. In other words, as in the case of the causal models developed for the tests of Hypothesis 1 and Hypothesis 2, the modification indices do not recommend that the model for the test of Hypothesis 3 be respecified.

The parameter estimates obtained during the test of Hypothesis 3 are given in Table 17. It can be seen that all the freed parameters have t-values which are greater than two, and hence their estimates are significant at a probability level of 0.05. The structural coefficient (γ) is significant and has a negative value. This indicates that an increase in the value of the exogenous variable (Difference in Actual) will be associated with a decrease in the value of the endogenous variable (Evaluation against Norms).

The parameter estimates obtained during the test of Hypothesis 3 were converted into their corresponding classical path estimates using the methods described in Chapter III. The classical path estimates of the causal model for testing Hypothesis 3 are presented in Table 17.

It can be seen from Table 18 that the error variances of indicators x_3 and x_2 (in that order) are quite large. However, the standardized measurement coefficients of the indicators in the model are larger than the standardized estimates of their corresponding error variances.

The normalized residuals computed by LISREL VI during the test of Hypothesis 3 indicate a good fit of the model to the data. No normalized residual value is larger than two (absolute) in size. The Q-plot of normalized residuals

TABLE 17

LISREL Parameter Estimates (Hypothesis 3)

	Unstandardized Parameter Estimate	T-value	Standardized Parameter Estimate
γ	-1.148	-7.494[b]	-0.769
λ_{y1}	1.000[a]	0.000	3.173
λ_{y2}	1.749	13.627[b]	5.551
λ_{y3}	0.590	10.029[b]	1.872
λ_{y4}	1.276	10.319[b]	4.050
λ_{y5}	1.317	14.039[b]	4.179
λ_{x1}	1.000[a]	0.000[b]	2.126
λ_{x2}	1.651	7.731[b]	3.509
λ_{x3}	0.933	7.922[b]	1.984
λ_{x4}	1.369	9.123[b]	2.911
$\theta_{\varepsilon 1}$	2.600	5.378[b]	-[c]
$\theta_{\varepsilon 2}$	5.745	4.848[b]	-[c]
$\theta_{\varepsilon 3}$	2.037	6.130[b]	-[c]
$\theta_{\varepsilon 4}$	8.764	6.077[b]	-[c]
$\theta_{\varepsilon 5}$	2.757	4.518[b]	-[c]
$\theta_{\delta 1}$	1.592	4.364[b]	-[c]
$\theta_{\delta 2}$	11.031	5.800[b]	-[c]
$\theta_{\delta 3}$	3.268	5.726[b]	-[c]
$\theta_{\delta 4}$	4.202	5.033[b]	-[c]

TABLE 17 (continued)

	Unstandardized Parameter Estimate	T-value	Standardized Parameter Estimate
ψ	4.116	4.487[b]	0.409
ϕ	4.519	4.900[b]	1.000

[a]Fixed factor loading.

[b]Significant t-value (p = 0.05).

[c]Not reported by LISREL VI.

TABLE 18

Classical Path Estimates (Hypothesis 3)

	Unstandardized Estimates	Standardized Estimates
γ	-1.371	-0.769
λ_{y1}	0.168523	0.8914[a]
λ_{y2}	0.294779	0.9181[a]
λ_{y3}	0.099409	0.7952[a]
λ_{y4}	0.215096	0.8072[a]
λ_{y5}	0.221917	0.9293[a]
λ_{x1}	0.201360	0.8600[a]
λ_{x2}	0.332366	0.7262[a]
λ_{x3}	0.187947	0.7391[a]
λ_{x4}	0.275705	0.8176[a]
$\theta_{\varepsilon 1}$	2.600	0.2053[b]
$\theta_{\varepsilon 2}$	5.746	0.1570[b]
$\theta_{\varepsilon 3}$	2.037	0.3675[b]
$\theta_{\varepsilon 4}$	8.764	0.3483[b]
$\theta_{\varepsilon 5}$	2.757	0.1362[b]
θ_{δ_1}	1.592	0.2603[b]
θ_{δ_2}	11.032	0.4725[b]
$\theta_{\delta 3}$	3.268	0.4536[b]
$\theta_{\delta 4}$	4.202	0.3313[b]

TABLE 18 (continued)

	Unstandardized Estimates	Standardized Estimates
ψ	144.946	0.409
ϕ	111.455	1.000

[a]Computed as below:
Corrected Standardized Measurement Coefficient

$$= \frac{\text{LISREL Standardized Coefficient}}{\text{Corresponding observed score standard deviation}}$$

[b]Computed as below:
Corrected Standardized Error Estimate =
1 - (square of corresponding corrected standardized measurement coefficient)

(Figure 20, page 376, Appendix U) has a slope of approximately 66 degrees to the horizontal axis. This is an indication of good fit.

The results of the test of Hypothesis 3 are not conclusive. The chi-square test of goodness-of-fit does not support Hypothesis 3. However, the goodness of fit index, the adjusted goodness of fit index, and the root mean square residual appear to support the hypothesis. The direction of the structural coefficient (γ) and its significance indicates that there is a significant negative relationship between supplier-customer differences in the perception of actual customer service levels (Difference in Actual) and departure from comparison levels (Evaluation against Norms). The indicators of the endogenous variable have a high degree of reliability, while the indicators of the exogenous variable have a lower but acceptable level of reliability. The total coefficient of determination of the structural equation indicates that a large proportion of the variance of the exogenous variable is explained by the structural equation.

4.6.4 Statistical Test of Hypothesis 4.

Hypothesis 4 states that there is a significant relationship between supplier-customer differences in the perception of customer service levels (comparison levels and actual performance levels) and departure from comparison levels. In other words, Hypothesis 4 posits that the two constructs (a) supplier-customer differences in the perception of comparison levels (Difference in Norms) and (b) supplier-customer differences in the perception of the actual service levels (Difference in Actual) are both related to a third construct, departure from comparison levels (Evaluation against Norms). The relationship of Difference in Norms to Evaluation agains Norms is hypothesized to be positive. The relationship of Difference in Actual to Evaluation against Norms is hypothesized to be negative.

The causal model for testing Hypothesis 4 is presented in Figure 16. The following structural equation was developed for testing this hypothesis.

$$\eta = \gamma_{11}\xi_1 + \gamma_{12}\xi_2 + \zeta$$

The measurement equations follow the basic measurement model presented in Chapter III. The endogenous variable (η) has five observables. The first exogenous variable (ξ_1) has five observables, while the second (ξ_2) has only four observables. Since Difference in Norms (ξ_1) and Difference in Actual (ξ_2) are constructs which are conceptually similar to each other and since the two constructs deal with different aspects of the same customer service

Figure 16: Causal Model for the Test of Hypothesis 4.

UNOBSERVABLE VARIABLES

η : Endogenous variable: Evaluation against Norms
ξ_1 : Exogenous variable: Difference in Norms
ξ_2 : Exogenous variable: Difference in Actual

OBSERVABLE VARIABLES (INDICATORS)

y_1 : Stock-out percent (EVALNORM)
y_2 : Delivery percent (EVALNORM)
y_3 : Entry to Ship - Av. Time (EVALNORM)
y_4 : Shipping Errors (EVALNORM)
y_5 : Info Handling Completion (EVALNORM)
x_1 : Stock-out percent (DIFNORM)
x_2 : Delivery percent (DIFNORM)
x_3 : Shipping Errors (DIFNORM)
x_4 : Damage (DIFNORM)
x_5 : Info. Handling Completion (DIFNORM)
x_6 : Stock-out percent (DIFACT)
x_7 : Delivery percent (DIFACT)
x_8 : Shipping Errors (DIFACT)
x_9 : Info. Handling Completion (DIFACT)

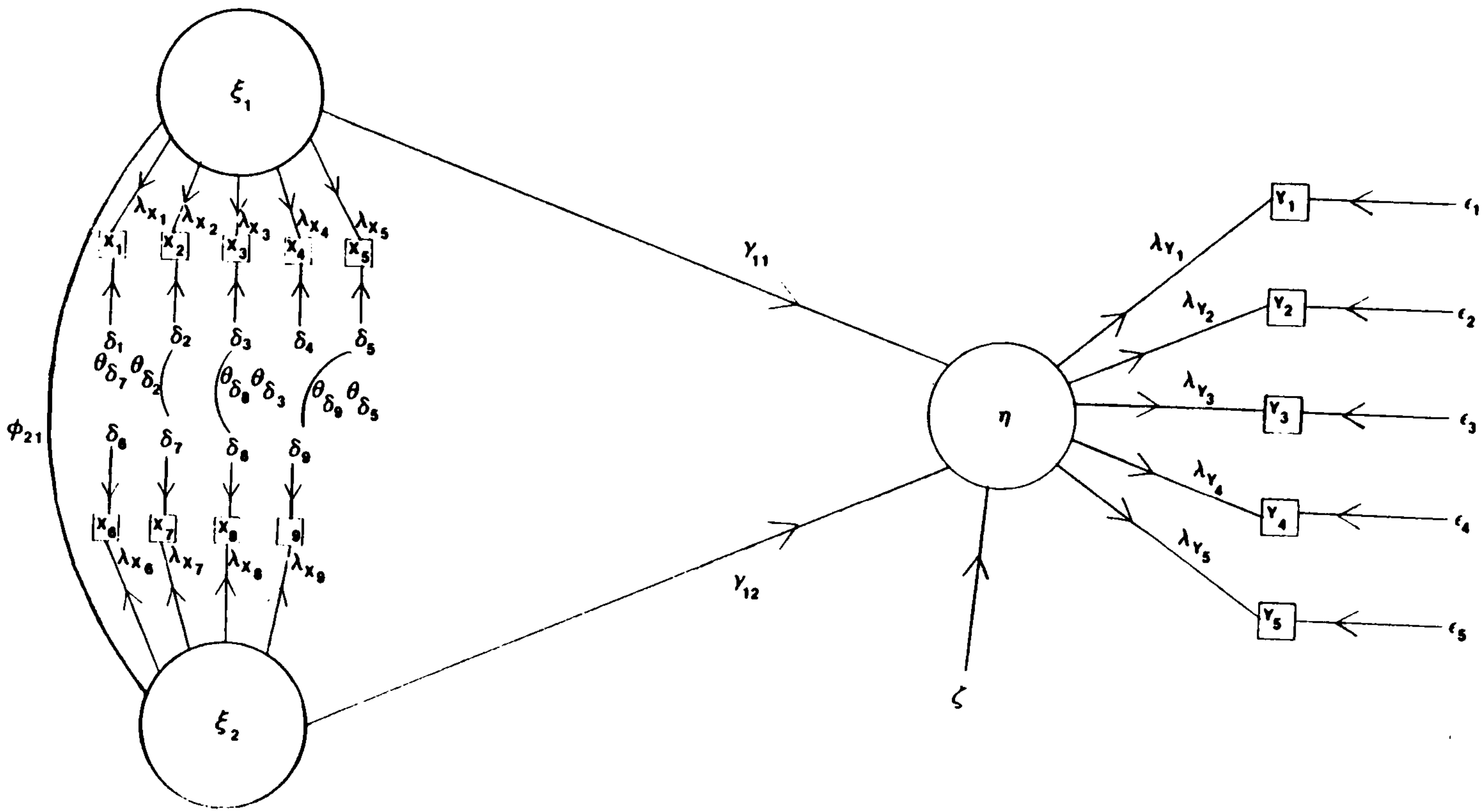


Figure 16 (continued)

relationships, they were allowed to covary. In order to solve the problem of scale indeterminacy, the factor loadings of the first observables of η, ξ_1, and ξ_2 were fixed at 1.0.

Unlike the earlier discussed hypotheses, correlated error terms between similar indicators of different constructs interfered in the test of Hypothesis 4. These correlated error terms seem to be the result of a measurement artifact which may be termed "questionnaire item-type variance." Difference in Norms (ξ_1) and Difference in Actual (ξ_2) are measured in a similar manner using similar questions. Besides, their values are computed differences between the responses of the same pairs of respondents. The nature of each questionnaire item can be expected to introduce some variance in the indicators. This variance can be expected to appear in the error variance associated with the indicator. If a pair of indicators of two constructs are very similar and if their values are measured from the same subject population, the parts of their error variances which are caused by the nature of the questionnaire item can be expected to be correlated.

Figure 16 indicates that four of the five indicators of Difference in Norms have corresponding indicators of the same type among the set of indicators which measure

Difference in Actual. These corresponding indicators can be expected to have correlated errors.

Whether or not correlated errors can be introduced into a causal model is a subject of debate. Correlated errors indicate that the measures of a construct are not perfectly unidimensional. Causal modeling analysis assumes that errors are uncorrelated. However, in actual practice it is difficult to avoid correlated errors completely. Bagozzi (1980) supports the inclusion of correlated errors across theoretical constructs on the argument that if a true model is actually described by such underlying correlations, then correlating error terms may be the only way to accurately represent the underlying causal process.

Kenny (1979) insists that ideally correlated error terms should be specified by theory and adds that just adding correlated errors to a model on the basis of estimated residuals without a priori theoretical justification makes the data analysis more exploratory than confirmatory.

During the test of Hypothesis 4 initially an effort was made to analyze using LISREL VI without correlating error terms. One of the resulting matrices, however, was not positive definite, and LISREL estimates could not be obtained. The model was then rerun freeing the covariances between the indicators in ξ_1 which had corresponding and similar indicators among the set of indicators of ξ_2. $\theta_{\delta 7}\theta_{\delta 2}$, $\theta_{\delta 8}\theta_{\delta 3}$, and $\theta_{\delta 9}\theta_{\delta 5}$ were found to increase the fit of the model. The errors of indicators x_6 and x_1 were not correlated in the model for the test of Hypothesis 1 because such a step did not improve the fit of the causal model. No effect was made to improve the fit of the model by freeing any other parameter.

The results presented in Table 9 (page 183) indicate that there are 105 equations in the causal model and only 34 unknowns. Hence, the model for testing Hypothesis 4 meets a necessary condition for the identification of all of its parameters.

The squared multiple correlations and the coefficients of determination generated by LISREL VI during the test of Hypothesis 4 are presented in Table 19. The squared multiple correlations of the observables of the endogenous variable (y variables) are high. Their squared multiple correlations range from 0.625 to 0.875. The total coefficient of determination of the y variables is 0.947, which indicates a very high level of reliability.

The squared multiple correlations of the x variables range from 0.373 to 0.718. Two of the x variables (x_4 and x_3 in that order) have relatively low reliability values.

TABLE 19

Squared Multiple Correlations and Coefficients of Determination (Hypothesis 4)

Variable/ Model	Squared Multiple Correlation	Total Coefficient of Determination
y_1	0.803[a]	-
y_2	0.821	-
y_3	0.625	-
y_4	0.656	-
y_5	0.875	-
Total Coefficient of Determination for y variables	-	0.947
x_1	0.652[a]	-
x_2	0.511	-
x_3	0.433	-
x_4	0.373	-
x_5	0.634	-
x_6	0.712[a]	-
x_7	0.540	-
x_8	0.539	-
x_9	0.688	-
Total Coefficient of Determination for x variables	-	0.978

Table 19 (continued)

Variable/ Model	Squared Multiple Correlation	Total Coefficient of Determination
Total Coefficient of Determination for Structural Equation[b]	-	0.919

[a]Factor loading was fixed at the value of 1.0 to solve the problem of scale indeterminacy.

[b]The chi-square for the test of Hypothesis 4 with 71 degrees of freedom is 173.26 (prob. level = 0.000).

These observables have a large amount of error in their values. The total coefficient of determination of the x variables is 0.978, which is a very high level of reliability. The total coefficient of determination of the structural equation indicates that 91.9 percent of the variance is the endogenous variable (η) is explained by the structural equation.

The chi-square test of goodness-of-fit for testing Hypothesis 4 does not support the hypothesis. The value of chi-square with 71 degrees of freedom is 173.26. It has a probability level of 0.000 which is below the minimum acceptable level for supporting the hypothesis.

The goodness of fit index of 0.811 and the adjusted goodness of fit index of 0.720 indicate a moderate to good fit of the model to the data. The root mean square residual has a value of 0.677. In order to correct for the influence of variance size on the value of the root mean square residual, the causal model for the test of Hypothesis 4 was analyzed using a correlation matrix of the input data (instead of a covariance matrix). This step resulted in the estimation of a lower value (0.051) for the root mean square residual. The relatively low value of the root mean square residual computed from the correlation matrix indicates that the average value of the residual variances and covariances is actually very low and that the model fits the data well.

The largest modification index generated by LISREL analysis of the causal model for testing Hypothesis 4 is 8.53. This value is associated with the indicator of Difference in Norms which measures the percentage of damage and the indicator of Difference in Actual which measures the stock-out level. Although the value of the largest modification index is greater than five, since no substantive reason could be found for correlating the indicators associated with this index, the corresponding fixed parameter was not freed in order to improve the fit of the model to the data. It was also noted that the largest modification index is not much larger than five and that the fit of the model to the data would not have increased very significantly even if the fixed parameter associated with the largest modification index was freed.

The parameter estimates obtained during the test of Hypothesis 4 are presented in Table 20. All the freed parameter values given in this table have t-values which are greater than two and are hence significant ($p = 0.05$). The two structural coefficients γ_{11} and γ_{12} are significant. The former has a positive value and the latter has a negative value. These directions are consistent with the directions hypothesized. The directions of the structural coefficients indicate that an increase in the value of ξ_1

TABLE 20

LISREL Parameter Estimates (Hypothesis 4)

	Unstandardized Parameter Estimates	T-value	Standardized Parameter Estimates
γ_{11}	0.863	7.482[b]	0.618
γ_{12}	-0.797	-7.035[b]	-0.521
λ_{y1}	1.000[a]	0.000	3.190
λ_{y2}	1.718	13.559[a]	5.480
λ_{y3}	0.583	10.079[b]	1.861
λ_{y4}	1.274	10.561[b]	4.064
λ_{y5}	1.319	14.749[b]	4.206
λ_{x1}	1.000[a]	0.000	2.284
λ_{x2}	1.652	7.657[b]	3.772
λ_{x3}	0.784	6.829[b]	1.791
λ_{x4}	0.850	5.920[b]	1.942
λ_{x5}	1.068	8.444[b]	2.439
λ_{x6}	1.000[a]	0.000	2.086
λ_{x7}	1.678	8.392[b]	3.500
λ_{x8}	0.935	8.216[b]	1.951
λ_{x9}	1.431	9.852[b]	2.986
$\theta_{\varepsilon 1}$	2.495	5.619[b]	-[c]
$\theta_{\varepsilon 2}$	6.526	5.476[b]	-[c]
$\theta_{\varepsilon 3}$	2.078	6.270[b]	-[c]
$\theta_{\varepsilon 4}$	8.653	6.205[b]	-[c]

TABLE 20 (continued)

	Unstandardized Parameter Estimates	T-value	Standardized Parameter Estimates
$\theta_{\varepsilon 5}$	2.525	4.818[b]	-[c]
$\theta_{\delta 1}$	2.783	5.150[b]	-[c]
$\theta_{\delta 2}$	14.035	5.896[b]	-[c]
$\theta_{\delta 3}$	4.258	6.105[b]	-[c]
$\theta_{\delta 4}$	6.348	6.225[b]	-[c]
$\theta_{\delta 5}$	3.856	5.460[b]	-[c]
$\theta_{\delta 6}$	1.760	4.824[b]	-[c]
$\theta_{\delta 7}$	10.7312	5.873[b]	-[c]
$\theta_{\delta 8}$	3.322	5.867[b]	-[c]
$\theta_{\delta 9}$	3.952	4.985[b]	-[c]
$\theta_{\delta 7}\theta_{\delta 2}$	7.209	4.291[b]	-[c]
$\theta_{\delta 8}\theta_{\delta 3}$	1.858	3.793[b]	-[c]
$\theta_{\delta 9}\theta_{\delta 5}$	2.497	4.160[b]	-[c]
ψ	0.824	2.681[b]	0.081
ϕ_{11}	5.217	4.457[b]	1.000
ϕ_{21}	-1.962	-3.010[b]	-0.412
ϕ_{22}	4.352	4.790[b]	1.000

[a]Fixed factor loading.

[b]Significant t-value (p = 0.05).

[c]Not reported by LISREL VI.

(Difference in Norms) and/or a decrease in the value of ξ_2 (Difference in Actual) will be associated in an increase in the value of η (Evaluation against Norms).

The parameter estimates obtained as the result of the test of Hypothesis 4 were converted into their corresponding classical counterparts. The classical path estimates of the causal model for testing Hypothesis 4 are presented in Table 21.

A review of Table 21 indicates that the standardized value of the structural coefficient connecting Difference in Norms and Evaluation against Norms (γ_{11}) is larger in magnitude than that of the structural coefficient connecting Difference in Actual and Evaluation against Norms. This finding is consistent with the a priori expectations of the researcher (described in Chapter III). However, the values of the two structural coefficients differ from each other only to a relatively moderate extent.

A review of Table 21 indicates that error variances of some indicators(especially x_4, x_3, and x_2 in that order) are quite large. The indicator x_4 has a standardized error estimate which is larger than the standardized estimate of its factor loading. All the other indicators in the model, however, have standardized estimates of error variances which are smaller than the standardized estimates of their factor loadings.

TABLE 21

Classical Path Estimates (Hypothesis 4)

	Unstandardized Estimates	Standardized Estimates
γ_{11}	0.952	0.622
γ_{12}	-0.926	-0.518
λ_{y1}	0.169489	0.8961[a]
λ_{y2}	0.291173	0.9063[a]
λ_{y3}	0.098878	0.7905[a]
λ_{y4}	0.215936	0.8100[a]
λ_{y5}	0.223505	0.9353[a]
λ_{x1}	0.181624	0.7898[a]
λ_{x2}	0.304365	0.6988[a]
λ_{x3}	0.143256	0.6432[a]
λ_{x4}	0.154410	0.5970[a]
λ_{x5}	0.205662	0.7788[a]
λ_{x6}	0.197292	0.8414[a]
λ_{x7}	0.335897	0.7329[a]
λ_{x8}	0.186379	0.7320[a]
λ_{x9}	0.279333	0.8269[a]
$\theta_{\varepsilon 1}$	2.501	0.1968[b]
$\theta_{\varepsilon 2}$	6.541	0.1785[b]
$\theta_{\varepsilon 3}$	2.076	0.3749[b]
$\theta_{\varepsilon 4}$	8.659	0.3437[b]
$\theta_{\varepsilon 5}$	2.511	0.1250[b]

TABLE 21 (continued)

	Unstandardized Estimates	Standardized Estimates
$\theta_{\delta 1}$	2.846	0.3760[b]
$\theta_{\delta 2}$	14.168	0.5115[b]
$\theta_{\delta 3}$	4.275	0.5862[b]
$\theta_{\delta 4}$	6.363	0.6435[b]
$\theta_{\delta 5}$	3.746	0.3934[b]
$\theta_{\delta 6}$	1.756	0.2920[b]
$\theta_{\delta 7}$	10.659	0.4628[b]
$\theta_{\delta 8}$	3.303	0.4640[b]
$\theta_{\delta 9}$	3.987	0.3161[b]
$\theta_{\delta 7}\theta_{\delta 2}$	7.226	-[c]
$\theta_{\delta 8}\theta_{\delta 3}$	1.853	-[c]
$\theta_{\delta 9}\theta_{\delta 5}$	2.452	-[c]
ψ	28.377	0.080
ϕ_{11}	151.245	1.000
ϕ_{21}	-52.991	-0.409
ϕ_{22}	111.105	1.000

[a]Computed as below:
Corrected Standardized Measurement Coefficient

$$= \frac{\text{LISREL Standardized Coefficient}}{\text{Corresponding observed score standard deviation}}$$

[b]Computed as below:
Corrected Standardized Error Estimate =
1 - (square of corresponding corrected standardized measurement coefficient)

[c]Cannot be calculated from any particular indicator measurement coefficient.

The normalized residuals computed by LISREL VI during the test of Hypothesis 4 indicate a good fit of the model to the data. No normalized residual value is larger than two (absolute) in size. The Q-plot of normalized residuals (Figure 21, page 376, Appendix U) has a slope of approximately 65.5 degrees to the horizontal axis. This is an indication of a moderately good fit.

The results of the test of Hypothesis 4 are not conclusive. Some test statistics support the hypothesis while others do not. The chi-square test of goodness of fit does not support Hypothesis 4. However, other indicators of goodness of fit such as the goodness of fit index, the adjusted goodness of fit index, and the root mean square residual support Hypothesis 4 at least to a moderate extent. The directions of the structural coefficients and their significance support the hypothesis. The indicators of the endogenous variable have a high degree of reliability. Some individual indicators of the exogenous variables have large error variances, but together, the indicators of the exogenous variables have a high level of reliability. The total coefficient of determination of the structural equation indicates that a very large proportion (91.9 percent) of the variance of the endogenous variable is explained by the structural equation. The normalized residuals and the Q-plot of normalized residuals indicate that there is a good fit between the model and the data.

4.6.5 Estimation of the Complete Model.

The theoretical structure proposed in Chapter I (Figure 3, page 10) was tested in this research by separate tests of four research hypotheses. A separate causal model was developed for the test of each hypothesis. Each causal model, however, analyzed only a portion of the entire theoretical structure. The analysis of the complete theoretical structure required the development of a different causal model. Such a causal model has been presented in Figure 17.

The following structural equations were developed for analyzing the complete model presented in Figure 17.

$$\eta_1 = \gamma_{11}\xi_1 + \gamma_{12}\xi_2 + \zeta_1$$

$$\eta_2 = \beta_{21}\eta_1 + \zeta_2$$

$$\eta_3 = \beta_{31}\eta_1 + \zeta_3$$

$$\eta_4 = \beta_{41}\eta_1 + \zeta_4$$

$$\eta_5 = \beta_{51}\eta_1 + \zeta_5$$

The measurement model follows the basic measurement model presented in Chapter III.

An initial effort was made to test the model presented in Figure 17 by following the usual procedure of fixing the factor loading of an indicator of each latent variable at

Figure 17: Causal Model for the Analysis of the Complete Model.

<u>UNOBSERVABLE VARIABLES</u>

η_1 : Evaluation against Norms

η_2 : Market Response : Eval. of Purchase Experience

η_3 : Market Response : Purchase Trend

η_4 : Market Response : Purchase Volume

η_5 : Market Response : Manufacturer's Share

ξ_1 : Difference in Norms

ξ_2 : Difference in Actual

<u>OBSERVABLE VARIABLES</u> (INDICATORS)

y_1 : Stock-out percent (EVALNORM)

y_2 : Delivery percent (EVALNORM)

y_3 : Entry to Ship - Av. Time (EVALNORM)

y_4 : Shipping Errors (EVALNORM)

y_5 : Info Handling Completion (EVALNORM)

y_6 : Satisfaction

y_7 : Preference

y_8 : C. S. Evaluation

y_9 : Past Trend

y_{10} : Future Trend

y_{11} : Purchase Volume

y_{12} : Manufacturer's Share

x_1 : Stock-out percent (DIFNORM)

x_2 : Delivery percent (DIFNORM)

x_3 : Shipping Errors (DIFNORM)

x_4 : Damage (DIFNORM)

x_5 : Info. Handling Completion (DIFNORM)

x_6 : Stock-out percent (DIFACT)

x_7 : Delivery percent (DIFACT)

x_8 : Shipping Errors (DIFACT)

x_9 : Info. Handling Completion (DIFACT)

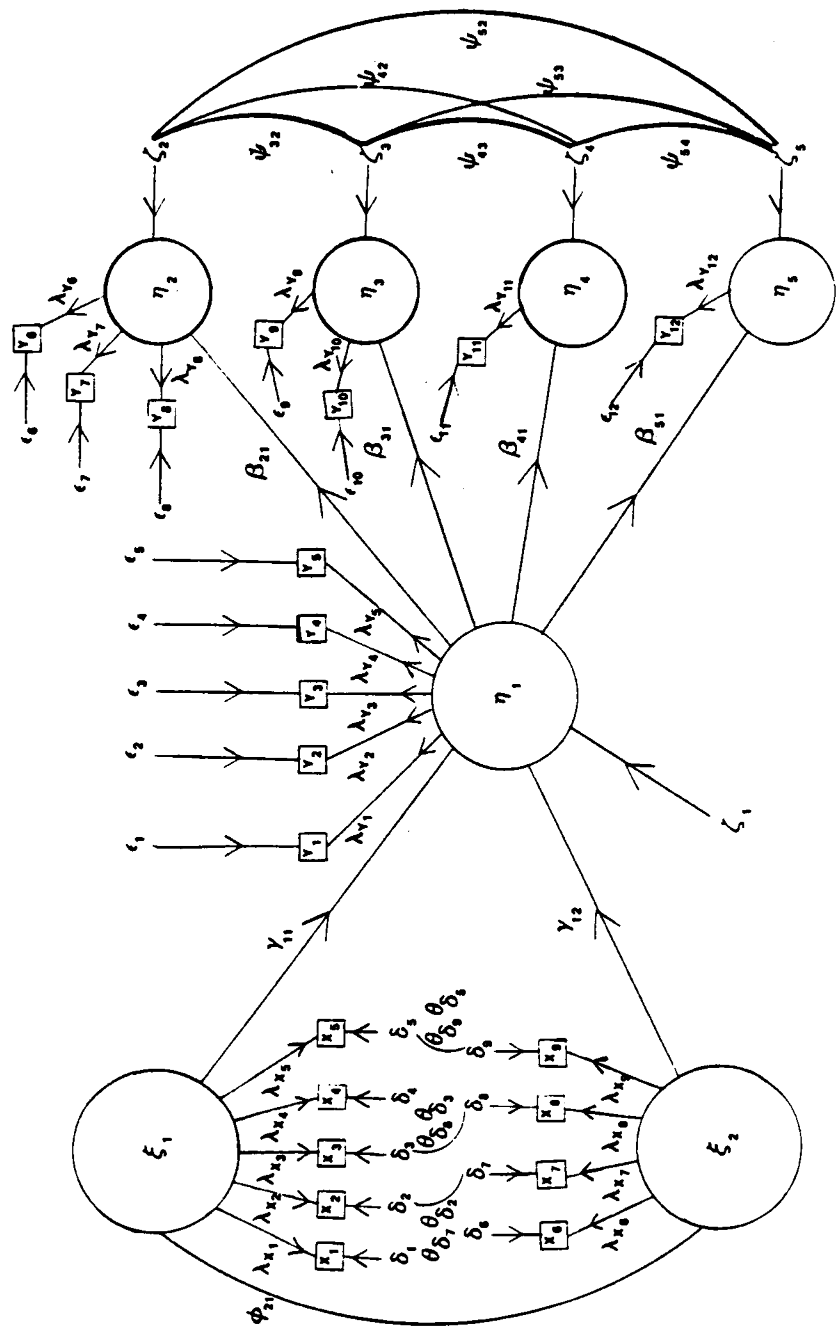


Figure 17 (continued)

1.0. However, such a procedure did not yield a positive definite matrix--a requirement for testing a causal model using the method of maximum likelihood.

In order to run the complete model, the factor loadings of all its indicators were fixed at the values of their unstandardized classical path estimates. The unstandardized estimates presented in Table 12 were used for fixing the factor loadings of the indicators of Market Response and Evaluation against Norms. The unstandardized estimates obtained from Tables 15 (page 208) and 18 (page 219) were used to fix the factor loadings of the indicators of Difference in Norms and Difference in Actual respectively. The factor loadings of the indicator λ_{y11} (Purchase Volume) and the indicator λ_{y12} (Manufacturer's Share) were fixed at 1.0. Their error variances ($\theta_{\varepsilon_{11}}$ and $\theta_{\varepsilon_{12}}$) were fixed at 20 percent of their observable variance as was done during the test of Hypothesis 1. The errors of three pairs of indicators: (λ_{x7} and λ_{x2}), (λ_{x8} and λ_{x3}), and (λ_{x9} and λ_{x5}) were correlated as was done during the test of Hypothesis 4.

The resulting model was also checked to find out whether it meets a necessary condition for the identification of all its parameter. It was found that the causal model presented in Figure 17 has more equations in it (231) than parameters to be estimated. Hence, it meets the necessary condition for identification.

The squared multiple correlations and coefficients of determination obtained by analysis using LISREL VI are presented in Table 22.

The total coefficients of determination are very high. The y variables have a total coefficient of determination of 0.999, while the x variable have a total coefficient of determination of 0.978. The structural equation explains 92.5 percent of the variance in the endogenous variable.

The parameter estimates obtained by LISREL analysis are presented in Table 23. All the estimates have significant t-values. Since the values of the fixed indicator factor loadings had been obtained from the same data set as that used for this analysis, the chi-square goodness-of-fit statistic was neglected. All the normalized residuals (except for one) were found to have a magnitude smaller than two. The Q-plot of normalized residuals presented in Figure 22 (page 377, Appendix U) indicates a somewhat better than moderate fit (56 degrees to the horizontal axis).

The LISREL estimates obtained by the analysis of the complete model were converted to their classical counterparts and are presented in Table 24.

The standardized LISREL estimates in Table 24 indicate that most of the measurement model parameter values are very close to those obtained during the tests of the research

TABLE 22

Squared Multiple Correlations and Coefficients of Determination (Analysis of Complete Model)

Variable/ Model	Squared Multiple Correlation	Total Coefficient of Determination
y_1	0.803	-
y_2	0.821	-
y_3	0.622	-
y_4	0.660	-
y_5	0.868	-
y_6	0.791	-
y_7	0.819	-
y_8	0.741	-
y_9	0.696	-
y_{10}	0.719	-
y_{11}	0.800[a]	-
y_{12}	0.800[a]	-
Total Coefficient of Determination of y variables	-	0.999
x_1	0.654	-
x_2	0.514	-
x_3	0.428	-
x_4	0.371	-

TABLE 22 (continued)

Variable/ Model	Squared Multiple Correlation	Total Coefficient of Determination
x_5	0.633	-
x_6	0.712	-
x_7	0.541	-
x_8	0.691	-
Total Coefficient of Determination of x variables	-	0.978
η_1	0.925	-
η_2	0.681	-
η_3	0.529	-
η_4	0.227	-
η_5	0.242	-
Total Coefficient of Determination for Structural Equation	-	0.925

[a]Factor loading was fixed at the value of 1.0 to solve the problem of scale indeterminacy and the error variance was fixed at 20 percent of the total variance of the observable.

TABLE 23

LISREL Parameter Estimates (Analysis of Complete Model)

	Unstandardized Parameter Estimate	T-value	Standardized Parameter Estimate
β_{21}	0.144	11.488[c]	0.825
β_{31}	0.132	8.051[c]	0.727
β_{41}	4.236	4.356[c]	0.476
β_{51}	0.588	4.434[c]	0.492
γ_{11}	0.918	10.604[c]	0.600
γ_{12}	-0.974	-9.849[c]	-0.546
λ_{y1}	0.168369[a]	0.000	3.168
λ_{y2}	0.295299[a]	0.000	5.556
λ_{y3}	0.099836[a]	0.000	1.878
λ_{y4}	0.215647[a]	0.000	4.058
λ_{y5}	0.221032[a]	0.000	4.159
λ_{y6}	0.260651[a]	0.000	0.859
λ_{y7}	0.564106[a]	0.000	1.858
λ_{y8}	0.176777[a]	0.000	5.582
λ_{y9}	0.541652[a]	0.000	1.857
λ_{y10}	0.458324[a]	0.000	1.571
λ_{y11}	1.000[a]	0.000	167.334
λ_{y12}	1.000[a]	0.000	22.475

TABLE 23 (continued)

	Unstandardized Parameter Estimate	T-value	Standardized Parameter Estimate
λ_{x1}	0.181624[a]	0.000	2.235
λ_{x2}	0.304365[a]	0.000	3.746
λ_{x3}	0.143256[a]	0.000	1.763
λ_{x4}	0.154410[a]	0.000	1.900
λ_{x5}	0.205662[a]	0.000	2.531
λ_{x6}	0.197292[a]	0.000	2.080
λ_{x7}	0.335897[a]	0.000	3.542
λ_{x8}	0.186379[a]	0.000	1.965
λ_{x9}	0.279333[a]	0.000	2.946
θ_{ε_1}	2.490	5.734[c]	-[e]
θ_{ε_2}	6.552	5.565[c]	-[e]
θ_{ε_3}	2.094	6.306[c]	-[e]
θ_{ε_4}	8.549	6.248[c]	-[e]
θ_{ε_5}	2.668	5.125[c]	-[e]
θ_{ε_6}	0.195	5.324[c]	-[e]
θ_{ε_7}	0.766	5.026[c]	-[e]

TABLE 23 (continued)

	Unstandardized Parameter Estimate	T-value	Standardized Parameter Estimate
θ_{ε_8}	0.118	5.671[c]	-[e]
θ_{ε_9}	1.506	4.846[c]	-[e]
$\theta_{\varepsilon_{10}}$	0.964	4.580[c]	-[e]
$\theta_{\varepsilon_{11}}$	7000.128[b]	0.000	-[e]
$\theta_{\varepsilon_{12}}$	126.285[b]	0.000	-[e]
θ_{δ_1}	2.768	5.348[c]	-[e]
θ_{δ_2}	13.953	5.959[c]	-[e]
θ_{δ_3}	4.291	6.173[c]	-[e]
θ_{δ_4}	6.369	6.291[c]	-[e]
θ_{δ_5}	3.870	5.455[c]	-[e]
θ_{δ_6}	1.763	5.050[c]	-[e]
θ_{δ_7}	10.718	5.927[c]	-[e]
θ_{δ_8}	3.309	5.930[c]	-[e]
θ_{δ_9}	3.916	5.183[c]	-[e]
$\theta_{\delta_7}\theta_{\delta_2}$	7.200	4.297[c]	-[e]
$\theta_{\delta_8}\theta_{\delta_3}$	1.865	3.803[c]	-[e]
$\theta_{\delta_9}\theta_{\delta_5}$	2.442	4.087[c]	-[e]

TABLE 23 (continued)

	Unstandardized Parameter Estimate	T-value	Standardized Parameter Estimate
ψ_{11}	26.685	2.711[c]	0.075
ψ_{22}	3.465	4.862[c]	0.319
ψ_{32}	3.588	4.648[c]	0.318
ψ_{42}	118.517	2.877[c]	0.215
ψ_{52}	20.804	3.658[c]	0.281
ψ_{33}	5.536	4.340[c]	0.471
ψ_{43}	72.470	1.393[d]	0.126
ψ_{53}	10.787	1.551[d]	0.140
ψ_{44}	21646.765	5.025[c]	0.773
ψ_{54}	1169.121	2.748[c]	0.311
ψ_{55}	382.739	4.997[c]	0.758
ϕ_{11}	151.452	5.767[c]	1.000
ϕ_{21}	-52.771	-3.220[c]	-0.407
ϕ_{22}	111.195	5.930[c]	1.000

[a]Fixed factor loading.

[b]Fixed indicator error variance.

[c]Significant t-value ($p = 0.05$).

[d]Non-significant t-value ($p = 0.05$).

[e]Not reported by LISREL VI.

TABLE 24

Classical Path Estimates (Total Model)

	Unstandardized Estimates	Standardized Estimates
β_{21}	0.144	0.825
β_{31}	0.132	0.727
β_{41}	4.236	0.476
β_{51}	0.588	0.492
γ_{11}	0.918	0.600
γ_{12}	-0.974	-0.546
λ_{y1}	0.168369	0.890[a]
λ_{y2}	0.295299	0.919[a]
λ_{y3}	0.099836	0.798[a]
λ_{y4}	0.215647	0.809[a]
λ_{y5}	0.221032	0.925[a]
λ_{y6}	0.260651	0.888[a]
λ_{y7}	0.564106	0.904[a]
λ_{y8}	0.176777	0.861[a]
λ_{y9}	0.541652	0.834[a]
λ_{y10}	0.458324	0.848[a]
λ_{y11}	1.0	0.894[a]
λ_{y12}	1.0	0.894[a]

TABLE 24 (continued)

	Unstandardized Estimates	Standardized Estimates
λ_{x1}	0.181624	0.790[a]
λ_{x2}	0.304365	0.699[a]
λ_{x3}	0.143256	0.644[a]
λ_{x4}	0.154410	0.597[a]
λ_{x5}	0.205662	0.779[a]
λ_{x6}	0.197292	0.841[a]
λ_{x7}	0.335897	0.733[a]
λ_{x8}	0.186379	0.732[a]
λ_{x9}	0.279333	0.828[a]
$\theta_{\varepsilon 1}$	2.490	0.207[b]
$\theta_{\varepsilon 2}$	6.552	0.155[b]
$\theta_{\varepsilon 3}$	2.094	0.363[b]
$\theta_{\varepsilon 4}$	8.549	0.346[b]
$\theta_{\varepsilon 5}$	2.668	0.144[b]
$\theta_{\varepsilon 6}$	0.195	0.211[b]
$\theta_{\varepsilon 7}$	0.766	0.183[b]
$\theta_{\varepsilon 8}$	0.118	0.254[b]
$\theta_{\varepsilon 9}$	1.506	0.304[b]
$\theta_{\varepsilon 10}$	0.964	0.280[b]
$\theta_{\varepsilon 11}$	7000.128	0.200[b]
$\theta_{\varepsilon 12}$	126.285	0.200[b]

TABLE 24 (continued)

	Unstandardized Estimates	Standardized Estimates
$\theta_{\delta 1}$	2.768	0.059[b]
$\theta_{\delta 2}$	13.953	0.511[b]
$\theta_{\delta 3}$	4.291	0.585[b]
$\theta_{\delta 4}$	6.369	0.643[b]
$\theta_{\delta 5}$	3.870	0.393[b]
$\theta_{\delta 6}$	1.763	0.082[b]
$\theta_{\delta 7}$	10.718	0.462[b]
$\theta_{\delta 8}$	3.309	0.464[b]
$\theta_{\delta 9}$	3.916	0.314[b]
$\theta_{\delta 7}\theta_{\delta 2}$	7.200	-[c]
$\theta_{\delta 8}\theta_{\delta 3}$	1.865	-[c]
$\theta_{\delta 9}\theta_{\delta 5}$	2.442	-[c]
ψ_{12}	26.685	0.075
ψ_{22}	3.465	0.319
ψ_{32}	3.588	0.318
ψ_{42}	118.517	0.215
ψ_{52}	20.804	0.281
ψ_{33}	5.536	0.471
ψ_{43}	72.470	0.126
ψ_{53}	10.787	0.140
ψ_{44}	21646.765	0.773

TABLE 24 (continued)

	Unstandardized Estimates	Standardized Estimates
ψ_{54}	1169.121	0.311
ψ_{55}	382.739	0.758
ϕ_{11}	151.452	1.000
ϕ_{21}	-52.771	-0.407
ϕ_{22}	111.195	1.000

[a]Computed as below:
Corrected Standardized Measurement Coefficient:

$$= \frac{\text{LISREL Standardized Coefficient}}{\text{Corresponding observed score standard deviation}}$$

[b]Computed as below:
Corrected Standardized Error Estimate =
1 - (square of corresponding corrected standardized measurement coefficient)

[c]Cannot be calculated from any particular indicator measurement coefficient.

hypotheses. The structural coefficients presented in Table 24 are very close to the estimates obtained during the test of each hypothesis. This finding indicates that the entire theoretical structure presented in Chapter I (Figure 3, page 10) holds together. In other words, the data collected as a part of this research supports the proposed theoretical structure at least to a moderate extent.

4.7 ANALYSIS OF THE INFLUENCE OF SELECTED VARIABLES ON THE PROPOSED THEORETICAL STRUCTURE

The empirical association between selected variables and the constructs and relationships posited in the theoretical structure of this research was analyzed. Some of the selected variables were obtained directly from the responses of grocery manufacturers and grocery wholesalers.

The following variables were obtained directly from the responses of the manufacturers.

VAR1. Whether the wholesaler's perception of the industry's typical level of performance in meeting wholesaler delivery dates is higher, lower, or equal to the manufacturer's own perception of the same variable (Appendix A, Q-15 and Q-15A).

<u>VAR2</u>. Whether the wholesaler's perception of the industry's typical <u>length of time from order entry to shipment</u> is shorter than, longer than, or equal to the manufacturer's own perception of the same variable (Appendix A, Q-16 and Q-16A).

<u>VAR3</u>. Number of competitors competing with the manufacturer in the sales of the identified product group (Appendix A, Q-17).

<u>VAR4</u>. How the prices of the manufacturer compare with the prices of competitors (Appendix A, Q-18).

<u>VAR5</u>. Approximate wholesale price of one case of the highest volume product in the identified product group (Appendix A, Q-19).

<u>VAR6</u>. Whether or not the manufacturer has a customer service department (Appendix A, Q-20).

<u>VAR7</u>. Organizational level at which service level targets are established.

<u>VAR8</u>. Number of distribution centers in the distribution system of the manufacturer (Appendix A, Q-23).

<u>VAR9</u>. Size of manufacturer based on annual dollar sales of grocery products (Appendix A, Q-24).

The following variables were obtained from the responses of wholesalers.

VAR10. Length of purchasing relationship with the manufacturer (Appendix B, Q-13).

VAR11. Intensity of competition between manufacturers of the identified product group (Appendix B, Q-15).

VAR12. How the prices of the manufacturer compare with the prices of other manufacturers of the same product group (Appendix B, Q-16).

VAR13. How many day's inventory of the manufacturer's product does the wholesaler usually carry (Appendix B, Q-18).

In addition to the above variables, some variables were computed from the gathered responses. Some of the computed variables are described below.

VAR14. The total number of service decisions (printed in the questionnaires) which, according to the manufacturer, have been implemented (Appendix A, Q-25).

VAR15. The total number of implemented service decisions, which, according to the manufacturer, have improved customer service (Appendix A, Q-25).

VAR16. The total number of service decisions (printed in the questionnaires) which, according to the wholesaler, have improved customer service (Appendix B, Q-30).

VAR17. The total number of implemented service decisions, which, according to the wholesaler, have improved customer service (Appendix B, Q-30).

VAR18. The total number of service decisions (Appendix A, Q-25; Appendix B, Q-30) which elicit identical responses from the manufacturer and from the wholesaler in the same unit of analysis when the respondents are asked whether or not the decisions have been implemented.

VAR19. The total number of service decisions which are perceived by both the manufacturer and wholesaler as implemented, and which elicit identical responses when the manufacturer and the wholesaler in a dyad are asked whether implementation has improved customer service.

The relationships between the above list of variables and the research constructs were tested using two-way chi square tests (p = 0.05). The results of the tests are presented in Table 25.

The results presented in Table 25 indicate that the only variables which are significantly related strongly to the research constructs are VAR16, VAR18, and VAR19.

TABLE 25

Chi-square Tests of Selected Variables against the Constructs in the Theoretical Structure: Probability Levels

	Market Response	Evaluation against Norms	Difference in Norms	Difference in Actual
VAR1	0.1073	0.1073	0.0764	0.0909
VAR2	0.4533	0.6103	0.1468	0.8655
VAR3	0.1684	0.4438	0.7836	0.3427
VAR4	0.9165	0.9165	0.5934	0.2431
VAR5	0.8427	0.5242	0.2023	0.1884
VAR6	0.1445	0.0534	0.1445	0.3712
VAR7[a]	0.2035	0.2189	0.2035	0.2035
VAR8	0.3933	0.2914	0.3933	0.3933
VAR9	0.9036	0.9036	0.9036	0.9036
VAR10	0.1937	0.8846	0.7949	0.4355
VAR11	0.2875	0.3792	0.5234	0.8315
VAR12	0.1139	0.3377	0.9545	0.2833
VAR13	0.9227	0.4568	0.7463	0.3481
VAR14	0.7540	0.3448	0.0159[c]	0.4637
VAR15	0.7599	0.9078	0.1676	0.4672
VAR16	0.0039[c]	0.0005[c]	0.0009[c]	0.0039[c]
VAR17[b]	-	-	-	-
VAR18	0.0001[c]	0.0001[c]	0.0001[c]	0.0001[c]
VAR19	0.0001[c]	0.0001[c]	0.0001[c]	0.0010[c]

[a]VAR7 has three nominal categories and not two as is the case of all the other variables.

[b]VAR17 cannot be usefully categorized into "High" and "Low" values because 98.9 percent of its observations have the same value.

[c]Significant (p = 0.05).

The significance of VAR18 and VAR19 indicate that identical perceptions regarding the implementation of customer service decisions are related to market response. A review of the number of observations in each cell in the cross tabulation indicate that identical perceptions are related positively to Market Response, Evaluation against Norms, and Difference in Norms. It is related negatively with Difference in Actual.

VAR 18 and VAR19 are inverse measures of supplier-customer differences in the perception of actual implemented customer service decisions. Although these variables are not measuring "levels" of customer service, their negative relationship with Difference in Actual may be considered to be an indication of the convergent validity of the indicators used in this research to measure supplier customer differences in the perception of actual (levels of) customer service.

4.8 SUMMARY

In this chapter, the results of data analysis and the findings of this study were presented. Although the focus of this chapter was on the tests of the research hypotheses, a considerable portion of this chapter was also devoted to response analysis, to the analysis of indicators for the development of unidimensional, reliable, and valid measures, and to the analysis of the empirical association of selected variables with the constructs and relationships in the proposed theoretical structure.

Before the tests of the research hypotheses using LISREL VI, an effort was made to purify the measures of the constructs in the proposed theoretical model. As the result of data analysis, the reclustering of indicator sets, and the dropping of poor indicators, a set of indicators was selected for each construct and dimension. These indicator sets formed measures with a high degree of unidimensionality and reliability.

These measures were also found to have a high level of content validity. A rigorous test of convergent and discriminant validity could not be carried out. However, the measures appeared to possess at least a moderate level of convergent and discriminant validity.

The analysis of the data for the creation of unidimensional measures led to the reclustering of the indicators of Market Response into four dimensions. The causal model developed for testing the link between Evaluation against Norms, and the dimensions of Market Response (Hypothesis 1) was supported by all the test statistics generated. However, the analysis of the links between Difference in Norms and Evaluation against Norms

(Hypotheses 2 and 4), and the link between Difference in Actual and Evaluation against Norms (Hypotheses 3 and 4) did not produce conclusive results. While the tests of Hypotheses 2, 3, and 4 produced significant structural parameter estimates which were found to have the hypothesized direction of relationship, the causal models developed for these hypotheses were not supported by the chi-square tests of goodness-of-fit.

The tests of the research hypotheses and the LISREL analysis of the complete theoretical model can be said to have given partial support to the theoretical structure presented in Figure 3 (page 10).

Congruence between the manufacturer and the wholesaler in the perception of implemented customer service decisions was found to have a strong relationship with the constructs and relationships in the proposed theoretical structure. The total number of such implemented decisions noticed by the wholesaler was also found to have an empirical relationship with the constructs and relationships in the theoretical structure.

The implications of the results discussed in this chapter and directions for future research are discussed in Chapter V.

CHAPTER V

IMPLICATIONS AND RECOMMENDATIONS

The background of this research, its objectives, the proposed model and theoretical structure to be tested, the research methodology, and the results of the analysis have been discussed in the preceding chapters. The implications which can be drawn from the preceding chapters and the recommendations for practitioners and researchers are discussed in this chapter.

5.1 IMPLICATIONS

The implications which can be drawn from the results of this research are discussed in this section.

5.1.1 Implications of the Tests of the Research Hypotheses.

5.1.1.1 Hypothesis 1.

Hypothesis 1 states that there is a significant relationship between departure from comparison levels (Evaluation against Norms) and market response. This relationship is hypothesized to be positive in direction. Evaluation against norms is calculated by subtracting the customer's perception of the industry's typical level of customer service from the customer's perception of the supplier's actual level of customer service.

The results of the test of Hypothesis 1 indicate that Market Response is related to Evaluation against Norms in the direction hypothesized. This conclusion is supported by the computed test statistics. The results of the test of Hypothesis 1 imply that the differences between a customer's perception of the actual customer service levels offered by a supplier and the same customer's perception of the typical levels of service provided by that industry may explain the customer's response to the supplier's customer service package to a large extent. Knowledge about the above differences may also be used to predict future responses of the customer.

The results of the test of Hypothesis 1 support the theory of psychological congruity which was discussed in Chapter II. The results are also consistent with the Exchange Theory of Thibaut and Kelley (1959) and the Adaptation-Level Theory (Helson, 1964). Although the results of the analysis of models based on the above theories have been published in other disciplines, no published literature is available in the area of logistics on any effort that might have been made to empirically study the applicability of these theories to physical distribution systems.

The most important theoretical contribution of this dissertation is that it analyzes the applicability of the theory of psychological congruity, the Exchange Theory and the Adaptation-Level Theory in the context of physical distribution systems. The findings resulting from the test of Hypothesis 1 indicate that the above theories are relevant to physical distribution. The results of the test of Hypothesis 1 encourage the study of the behavioral aspects of logistical systems.

Since the model developed for the test of Hypothesis 1 is supported by the collected data, it can be concluded that the data also supports the a priori conceptualization of the industry's typical level of service as the norm, comparison level, or the evoked frame of reference used by grocery wholesalers while evaluating the customer service offerings of their suppliers. However, this finding does not necessarily indicate that the industry's typical level of service is the <u>only</u> comparison level used by grocery wholesalers. Different wholesalers may use different comparison levels. Besides, the same wholesaler may use more than one type of comparison level while evaluating a particular supplier.

The theory of psychological congruity and related theories usually treat comparison levels or evoked frames of reference as anchors against which percepts (currently perceived levels) are compared and evaluated. It should be noted that these anchors need not be rigid. They will change over time with the accumulation of more experience. Since percepts themselves are a part of the perceiving individual's experience, percepts tend to influence their own comparison levels over time.

Some respondents may even be adjusting their comparison levels unknowingly in order to make the difference between the actual service level and the comparison level more consistent with the respondent's prior evaluation of the supplier. The extent to which the use of the industry's typical level of service as the comparison level is supported by the data may be partly the result of the tendency of wholesaler respondents to adjust their comparison levels as well as the actual service levels received from their suppliers in this manner.

The results of the test of Hypothesis 1 indicate that all the dimensions of Market Response are not related to Evaluation agains Norms to the same extent.

Dimension 1 (Evaluation of Purchase Experience) seems to have the closest relationship with Evaluation against Norms and is followed by Dimension 2 (Purchase Trend). Dimension 1 measures Market Response using measures of attitude and satisfaction. Among the indicators of Market Response used in this research, the measures of Dimension 1 are the most distant from actual dollar purchases. Dimension 2 measures Market Response using an indicator of past purchase history and an indicator of future purchase plans. The indicators of Dimension 2 are somewhat closer to actual purchases than are the indicators of Dimension 1.

Dimension 3 (Purchase Volume) is measured by an indicator of actual dollar purchases from the manufacturer. Dimension 4 (Manufacturer's Share) is measured by an indicator which is slightly removed, yet very close to actual dollar purchases. Among the dimensions of Market Response, Dimension 3 has the weakest link with Evaluation against Norms and is followed by Dimension 4.

The results of the relationship between Evaluation against Norms and the dimensions of Market Response imply that Evaluation against Norms can explain a greater proportion of the variance in the psychological responses of the customer than of the variance in the customer's actual purchases (in cases or other store units) from the supplier. The actual purchases of a customer from a supplier are probably the result of several factors, many of which are not included in the theoretical model proposed in this dissertation.

The conclusions and ideas resulting from the test of Hypothesis 1 are not totally new to logistics practitioners. The findings support a belief which is already popular with practitioners, i.e. that if customers evaluate a supplier above others in the industry, this evaluation will be translated into favorable customer responses such as higher purchase volumes from that supplier (ceteris paribus).

5.1.1.2 Hypothesis 2.

Although the results of the test of Hypothesis 2 are not very conclusive, they indicate that Difference in Norms and Evaluation against Norms are related, at least to a moderate extent and that this relationship is in the positive direction. This implies that, in general, if the supplier has higher norms and if the customer has lower norms, the supplier will be evaluated favorably by the customer.

In a particular dyad, if a supplier has very high norms, and if the customer has very low norms, it will result in large positive values of the computed differences (if computed as in this research). According to Hypothesis 2, this will lead ultimately to a favorable (positive) response by the customer. In other words, Hypothesis 2 implies that it is the combination of <u>absolute differences</u> between supplier and customer perceptions of norms and the direction of these differences which influences Evaluation against Norms and Market Response. Large positive values of Difference in Norms can lead to large positive values of Market Response if Difference in Norms is calculated by subtracting customer perceptions from supplier perceptions as was done in this research.

The significant structural parameter obtained as the result of the test of Hypothesis 2 indicates that supplier-customer differences do not necessarily lead to unfavorable market response. If the customer's perceptions are subtracted from the manufacturer's perceptions in order to calculate Difference in Norms, then larger differences will seem to lead to more favorable market response. The conclusion, of course, will be the exact opposite of this if supplier perceptions are subtracted from customer perceptions for the computation of Difference in Norms.

The findings of the test of Hypothesis 2 indicate that the assumption[9] that the customer service issues upon which suppliers and customers differ most are the 'problem' issues is correct only if the direction of difference is clearly stated.

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[9]Levy (1978, 1981b) has made such an assumption in his research. However, Levy's assumption was regarding supplier-customer differences in the perception of the relative importance of various customer service issues. The supplier-customer differences studied in this dissertation are differences in the perception of service 'levels.'

One of the implications of the results of the test of Hypothesis 2 is that if a supplier perceives the industry's typical level of customer service to be high, it is likely to be translated into actions which will ultimately lead to a favorable response from the customer. This influence is mediated by the customer's perception of the industry's typical levels of customer service. Since the customer's perception of the industry's typical level of customer service is an important factor in the relationship between the supplier's norms and market response, it is advisable for suppliers to monitor the levels of customer service which their customers perceive as the typical levels in the industry. This monitoring task may be carried out through a practice of frequent customer service evaluation or audit.

During the process of customer service evaluation or audit, the usual practice is to collect the opinions of the customer regarding the customer service package of the supplier and often also regarding the packages of competitors. Very often these perceptions of the customer are collected using ordinal scales similar to the Likert scale or to the semantic differential scale. If the supplier is to understand the full meaning of such responses correctly, it is necessary for the supplier and the customer to have identical anchors and frames of reference for understanding the meaning of each response. Since suppliers and their customers rarely have such identical anchors and frames of reference, much information is usually lost or is incorrectly perceived and understood.

Responses collected using such ordinal scales have another weakness. Such responses cannot be used to calculate supplier-customer differences in perception. In order to obtain more accurate and usable information, it is advisable for suppliers to measure customer perceptions of at least some of the elements of customer service using ratio scales which measure customer service in actual units which are used by logistics managers for recording customer service performance. A sample of such items can be obtained from the measuring instruments used for data collection during this research. Responses of this nature may be collected through a mail or telephone survey or even through informal interaction with customers.

5.1.1.3 Hypothesis 3.

The results of the test of Hypothesis 3 are not very conclusive. The chi-square goodness-of-fit test do not support the model developed for testing Hypothesis 3. However, the direction of the structural parameter which describes the relationship between Difference in Actual and Evaluation against Norms is negative as hypothesized.

The results of the test of Hypothesis 3 indicate, at least to a moderate extent, that Difference in Actual and Evaluation against Norms are related and that this relationship is in the negative direction. Difference in Actual can also be said to be related indirectly to Market Response, and this relationship too has a negative direction.

The results of the test of Hypothesis 3 indicate that supplier-customer differences in the perception of actual customer service levels lead to unfavorable customer responses. This finding supports an assumption made by researchers such as Levy (1978, 1981b) that supplier-customer differences in the perception of customer-service variables may indicate customer service problems and areas of customer service which need to be given more attention.

The data gathered as a part of this research indicated that, in general, manufacturers' (suppliers') perceptions of actual service levels offered were higher than their wholesalers' (customers') perception of the same customer service levels. Supplier-customer differences in perception typically were the result of lower customer perceptions. As in the case of Hypothesis 2, the direction of the structural parameter was dependent upon the method used for computing the values of Difference in Actual.

One of the implications of the test of Hypothesis 3 is that if the customer's perception of the supplier's customer service levels is far below the supplier's perception of the same level, the situation is likely to be translated into poor evaluations of the supplier's service by the customer, which in turn is likely to lead to poor or unfavorable purchase responses by the customer. In order to avoid such a situation, it is advisable for the supplier to monitor the customer's perceptions of the actual customer service level. Such a practice may help the supplier to decide when and how to improve the perceptions of the customer.

The customer's perception of the supplier's actual service levels may be raised by either improving the customer service package itself or by adapting a suitable method of communicating the high quality of the existing customer service package. A prerequisite of the latter strategy is that a good customer service package be already in effect.

5.1.1.4 Hypothesis 4 and the Analysis of the Complete Model.

The results of the test of Hypothesis 4 essentially confirm the findings of Hypotheses 2 and 3. It indicated, in spite of some correlated errors, that the separate structural relationships(as indicated by the values of the structural parameters) described by Hypotheses 2 and 3 hold true even when they are brought together.

The contribution of the analysis of the complete model is essentially the same. It indicates that all the separate structural relationships in the proposed theoretical structure hold true even when they are brought together in one causal model.

Some of the findings and implications of the analysis of the complete model and the tests of the four research hypotheses have been summarized below:

1. Supplier-customer differences in the perception of customer service are related to market response. While researchers in the field of logistics have assumed this relationship (Levy, 1978, 1981b), no empirical support for this assumption has been published in logistics and marketing literature.
2. Measures of supplier-customer differences the perception of customer service can be placed in separate groups on the basis of the defined level of customer service to which the measures apply. For instance, some measures may be grouped together as measures of the industry's typical levels of customer service. Others may be grouped together as measures of a supplier's current customer service levels.

3. The direction of the relationship between supplier-customer differences in the perception of customer service and market response is dependent upon the predefined level of customer service to which the perceptions of customer service apply and the manner in which the supplier-customer differences are computed. If the supplier-customer differences are measured by subtracting the customer's perceptions from the supplier's perceptions (assuming that higher values represent higher levels of customer service), then the resulting difference values obtained from measures of the industry's typical level of service will be positively related to market response. The difference values obtained from the customer's actual level of service will be negatively related to market response.
4. The relationship between supplier-customer differences in perception and market response is mediated by the customer's mental process of comparing the perceived actual service level against the perceived typical level of the industry.

5. While the above relationships are strong enough to have been supported by the structural parameters in the causal model, most of the relationships are not strong enough to be supported by the chi-square statistics computed by LISREL. The only relationship to be supported by the chi-square statistic is the relationship between the mediating or intervening variable (the customer's mental comparison) and the dependent variable (market response). This relationship was stated in Hypothesis 1.

5.1.2 Implications of the Analysis of the Influence of Selected Variables on the Proposed Theoretical Structure.

The analysis of the influence of selected variables on the proposed theoretical structure did not lead to the identification of any variable outside the proposed model which had a significant relationship with any of the research constructs and which had a clear interaction with the hypothesized relationships. The only variables studied which were significantly related to the research constructs and which interacted with the hypothesized relationships were measures of customer perception of the supplier's customer service package and measures of supplier-customer similarity (or differences) in the perception of the same the supplier's service package.

The results of this analysis support the generalizability of the relationships in the proposed model. The relationships and constructs in the theoretical structure appear to be relatively unaffected by situational variables. However, it is also possible that the apparent absence of relationship with any of the selected variables is the result of the heterogeneity in the sample of dyads used in the analysis. For instance, the relationship between number of distribution centers and market response might be different for different grocery product types and the relationships may cancel each other in a heterogenous sample.

One interesting finding is that the manufacturer's opinion regarding the relative level of wholesaler's perception of the industry's typical level vis-a-vis the manufacturer's own perception of the same, is not significantly related to any of the constructs in the theoretical structure tested in this dissertation. This finding is not consistent with the prior rationale (presented in Chapter I) that the supplier uses what he or she perceives as the customer's comparison level as a benchmark or guideline while providing a customer service package to the customer. An alternative explanation for this finding is that the manufacturers' opinions were primarily guesses and thus contained enough error to blanket any existing relationship.

5.1.3 Methodological Implications.

One of the contributions of this research is in the measurement of supplier-customer differences in the perception of physical distribution customer service using supplier-customer pairs (or dyads) as units of analysis. Such a procedure retains more information than a procedure which involves the computation of differences between aggregated groups of suppliers and customers. Aggregation before the computation of differences can bury a considerable amount of useful information. For example, within each dyad there may be differences between the supplier and the customer in what they believe is the industry's typical stock-out level. However, the average of the values perceived by all the suppliers in a sample might be almost identical to the average of the values perceived by all the customers taken together. The two averages may lead to the wrong conclusion that suppliers and customers do not differ in their perceptions of the industry's typical stock-out level. The use of dyadic data in this research may encourage more research of a dyadic nature in the field of logistics.

Another unique contribution of this research is in the measurement of supplier-customer differences in the perception of customer service using actual units of measurement which are used by distribution managers. Such a measurement methodology can provide researchers with ratio scaled data regarding the elements of customer service. In addition to this, such a measurement procedure may be more relevant to the business world and more acceptable to practitioners. The measurement procedure used by the researcher, and the hurdles faced by researcher may be useful to future researchers who propose to adopt similar measurement methods.

The results of the analysis of the indicators to ensure their unidimensionality and a high level of reliability indicated that measures of customer service which elicit responses in percentages are relatively more unidimensional and reliable than measures which elicit responses in time units. As was discussed in Chapter IV, this may be the result of the tendency of respondents to provide answers which fall into a relatively discrete distribution whenever they are asked to respond to a question in time units (e.g., one day, two days, etc.). Responses in percentages tend to form a more continuous distribution.

The relatively high levels of reliability, unidimensionality, and validity of the measures which were developed by empirical analysis and selection indicate that quite good measures can be developed for the constructs in the theoretical structure of this research. This is a particularly important finding because two of the research constructs--Difference in Norms and Difference in Actual--are inter-personal and inter-organizational in nature.

5.2 RECOMMENDATIONS

5.2.1 Recommendations for Practitioners.

On the basis of the findings and implications of this research, the following recommendations can be made to practitioners in the area of physical distribution customer service.

1. Even if a company provides a high level of customer service, customers may not observe and recognize this fact. It is very important that practitioners pay special attention to the communication of the qualities of their customer service packages to their customers.

   The data collected during this study indicates that there is a communication gap between grocery manufacturers and their wholesalers. While the manufacturers in 46.5 percent of the 91 dyads used in the analysis indicated that they have a written statement of their customer service policy, the wholesalers in only 17.6 percent of the dyads knew about this. Similarly, while the manufacturers in 39.6 percent of the dyads indicated that they followed the practice of giving a copy of their service policy statement to their wholesaler, the wholesalers in only 12.1 percent of the dyads knew about this practice.

2. It is very important for a supplier to monitor customer perceptions of the supplier's service levels. Low perceptions of the customer may lead to unfavorable market response. Monitoring of customer service perceptions through periodic customer service audits and customer service evaluation can help the supplier to decide what corrective actions to take, when to take them, and with which particular customer.

3. Supplier perceptions of the typical level of customer service in the industry, and customer perceptions of the same level may influence the success of a customer service strategy. A supplier

should frequently try to find out the levels of customer service which customers seem to perceive to be the typical levels in their industry. This may be done through periodic customer service evaluation, maybe by following a policy of conducting an annual customer service audit. The supplier should compare the levels measured by the above procedure with the supplier's own judgement of the industry's typical levels of service. The supplier should also frequently evaluate the supplier's own perceptions of the industry's typical levels of service.

5.2.2 Limitations of the Research.

This study has the following limitations:

1. Due to its focus on only one industry (in order to increase internal validity), the generalizability of its results (external validity) to other industries cannot be assumed.
2. The quality of the data collected hinges upon the quality and the suitability of the key informants. Wrong and unsuitable informants may have added a considerable amount of "noise" to the data.
3. In order to develop a suitable interval or ratio measure of the construct labeled supplier-customer

differences in perception, it was necessary to measure supplier perceptions and customer perceptions using ratio scales. Hence, some customer service elements (e.g. Post Sale Technical Advice) which cannot be measured using ratio scales had to be excluded from the measures of customer service.

4. Only elements of customer service which can be perceived and identified by the supplier as well as by the customer were included in the measures of customer service. Elements which cannot be perceived by a customer (e.g. Forecasting Data Base) had to be excluded from the measures of customer service.
5. The measurement of supplier perceptions and the measurement of customer perceptions were separated by a period of a few months due to the requirements of the research design. The dynamic customer service relationship between the supplier and the customer may have undergone some changes during this period. This may have increased the measurement error.
6. In order to make the measures of the different constructs unidimensional, and in order to improve

their reliabilities, several customer service items were dropped from the analysis. While the above procedure has improved measure reliability, convergent validity, and discriminant validity, it may have adversely affected the content validity of the measures of customer service used in this research.

7. The selection of potential respondents may have biased the results of this research. Responding manufacturers may have had a tendency to identify only relatively satisfied customers and those customers with whom they have good relationships. It is also possible that only those supplier-customer pairs which have good customer service relationships continue to exist for a relatively long period of time. Thus supplier-customer pairs who participated in this study may not adequately represent a cross-section of all the successful and unsuccessful supplier-customer pairs in the grocery industry.

8. The measures of the independent variables (Difference in Norms and Difference in Actual) and the measures of the intervening variable (Evaluation against Norms) are dependent on each

other due the manner in which their values were computed. The customer's perception of the industry's typical level is used for the computation of Difference in Norms as well as in the computation of Evaluation against Norms. Similarly the customer's perception of the actual level of customer service is used for the computation of Difference in Actual as well as the computation of Evaluation against Norms. This dependence between the values of the independent variables and the values of the intervening variable may have inflated the values of the structural coefficients between the independent and intervening variables.

9. The covariance matrix which was used as the input matrix during the tests of the research hypotheses was created from data from which outliers had been excluded. The outliers were excluded partly because of the extreme sensitivity of variances and covariances to outliers and partly because outliers are very likely to be the result of contaminants in the data. However, it is also likely that some of the excluded outliers are 'valid' or 'good' observations and that their exclusion has actually

resulted in a loss of information and in biasing the results of the analysis.[10]

5.2.3 Directions for Research.

Some directions for future research are discussed in this section. The first three research ideas can be pursued using the data which has already been collected as a part of this research. These research ideas will be pursued soon after the completion of this dissertation. The remaining may be pursued by the researcher later.

5.2.3.1 Research based on the Collected Data.

The data gathered for this dissertation will be used to pursue the following research ideas:

1. The primary purpose of the research methodology developed for this research was to analyze and to test the theoretical structure presented in Figure 3 (page 10). This methodology is too esoteric to be useful to most practitioners. An effort will be made to use the data collected for this research and some of the findings of this research to

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[10]The causal models developed for the tests of the research hypotheses were also analyzed using a covariance matrix created from data from which outliers had not been excluded. The use of such an input matrix was found to reduce the fit of the model to the data. Although the goodness of fit indicators indicated poorer fit, almost all the structural and measurement parameters in the causal models retained their direction and significance.

develop a procedure which can be used by practitioners for improving the effectiveness of their customer service strategies. This procedure may use a more popular technique such as regression and focus more on the predictive validity of the model developed rather than its ability to test theoretical structures.

2. The model proposed in Figure 2 (page 9) and the theoretical structure presented in Figure 3 (page 10) will be modified and tested. The modifications of the model will be grounded in theory and on the findings of this research. One such research idea is that of studying and analyzing the possibility of a causal relationship between the four dimensions of market response identified during this research.

3. During the data collection phase of this research, it was observed that grocery manufacturers often had a tendency to indicate that they were providing the same levels of customer service to all the wholesalers whom they identified. The researcher proposes to study the extent to which the wholesalers identified by such manufacturers differ from one another in their perceptions of the manufacturer's customer service levels.

5.2.3.2 Directions for Future Research.

1. This research was conducted in one industry and on one link in its channel of distribution. The methodology of this research may be replicated in a different industry to determine whether the proposed model is applicable across industries. Such replications may also be conducted in other market situations different from the situation in which this research was conducted. For instance, this research may be replicated in an industry at its introductory or growth stage, unlike the grocery industry which is at its maturity stage.

2. One of the weaknesses of this research is that the method used for selecting wholesalers may be causing the sample and the results to be biased. Since, unsuccessful manufacturer-wholesaler pairs tend to break up soon, and since manufacturers may have more information about their service relationships with wholesalers with whom they have been working for some time, it is very likely that all the wholesalers identified by the manufacturers belong to successful or at least partially successful dyads. In order to avoid this bias, in future research, the researcher may select

manufacturers and wholesalers at the same time. Pairs of manufacturers and wholesalers can then be matched after determining whether they have a business relationship with each other or have had one in the past.

3. In this research only one type of comparison level or norm was measured to test the modeled relationship. However, some researchers have indicated that customers may use more than one kind of norm for comparison purposes. Woodruff, Cadotte, and Jenkins (1983) have proposed three kinds of norms--the best brand norm, the product norm, and the brand norm. Miller (1977) has identified four kinds of norms or comparison standards. They are the ideal, the expected, the minimum tolerable, and the deserved. The above norms have been defined and have been discussed in greater detail in Chapter II. The applicability of the above norms may be studied making use of a methodology similar to that used in this research.

4. In this research, during the selection of indicators for analysis on the basis of their unidimensionality, reliability, and validity, several indicators had to be dropped. An effort

should be made to find out the exact reason for the poor performance of certain indicators. The insight gained by this method should be used for the development of better indicators for the measurement the latent variables conceptualized in this research. These indicators may be used in future research of a similar nature.

5. One of the weaknesses of the measuring instrument used in this research is the absence of two different methods for the measurement of the research constructs. One of the problems encountered in the development of such an alternative measurement method is the requirement that the alternative method be capable of collecting data on an interval or ratio scale. However, most rating scales give only ordinal data. It may be possible to use a technique such as magnitude scaling to obtain data which has many of the strengths of interval data and even ratio scaled data. There is an ongoing debate on whether magnitude scaling actually provides ratio scaled data (Lodge, 1982; Neibecker, 1984). The most popular contention is that magnitude scaling provides at least log-interval data (Neibecker,

1984). The reliability and validity of magnitude scaling have also been tested successfully (Neibecker, 1984).

The application of magnitude scaling to data collection in the field of logistics is a promising direction for future research. If magnitude scaling is used as an alternative measurement method in addition to the kinds of measures used in this research, it will be possible to analyze the convergent and discriminant validities of the constructs in the theoretical structure presented in this dissertation. It will also be possible to collect interval scaled data regarding more elements of customer service. Besides, the inclusion of magnitude scales in a questionnaire can make an otherwise uninteresting questionnaire more interesting to the respondent.

6. In this research, only one respondent each was contacted from the supplier organization and the customer organization of each supplier-customer pair. Since many purchases are made by buying centers which include more than one individual, and since physical distribution decisions are often made by more than one individual in an

organization, it may be useful to collect data from more than one individual from the supplier organization as well as from the buying organization.

7. A longitudinal study of supplier--customer differences in the perception of customer service may provide some insights into the dynamic nature of the customer service relationship. In addition to the measurement of supplier-customer differences in perception, during this longitudinal study, variables which have the potential of influencing supplier and customer perceptions and other relevant variables should also be studied. Such a study may help in explaining the reasons for changes in the customer service relationship over time.

8. Instead of finding out the differences between the customer service levels perceived by the supplier and by the customer (as was done in this dissertation) an effort may be made to chart the supplier's perceived response curve to customer service variables and also a similar curve perceived by the customer. The methodology used for this purpose may be similar to that used by

Gilmour (1979), who made use of the judgements of respondents regarding the expected response to different levels of customer service.

9. The concepts and the methodology of this research may also be applied to other settings with appropriate modifications. For instance, the basic model upon which this research is based may be applied to settings such as international relations, labor relations, and household relations. The data collection methodology, however, will have to be modified to a very great extent to match the characteristics of these settings.

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APPENDIXES

APPENDIX A

MANUFACTURER QUESTIONNAIRE

CUSTOMER SERVICE PERCEPTIONS OF MANUFACTURERS IN THE GROCERY INDUSTRY

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We would like to know your perceptions of the distribution service levels which you have been providing to one or more of your grocery wholesalers (whom you may choose). Please use approximate estimates if you are unable to recollect the exact figures requested.

Your responses will be kept STRICTLY CONFIDENTIAL. However, identification of the wholesaler is necessary in order to match your answers with those of the wholesaler for the purpose of determining supplier-customer differences in perception. We hope to collect responses from several such matched pairs. Your responses will be analyzed only in combination with several such pairs.

In the page which follows this, you will be requested to identify the primary product group (e.g. Dairy products, Meat, Canned food, etc.) which you have been supplying to each of the selected wholesalers. The primary product group should account for most of your sales to that particular wholesaler.

We would like you to give your own estimates of the typical levels of service provided by suppliers of the primary product group. These estimates should be placed under the title YOUR INDUSTRY'S TYPICAL LEVEL.

We would also like you to give your own estimates of the actual levels of service which you have been providing to each of the selected wholesalers. These estimates should be placed under the title YOUR COMPANY'S ACTUAL LEVEL.

Please note that the ACTUAL LEVEL stands for your actual performance, and not for the performance targets which you might have set for your organization. The actual performance may not meet these targets, or it may exceed them.

	WHOLESALER #1
Name of grocery wholesaling company....................	______________
Address...	______________ ______________ ______________ ______________
Telephone #...	______________
The primary product group supplied to this wholesaler...	______________ ______________
If possible, please identify an individual in the wholesaling company who is most likely to be aware of the service levels offered by competing manufacturers	______________ ______________ ______________

PRODUCT AVAILABILITY	YOUR INDUSTRY'S TYPICAL LEVEL	YOUR COMPANY'S ACTUAL LEVEL
Q-1 What percent of total cases (or cartons, bags, etc.) ordered encounter delayed shipment due to product stock-out?......................................	______ %	______ %
Q-2 What percent of total number of orders received are shipped complete?...........................	______ %	______ %
Q-3 What percent of total cases (or cartons, bags, etc.) ordered are shipped to meet wholesaler's delivery date?..	______ %	______ %

WHOLESALER #2	WHOLESALER #3	WHOLESALER #4
____________	____________	____________
____________	____________	____________
____________	____________	____________
____________	____________	____________
____________	____________	____________
____________	____________	____________
____________	____________	____________
____________	____________	____________
____________	____________	____________
____________	____________	____________

You may find that your answers to some questions are repetitious, i.e. they are identical to answers given earlier under another wholesaler #. If you wish, you may respond to such items using the form "same as #____."

YOUR INDUSTRY'S TYPICAL LEVEL	YOUR COMPANY'S ACTUAL LEVEL	YOUR INDUSTRY'S TYPICAL LEVEL	YOUR COMPANY'S ACTUAL LEVEL	YOUR INDUSTRY'S TYPICAL LEVEL	YOUR COMPANY'S ACTUAL LEVEL
_____ %	_____ %	_____ %	_____ %	_____ %	_____ %
_____ %	_____ %	_____ %	_____ %	_____ %	_____ %
_____ %	_____ %	_____ %	_____ %	_____ %	_____ %

	WHOLESALER #1	
	YOUR INDUSTRY'S TYPICAL LEVEL	YOUR COMPANY'S ACTUAL LEVEL
ORDER CYCLE TIME		
Q-4 ORDER ENTRY TO SHIPMENT		
4A Average Time: What is the average length of time from the moment an order is RECEIVED by the manufacturer to the time it is SHIPPED to the wholesaler? .. (If shipped on the same day, write '0' days; If shipped on the next day, write '1' day, and so on)	_____ days	_____ days
Consistency: How much variation or "swing" is experienced around the above average time?		
4B Low (Length of time from order entry to shipment when order cycle time is short)	_____ days	_____ days
4C High (Length of time from order entry to shipment when order cycle time is long)	_____ days	_____ days
Q-5 Who makes the carrier selection decision for most of your shipments to this wholesaler? .... (Please circle the number of your answer)	1 YOUR COMPANY 2 THE WHOLESALER 3 OTHER: Please specify _____________	
Q-6 What is the mode of shipment which your company uses most often to deliver goods to this wholesaler? .... (Circle number of your answer)	1 RAIL 2 TRUCK 3 PIGGYBACK 4 OTHER: Please specify _____________	
Q-7 TRANSIT TIME		
7A Average Transit Time: What is the average length of time from the moment an order is shipped to the time it is received by the wholesaler? (when goods are shipped by your usual mode of shipment)	_____ days (If received on the same day, write '0' days)	_____ days
Consistency: How much variation or "swing" is experienced around the average transit time?		
7B Low (Length of transit time when transit time is short)	_____ days	_____ days
7C High (Length of transit time when transit time is long)	_____ days	_____ days

WHOLESALER #2

YOUR INDUSTRY'S TYPICAL LEVEL | YOUR COMPANY'S ACTUAL LEVEL

_____ days _____ days

_____ days _____ days

_____ days _____ days

1 YOUR COMPANY
2 THE WHOLESALER
3 OTHER: Please specify

____

1 RAIL
2 TRUCK
3 PIGGYBACK
4 OTHER: Please specify

____

_____ days _____ days

_____ days _____ days

_____ days _____ days

WHOLESALER #3

YOUR INDUSTRY'S TYPICAL LEVEL | YOUR COMPANY'S ACTUAL LEVEL

_____ days _____ days

_____ days _____ days

_____ days _____ days

1 YOUR COMPANY
2 THE WHOLESALER
3 OTHER: Please specify

____

1 RAIL
2 TRUCK
3 PIGGYBACK
4 OTHER: Please specify

____

_____ days _____ days

_____ days _____ days

_____ days _____ days

WHOLESALER #4

YOUR INDUSTRY'S TYPICAL LEVEL | YOUR COMPANY'S ACTUAL LEVEL

_____ days _____ days

_____ days _____ days

_____ days _____ days

1 YOUR COMPANY
2 THE WHOLESALER
3 OTHER: Please specify

____

1 RAIL
2 TRUCK
3 PIGGYBACK
4 OTHER: Please specify

____

_____ days _____ days

_____ days _____ days

_____ days _____ days

	WHOLESALER #1	
	YOUR INDUSTRY'S TYPICAL LEVEL	YOUR COMPANY'S ACTUAL LEVEL
DISTRIBUTION SYSTEM FLEXIBILITY		
Q-8 EXPEDITE ORDER		
8A Do you handle expedite orders? (Circle number) 1 YES (Go to Q-8B) 2 NO (Go to Q-9)		
8B If your answer to Q-8A is "YES", then what is your average <u>Expedite Order Response Time</u>? (from the time an expedite order is received by the manufacturer to the time the shipment is received by the wholesaler)	_____ days	_____ days
	(if received on the same day, write '0' days)	
Q-9 BACK ORDER		
9A Do you handle back orders? (Circle number) 1 YES (Go to Q-9B) 2 NO (Go to Q-10)		
9B If your answer to Q-9A is "YES", then what is your average <u>Back Order Response Time</u>? (from the time the manufacturer decides to make a back order to the time the back ordered items are received by the wholesaler)	_____ days	_____ days
9C Back orders are usually: 1 SHIPPED WITH THE NEXT SHIPMENT 2 SHIPPED IMMEDIATELY 3 SHIPPED AT CUSTOMER REQUEST		
DISTRIBUTION SYSTEM RELIABILITY		
Q-10 What percent of invoices have billing/invoice errors?	_____ %	_____ %
Q-11 What percent of shipments have loading/shipping errors?	_____ %	_____ %
Q-12 What percent of shipments have some damaged goods? (warehouse damage and/or shipping damage)	_____ %	_____ %

WHOLESALER #2		WHOLESALER #3		WHOLESALER #4	
YOUR INDUSTRY'S TYPICAL LEVEL	YOUR COMPANY'S ACTUAL LEVEL	YOUR INDUSTRY'S TYPICAL LEVEL	YOUR COMPANY'S ACTUAL LEVEL	YOUR INDUSTRY'S TYPICAL LEVEL	YOUR COMPANY'S ACTUAL LEVEL
_____ days	_____ days	_____ days	_____ days	_____ days	_____ days
_____ days	_____ days	_____ days	_____ days	_____ days	_____ days
_____ %	_____ %	_____ %	_____ %	_____ %	_____ %
_____ %	_____ %	_____ %	_____ %	_____ %	_____ %
_____ %	_____ %	_____ %	_____ %	_____ %	_____ %

	WHOLESALER #1	
	YOUR INDUSTRY'S TYPICAL LEVEL	YOUR COMPANY'S ACTUAL LEVEL

DISTRIBUTION SYSTEM INFORMATION

Q-13 ORDER STATUS REQUEST RESPONSE TIME:

If the wholesaler makes a telephone call to you at the beginning of a weekday, enquiring about the status of his order, how long will it take your company to provide that information?

	YOUR INDUSTRY'S TYPICAL LEVEL	YOUR COMPANY'S ACTUAL LEVEL
When the request is made before order shipment		
If less than one day, specify in hours	_____ hours	_____ hours
If one day or more, specify in days	_____ days	_____ days
When the request is made after order shipment		
If less than one day, specify in hours	_____ hours	_____ hours
If one day or more, specify in days	_____ days	_____ days

Q-14 ORDER STATUS HANDLING COMPLETION

In what percent of requests for order status information are you able to provide all the information requested by the wholesaler?

	YOUR INDUSTRY'S TYPICAL LEVEL	YOUR COMPANY'S ACTUAL LEVEL
When the request is made before order shipment......	_____ %	_____ %
When the request is made after order shipment	_____ %	_____ %

Q-15 Do you believe that this wholesaler's perception of the industry's typical level of performance in meeting wholesaler delivery dates is different from your own perception of it? (Please circle the number of the correct answer)

1 YES (Go to Q-15A)
2 NO (Go to Q-16)
3 DON'T KNOW (Go to Q-16)

15A If your answer to Q-15 is "YES", does the wholesaler seem to perceive the industry's typical level of performance to be _______ than you do? (Circle number of correct answer) .....

1 MUCH HIGHER
2 SOMEWHAT HIGHER
3 SOMEWHAT LOWER
4 MUCH LOWER

WHOLESALER #2		WHOLESALER #3		WHOLESALER #4	
YOUR INDUSTRY'S TYPICAL LEVEL	YOUR COMPANY'S ACTUAL LEVEL	YOUR INDUSTRY'S TYPICAL LEVEL	YOUR COMPANY'S ACTUAL LEVEL	YOUR INDUSTRY'S TYPICAL LEVEL	YOUR COMPANY'S ACTUAL LEVEL
______ hours	______ hours	______ hours	______ hours	______ hours	______ hours
______ days	______ days	______ days	______ days	______ days	______ days
______ hours	______ hours	______ hours	______ hours	______ hours	______ hours
______ days	______ days	______ days	______ days	______ days	______ days
______ %	______ %	______ %	______ %	______ %	______ %
______ %	______ %	______ %	______ %	______ %	______ %

WHOLESALER #2	WHOLESALER #3	WHOLESALER #4
1 YES (Go to Q-15A)	1 YES (Go to Q-15A)	1 YES (Go to Q-15A)
2 NO (Go to Q-16)	2 NO (Go to Q-16)	2 NO (Go to Q-16)
3 DON'T KNOW (Go to Q-16)	3 DON'T KNOW (Go to Q-16)	3 DON'T KNOW (Go to Q-16)
1 MUCH HIGHER	1 MUCH HIGHER	1 MUCH HIGHER
2 SOMEWHAT HIGHER	2 SOMEWHAT HIGHER	2 SOMEWHAT HIGHER
3 SOMEWHAT LOWER	3 SOMEWHAT LOWER	3 SOMEWHAT LOWER
4 MUCH LOWER	4 MUCH LOWER	4 MUCH LOWER

	WHOLESALER #1
Q-16 Do you believe that this wholesaler's perception of the industry's typical length of time from order entry to shipment is different from your own perception of it? (Circle number of correct answer)..	1 YES (Go to Q-16A) 2 NO (Go to Q-17) 3 DON'T KNOW (Go to Q-17)
16A If your answer to Q-16 is "YES", does the wholesaler seem to perceive the length of time to be ______ than you do? (Circle number)..............	1 MUCH SHORTER 2 SOMEWHAT SHORTER 3 SOMEWHAT LONGER 4 MUCH LONGER
Q-17 Think of other manufacturers competing with your company for the sales of the product group which was identified earlier. How many such competitors do you have?	______
Q-18 How do your prices compare with those of your competitors? Your prices are usually ______ than those of your competitors. (Circle number).....................................	1 VERY MUCH HIGHER 2 SOMEWHAT HIGHER 3 ABOUT THE SAME AS 4 SOMEWHAT LOWER 5 VERY MUCH LOWER
Q-19 If possible, please indicate the approximate wholesale price of one case of your highest volume product item in the identified product group..	______ dollars
19A If possible, please identify this product item by its name	______

PLEASE RESPOND TO THE FOLLOWING QUESTIONS REGARDING YOUR COMPANY AND ITS DISTRIBUTION SYSTEM

Q-20 Do you have a customer service department? (Circle number)

1 YES

2 NO

Q-21 At which organizational level are your service level targets established?

1 CORPORATE LEVEL

2 REGIONAL LEVEL

3 LOCAL LEVEL

Q-22 What is the title of your highest ranking officer who is directly responsible for distribution?

______

WHOLESALER #2	WHOLESALER #3	WHOLESALER #4
1 YES (Go to Q-16A)	1 YES (Go to Q-16A)	1 YES (Go to Q-16A)
2 NO (Go to Q-17)	2 NO (Go to Q-17)	2 NO (Go to Q-17)
3 DON'T KNOW (Go to Q-17)	3 DON'T KNOW (Go to Q-17)	3 DON'T KNOW (Go to Q-17)
1 MUCH SHORTER	1 MUCH SHORTER	1 MUCH SHORTER
2 SOMEWHAT SHORTER	2 SOMEWHAT SHORTER	2 SOMEWHAT SHORTER
3 SOMEWHAT LONGER	3 SOMEWHAT LONGER	3 SOMEWHAT LONGER
4 MUCH LONGER	4 MUCH LONGER	4 MUCH LONGER
____________	____________	____________
1 VERY MUCH HIGHER	1 VERY MUCH HIGHER	1 VERY MUCH HIGHER
2 SOMEWHAT HIGHER	2 SOMEWHAT HIGHER	2 SOMEWHAT HIGHER
3 ABOUT THE SAME AS	3 ABOUT THE SAME AS	3 ABOUT THE SAME AS
4 SOMEWHAT LOWER	4 SOMEWHAT LOWER	4 SOMEWHAT LOWER
5 VERY MUCH LOWER	5 VERY MUCH LOWER	5 VERY MUCH LOWER
____________ dollars	____________ dollars	____________ dollars
____________	____________	____________

Q-23 How many distribution centers are included in the distribution system of your company?

____

Q-24 Please indicate the size of your company (based on annual dollar sales of grocery products sold through all channels in the United States)

1 LESS THAN $50 MILLION
2 $50M - $100M
3 $101M - $250M
4 $251M - $500M
5 MORE THAN $500M
6 DON'T KNOW

Q-25 Your company may have made and implemented some decisions in order to improve the customer service which you have been providing to your wholesalers. Please indicate whether you have implemented any of the following service-related decisions and whether (in your opinion) the implementation of these decisions has improved the effectiveness of your customer service strategy? (Please circle the correct answer)

SERVICE DECISIONS	IMPLEMENTED?		HAS IMPLEMENTATION IMPROVED CUSTOMER SERVICE?		
COMPUTERIZATION OF					
Order Processing	YES	NO	YES	NO	DON'T KNOW
Invoicing	YES	NO	YES	NO	DON'T KNOW
Shipment performance reports (reports of shipment errors, damages, delays, etc)	YES	NO	YES	NO	DON'T KNOW
Inventory control	YES	NO	YES	NO	DON'T KNOW
Carrier performance and control	YES	NO	YES	NO	DON'T KNOW
Car tracing and control	YES	NO	YES	NO	DON'T KNOW

SERVICE DECISIONS	IMPLEMENTED?		HAS IMPLEMENTATION IMPROVED CUSTOMER SERVICE?		
IMPLEMENTATION OF					
Periodic survey of customer needs.......	YES	NO	YES	NO	DON'T KNOW
Periodic review of service levels.......	YES	NO	YES	NO	DON'T KNOW
Procedure for complaint handling........	YES	NO	YES	NO	DON'T KNOW
Written statement of customer service policy....................	YES	NO	YES	NO	DON'T KNOW
Practice of giving a copy of service policy statement to wholesaler.....................	YES	NO	YES	NO	DON'T KNOW
Guaranteed delivery date...............	YES	NO	YES	NO	DON'T KNOW
Standardized pallets...................	YES	NO	YES	NO	DON'T KNOW
Pallet exchange program................	YES	NO	YES	NO	DON'T KNOW
Trailer drop-off.......................	YES	NO	YES	NO	DON'T KNOW
Customer pick-up.......................	YES	NO	YES	NO	DON'T KNOW
Manufacturer's private fleet of trucks............................	YES	NO	YES	NO	DON'T KNOW
OTHER STEPS YOU HAVE TAKEN TO IMPROVE YOUR CUSTOMER SERVICE					
____________________	YES	NO	YES	NO	DON'T KNOW
____________________	YES	NO	YES	NO	DON'T KNOW
____________________	YES	NO	YES	NO	DON'T KNOW
____________________	YES	NO	YES	NO	DON'T KNOW
____________________	YES	NO	YES	NO	DON'T KNOW

THANK YOU VERY MUCH FOR RESPONDING TO THIS SURVEY

APPENDIX B

WHOLESALER QUESTIONNAIRE

CUSTOMER SERVICE PERCEPTIONS
IN
THE GROCERY INDUSTRY

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Virginia Polytechnic Institute and State University
Blacksburg, Virginia 24061
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We would like to know your perceptions of the distribution service levels which you are receiving from the following grocery manufacturer.

The manufacturer is:

____

____

____

____

____

This manufacturer has been supplying you with grocery products belonging to the following product group(s):

____

____

Please base your answers on customer service levels for ONLY THE ABOVE PRODUCT GROUP. If the manufacturer is selling you other product groups in addition to the above, please exclude those from your consideration while answering this questionnaire.

Your responses will be kept STRICTLY CONFIDENTIAL. Your answers will be matched with those of the manufacturer for the purpose of determining supplier-customer differences in service perception. We hope to collect responses from several such matched pairs. Your responses will be analyzed only in combination (and when averaged) with several such manufacturer-wholesaler pairs.

We would like you to give your own estimates of the typical levels of service provided by suppliers of ______________________________.
These estimates should be placed under the title INDUSTRY'S TYPICAL LEVEL.

We would also like you to give your own estimates of the actual levels of service which you have been receiving from ______________________________ for your purchases of ______________________________ from them. These estimates should be placed under the title MANUFACTURER'S ACTUAL LEVEL.

Please note that the ACTUAL LEVEL stands for the manufacturer's actual performance, and not for the performance targets which the manufacturer claims to provide. The actual performance may not meet these targets, or it may exceed them.

	INDUSTRY'S TYPICAL LEVEL	MANUFACTURER'S ACTUAL LEVEL
PRODUCT AVAILABILITY		
Q-1 What percent of total cases (or cartons, bags, etc.) ordered encounter delayed shipment due to product stock-out?.......	______ %	______ %
Q-2 What percent of total number of orders placed are shipped complete?	______ %	______ %
Q-3 What percent of total cases (or cartons, bags, etc.) ordered are shipped to meet your delivery date?	______ %	______ %

ORDER CYCLE TIME

For answering the following questions, assume that it will take two days for an order to be received by the manufacturer after it is placed by mail. Orders placed by telephone, by teletype, or by electronic order communication methods are received immediately. Orders are considered to be received when they are received by a salesperson of the manufacturer, or by the manufacturer's office.

Q-4 ORDER ENTRY TO SHIPMENT

	INDUSTRY'S TYPICAL LEVEL	MANUFACTURER'S ACTUAL LEVEL
4A Average Time: What is the average length of time from the moment an order is RECEIVED by the manufacturer to the time it is SHIPPED .... (If shipped on the same day, write '0' days; if shipped on the next day, write '1' day, and so on)	______	______
Consistency: How much variation or "swing" is experienced around the above average time?..................................		
4B Low (Length of time from order entry to shipment when order cycle time is short)	______ days	______ days
4C High (length of time from order entry to shipment when order cycle time is long)	______ days	______ days

	INDUSTRY'S TYPICAL LEVEL	MANUFACTURER'S ACTUAL LEVEL

Q-5 TRANSIT TIME

5A <u>Average Transit Time</u>: What is the average length of time from the moment an order is shipped by the manufacturer to the time when it is received by your company?...... (when goods are shipped by your usual mode of shipment) _______ days _______ days (If received on the same day, write '0' days)

<u>Consistency</u>: How much variation or "swing" is experienced around the average transit time?

5B Low (Length of transit time when transit time is short) _______ days _______ days

5C High (Length of transit time when transit time is long) _______ days _______ days

<u>DISTRIBUTION SYSTEM FLEXIBILITY</u>

Q-6 EXPEDITE ORDER

6A Does this manufacturer handle expedite orders? (Circle number of answer)

1 YES (Go to Q-6B)
2 No (Go to Q-7)

6B If the answer to Q-6A is "yes", then what is the average <u>Expedite Order Response Time</u>? (from the time an expedite order is received by the manufacturer to the time the shipment is received by your company) _______ days _______ days (if received on the same day, write '0'days)

Q-7 BACK ORDER

7A Does this manufacturer handle back orders? (Circle number)

1 YES (Go to Q-7B)
2 NO (Go to Q-8)

7B If you answer to Q-7 is "YES", then what is the average <u>Back Order Response Time</u>? (from the time the manufacturer decides to make a back order to the time the back ordered items are received by your company) _______ days _______ days (if received on the same day, write'0' days)

	INDUSTRY'S TYPICAL LEVEL	MANUFACTURER'S ACTUAL LEVEL
DISTRIBUTION SYSTEM RELIABILITY		
Q-8 What percent of invoices have billing/ invoices errors?	_____ %	_____ %
Q-9 What percent of shipments have loading/ shipping errors?	_____ %	_____ %
Q-10 What percent of shipments have some damaged goods? (warehouse damage and/or shipping damage).........................	_____ %	_____ %

DISTRIBUTION SYSTEM INFORMATION

Q-11 ORDER STATUS REQUEST RESPONSE TIME

If you make a telephone call to the manufacturer at the beginning of a weekday, enquiring about the status of your order, how long do you usually have to wait before you are provided the requested information?

	INDUSTRY'S TYPICAL LEVEL	MANUFACTURER'S ACTUAL LEVEL
When the request is made before order shipment		
If less than one day, specify in hours ..	_____ hours	_____ hours
If one day or more, specify in days	_____ days	_____ days
When the request is made after order shipment		
If less than one day, specify in hours..	_____ hours	_____ hours
If one day or more, specify in days.....	_____ days	_____ days

Q-12 ORDERS STATUS HANDLING COMPLETION

In what percent of requests for order status information is the manufacturer able to provide all the information requested?

	INDUSTRY'S TYPICAL LEVEL	MANUFACTURER'S ACTUAL LEVEL
When the request is made before order shipment	_____ %	_____ %
When the request is made after order shipment.................................	_____ %	_____ %

Q-13 For how long has your company been purchasing________________ ________________from ________________ (Circle number of correct answer)

1 LESS THAN TWO YEARS
2 TWO TO FOUR YEARS
3 FOUR TO SIX YEARS
4 MORE THAN SIX YEARS
5 DON'T KNOW

Q-14 How do you usually place orders with this manufacturer? (Circle number)

1 BY MAIL
2 BY TELEPHONE
3 BY TELEX/TELETYPE
4 BY ELECTRONIC METHODS (COMPUTER TO COMPUTER)
5 SALESMAN PICK-UP
6 OTHER. Specify: ________________

Q-15 How intense is the competition between manufacturers of________________ ________________? (Circle number of correct answer)

1 VERY MUCH HIGHER THAN AVERAGE (in intensity)
2 SOMEWHAT HIGHER THAN AVERAGE
3 ABOUT THE AVERAGE LEVEL FOR MOST GROCERY PRODUCTS
4 SOMEWHAT LOWER THAN AVERAGE
5 VERY MUCH LOWER THAN AVERAGE (in intensity)

Q-16 How do the prices of ________________ compare with the prices of other manufacturers of ________________ This manufacturer's prices are:

1 VERY MUCH HIGHER THAN PRICES OF OTHERS
2 SOMEWHAT HIGHER THAN PRICES OF OTHERS
3 ABOUT THE SAME AS PRICES OF OTHERS
4 SOMEWHAT LOWER THAN PRICES OF OTHERS
5 VERY MUCH LOWER THAN PRICES OF OTHERS

Q-17 As is typical with several large wholesalers and retailers, the purchasing and distribution activities of your company may be organized on a divisional or regional basis. Your experience with the customer service provided by ________________for its________________is primarily at the:

1 CORPORATE COMPANY LEVEL
2 DIVISIONAL LEVEL
3 REGIONAL LEVEL
4 LOCAL LEVEL
5 ANY OTHER. Specify: ________________

Use your answer to the above question (Q-17) as the basis for answering the following questions (Q-18 to Q-23A). For example, if your experience with the distribution service levels of this manufacturer is primarily at the regional level, you may base your answers to questions 18-23A on your regional purchases of this manufacturer's products.

Q-18 How many days's inventory of________________________________
of__________________________________ do you usually carry?

____________________days' inventory

Q-19 On the basis of your annual dollar volume of purchases of_______________
____________________________from____________________________________
would you call this manufacturer one of your:

1 MAJOR SUPPLIERS (Accounts for 50% or more of your dollar purchases of the above product category)
2 AVERAGE SUPPLIERS (Accounts for 15-49% or more of your dollar purchases of the above product category)
3 MINOR SUPPLIERS (Accounts for less than 15% of your dollar purchases)

Q-20 What is your annual volume of purchases of ____________________________
__________________________________from this manufacturer?

________________cases or other store units.
(give an approximate number, if necessary)

Q-21 What percent of your purchases (in cases or other store units) of __________
______________________________________is purchased from this manufacturer?

__________________________ % of purchase (approximate, if necessary)

Q-22 Has there been any change in this manufacturer's share of your purchase of ______________________________in the past two years?

1 YES (Go to Q-22A)
2 NO (Go to Q-23)
3 DON'T KNOW (Go to Q-23)

22A If your answer to Q-22 is "YES", then what was the change in this manufacturer's share of your total purchases of ____________________________
_______________________in the past two years? (Circle number of answer)

1 INCREASED BY 16% OR MORE
2 INCREASED BY 13 to 15%
3 INCREASED BY 10 to 12%
4 INCREASED BY 7 to 9%
5 INCREASED BY 4 to 6%
6 INCREASED BY 1 to 3%
7 DECREASED BY 1 to 3%
8 DECREASED BY 4 to 6%
9 DECREASED BY 7 to 9%
10 DECREASED BY 10 to 12%
11 DECREASED BY 13 to 15%
12 DECREASED BY 16% OR MORE

Q-23 Do you anticipate a change in this manufacturer's share of your purchase of ____________________________________in the next two years?

1 YES (Go to Q-23A)
2 NO (Go to Q-24)
3 DON'T KNOW (Go to Q-24)

23A If your answer to Q-23 is "YES", then what do you expect will happen to this manufacturer's share of your total purchases of ______________________________ in the next two years? It will:

1 INCREASE BY 16% OR MORE
2 INCREASE BY 13 to 15%
3 INCREASE BY 10 to 12%
4 INCREASE BY 7 to 9%
5 INCREASE BY 4 to 6%
6 INCREASE BY 1 t 3%
7 DECREASE BY 1to 3%
8 DECREASE BY 4 to 6%
9 DECREASE BY 7 to 9%
10 DECREASE BY 10 to 12%
11 DECREASE BY 13 to 15%
12 DECREASE BY 16% OR MORE

Q-24 Please evaluate the performance of ______________________________ on the following customer service issues. (Circle number)

	OUT-STAND-ING	VERY GOOD	GOOD	SOMEWHERE IN BETWEEN	POOR	VERY POOR	TER-RIBLE
PRODUCT AVAILABILITY	1	2	3	4	5	6	7
AVERAGE ORDER CYCLE TIME	1	2	3	4	5	6	7
CONSISTENCY OF ORDER CYCLE TIME..........	1	2	3	4	5	6	7
TIMELINESS OF DELIVERY............	1	2	3	4	5	6	7
SERVICE FLEXIBILITY	1	2	3	4	5	6	7
ABILITY TO PROVIDE NEEDED INFORMATION	1	2	3	4	5	6	7
FREEDOM FROM ERRORS	1	2	3	4	5	6	7
FREEDOM FROM DAMAGE	1	2	3	4	5	6	7
AFTER SALE SERVICE	1	2	3	4	5	6	7

Q-25 Considering everything that you know about this manufacturer, please indicate your overall satisfaction with the customer service which this manufacturer has been providing you. (Circle number of answer)

1 EXTREMELY SATISFIED
2 VERY SATISFIED
3 SATISFIED
4 PARTIALLY SATISFIED
5 NOT AT ALL SATISFIED

Q-26 The product quality of this manufacturer is usually considered to be:

1 VERY MUCH ABOVE AVERAGE
2 SOMEWHAT ABOVE AVERAGE
3 AVERAGE
4 SOMEWHAT BELOW AVERAGE
5 VERY MUCH BELOW AVERAGE

Q-27 The sales incentives given to wholesalers and retailers by this manufacturer are usually:

1 VERY MUCH BETTER THAN AVERAGE
2 SOMEWHAT BETTER THAN AVERAGE
3 ABOUT AVERAGE
4 SOMEWHAT POORER THAN AVERAGE
5 VERY MUCH POORER THAN AVERAGE
6 DON'T KNOW

Q-28 You must be purchasing grocery products from various grocery manufacturers. On the basis of the quality of their customer service, you may have developed a preference for some manufacturers. If you were to rank all your suppliers of grocery products from #1 onwards, on the basis of your preference for their customer service, where would you position ____________ ____________________

Relative preference ranking on the basis of
THE QUALITY OF CUSTOMER SERVICE

☐ Top 10% of suppliers
☐ Better than 80%
☐ Better than 70%
☐ Better than 60%
☐ Better than 50%
☐ Better than 40%
☐ Better than 30%
☐ Better than 20%
☐ Better than 10%
☐ Bottom 10%

↑ Place an "x" mark at the appropriate position in this column

Q-29 Please indicate the approximate size of your distribution operations (based on your annual sales turnover in dollars)

CORPORATE LEVEL: $ ____________________ (millions)

DIVISIONAL LEVEL: (if applicable) $ ____________________ (millions)

REGIONAL LEVEL: (if applicable) $ ____________________ (millions)

LOCAL LEVEL: (if applicable) $ ____________________ (millions)

ANY OTHER. Specify: ____________ $ ____________ (millions)

Q-30 This manufacturer ( ) may have made some decisions and implemented them in order to improve the customer service which it has been providing to its customers. Please indicate whether the manufacturer has implemented any of the following service-related decisions, and whether (in your opinion), the implementation of these decisions have improved customer service?
(Please circle the correct answer)

SERVICE DECISIONS	IMPLEMENTED?			HAS IMPLEMENTATION IMPROVED CUSTOMER SERVICE?		
COMPUTERIZATION OF						
Order Processing	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
Invoicing	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
Shipment performance reports. (reports of shipment errors, damages, delays, etc.)	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
Inventory Control	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
Carrier performance and control	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
Car tracing and control......	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
IMPLEMENTATION OF						
Periodic survey of customer needs	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
Periodic review of service levels	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
Procedure for complaint handling	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
Written statement of customer service policy	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
Practice of giving a copy of service policy statement to wholesaler of retailer.......	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
Guaranteed delivery date	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
Standardized pallets	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
Pallet exchange program	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
Trailer drop-off	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
Customer pick-up	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
Manufacturer's private fleet of trucks	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
OTHER STEPS TAKEN BY THE MANUFACTURER TO IMPROVE CUSTOMER SERVICE						
______________________	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
______________________	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
______________________	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
______________________	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
______________________	YES	NO	DON'T KNOW	YES	NO	DON'T KNOW

THANK YOU VERY MUCH FOR RESPONDING TO THIS SURVEY

APPENDIX C

FACTOR INTERCORRELATIONS AND LOADING MATRIX

1 FACTOR INTERCORRELATIONS AND LOADING MATRIX

COMMUNALITY IN THE DIAGONAL

	1	3	11	12	82	17	19	27	84	49	51	52	59	88	78	80	90	67	68	65	66	501	502	503	504	505	506	507
1	65	63	56	47	63	-33	-19	-26	-21	63	61	49	60	57	50	52	37	35	40	32	41	81	-31	67	52	45	32	41
3	63	51	48	48	50	-28	9	-16	-23	59	54	47	49	50	46	52	26	25	32	17	34	72	-18	60	47	34	17	34
11	56	48	46	42	54	-34	-10	7	-13	53	44	40	64	52	36	30	18	13	15	19	12	68	-16	59	32	17	19	12
12	47	48	42	43	57	-41	-14	-27	-13	46	40	43	42	46	30	31	24	32	31	18	11	65	-30	50	32	37	18	11
82	63	50	54	57	62	-30	-28	-23	-1	58	55	59	49	67	31	31	26	29	22	19	19	79	-26	67	33	30	19	19
17	-33	-28	-34	-41	-30	68	60	60	72	-71	-59	-50	-63	-63	-63	-63	-56	-52	-50	-41	-36	-46	82	-71	-68	-60	-41	-36
19	-19	9	-10	-14	-28	60	54	62	55	-45	-61	-41	-48	-54	-41	-44	-49	-41	-43	-35	-26	-17	73	-57	-50	-50	-35	-26
27	-26	-16	7	-27	-23	60	62	61	63	-45	-46	-41	-54	-47	-53	-55	-57	-51	-49	-47	-39	-23	78	-54	-62	-59	-47	-39
84	-21	-23	-13	-13	-1	72	55	63	66	-54	-53	-41	-52	-61	-67	-66	-63	-50	-61	-38	-42	-19	81	-60	-74	-65	-38	-42
49	63	59	53	46	58	-71	-45	-45	-54	82	82	72	73	83	64	71	62	52	54	40	46	77	-68	91	74	62	40	46
51	61	54	44	40	55	-59	-61	-46	-53	82	84	72	73	85	65	69	62	52	61	35	37	70	-69	92	74	66	35	37
52	49	47	40	43	59	-50	-41	-41	-41	72	72	62	61	73	53	57	59	50	48	29	37	65	-55	79	64	58	29	37
59	60	49	64	42	49	-63	-48	-54	-52	73	73	61	62	72	62	65	54	46	54	39	29	73	-69	79	68	59	39	29
88	57	50	52	46	67	-63	-54	-47	-61	83	85	73	72	85	67	67	64	53	55	40	36	75	-71	92	74	64	40	36
78	50	46	36	30	31	-63	-41	-53	-67	64	65	53	62	67	83	80	80	63	69	49	57	53	-71	72	91	78	49	57
80	52	52	30	31	31	-63	-44	-55	-66	71	69	57	65	67	80	77	76	72	72	49	54	54	-72	76	87	85	49	54
90	37	26	18	24	26	-56	-49	-57	-63	62	62	59	54	64	80	76	77	67	67	46	53	36	-71	70	87	79	46	53
67	35	25	13	32	29	-52	-41	-51	-50	52	52	50	46	53	63	72	67	73	71	35	32	37	-61	58	76	85	35	32
68	40	32	15	31	22	-50	-43	-49	-61	54	61	48	54	55	69	72	67	71	73	36	43	38	-64	63	78	85	36	43
65	32	17	19	18	19	-41	-35	-47	-38	40	35	29	39	40	49	49	46	35	36	100	44	29	-51	42	54	42	100	44
66	41	34	12	11	19	-36	-26	-39	-42	46	37	37	29	36	57	54	53	32	43	44	100	32	-45	43	62	44	44	100
501	81	72	68	65	79	-46	-17	-23	-19	77	70	65	73	75	53	54	36	37	38	29	32	100	-33	83	54	45	29	32
502	-31	-18	-16	-30	-26	82	73	78	81	-68	-69	-55	-69	-71	-71	-72	-71	-61	-64	-51	-45	-33	100	-77	-81	-74	-51	-45
503	67	60	59	50	67	-71	-57	-54	-60	91	92	79	79	92	72	76	70	58	63	42	43	83	-77	100	82	72	42	43
504	52	47	32	32	33	-68	-50	-62	-74	74	74	64	68	74	91	87	87	76	78	54	62	54	-81	82	100	91	54	62
505	45	34	17	37	30	-60	-50	-59	-65	62	66	58	59	64	78	85	79	85	85	42	44	45	-74	72	91	100	42	44
506	32	17	19	18	19	-41	-35	-47	-38	40	35	29	39	40	49	49	46	35	36	100	44	29	-51	42	54	42	100	44
507	41	34	12	11	19	-36	-26	-39	-42	46	37	37	29	36	57	54	53	32	43	44	100	32	-45	43	62	44	44	100

APPENDIX D

RESIDUAL INTERCORRELATIONS AFTER THE LATENT SCORE IS PARTIALLED OUT

TEST FOR INTERNAL CONSISTENCY FOR THE INDICATORS WITH COMMUNALITIES ON THE DIAGONAL

LOCATIONS WITH A 9.999 INDICATES THAT THE COMMUNALITY OF THE INDICATOR IS GREATER THAN ONE.

	1	3	11	12	82	17	19	27	84	49	51	52	59	88	78	80	90	67
1	0.649	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.132	0.514	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	0.022	-0.013	0.460	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	-0.130	0.026	-0.037	0.430	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
82	-0.010	-0.152	0.026	0.125	0.617	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17	-2.966	-2.219	-2.163	-2.218	-2.690	0.680	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	-1.949	-0.922	-1.199	-1.215	-2.047	-0.020	0.543	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
27	-2.412	-1.664	-1.002	-1.666	-2.194	-0.121	0.104	0.614	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
84	-2.493	-1.998	-1.596	-1.496	-1.785	0.150	-0.115	-0.017	0.660	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49	-0.402	-0.205	-0.269	-0.425	-0.488	-6.091	-3.934	-4.419	-5.220	0.822	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
51	-0.547	-0.411	-0.607	-0.667	-0.681	-5.975	-4.773	-4.759	-5.522	-0.055	0.842	0.000	0.000	0.000	0.000	0.000	0.000	0.000
52	-0.400	-0.221	-0.298	-0.185	-0.081	-3.295	-2.372	-2.680	-2.922	0.022	-0.007	0.621	0.000	0.000	0.000	0.000	0.000	0.000
59	-0.096	-0.167	0.223	-0.212	-0.338	-3.681	-2.565	-3.026	-3.235	0.045	0.021	-0.044	0.623	0.000	0.000	0.000	0.000	0.000
88	-0.753	-0.592	-0.359	-0.506	-0.221	-6.370	-4.651	-4.974	-6.024	-0.041	0.054	0.029	-0.024	0.850	0.000	0.000	0.000	0.000
78	-0.979	-0.672	-0.853	-0.961	-1.590	-5.946	-3.916	-4.905	-5.934	-1.109	-1.146	-0.759	-0.382	-1.059	0.833	0.000	0.000	0.000
80	-0.653	-0.324	-0.818	-0.724	-1.260	-4.948	-3.335	-4.109	-4.862	-0.398	-0.591	-0.401	-0.130	-0.739	0.001	0.766	0.000	0.000
90	-1.180	-1.088	-1.175	-0.923	-1.443	-4.669	-3.463	-4.179	-4.753	-0.839	-0.965	-0.323	-0.513	-0.912	0.001	-0.035	0.766	0.000
67	-1.084	-0.982	-1.154	-0.592	-1.160	-4.107	-2.937	-3.607	-3.903	-1.164	-1.269	-0.542	-0.666	-1.246	-0.691	-0.103	-0.310	0.726
68	-0.911	-0.793	-1.105	-0.634	-1.398	-4.045	-2.987	-3.552	-4.254	-1.057	-0.835	-0.586	-0.423	-1.147	-0.429	-0.098	-0.299	-0.067
65	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999
66	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999	9.999

TEST FOR INTERNAL CONSISTENCY FOR THE INDICATORS WITH COMMUNALITIES ON THE DIAGONAL

LOCATIONS WITH A 9.999 INDICATES THAT THE COMMUNALITY OF THE INDICATOR IS GREATER THAN ONE.

	68	65	66
1	0.000	0.000	0.000
3	0.000	0.000	0.000
11	0.000	0.000	0.000
12	0.000	0.000	0.000
82	0.000	0.000	0.000
17	0.000	0.000	0.000
19	0.000	0.000	0.000
27	0.000	0.000	0.000
84	0.000	0.000	0.000
49	0.000	0.000	0.000
51	0.000	0.000	0.000
52	0.000	0.000	0.000
59	0.000	0.000	0.000
88	0.000	0.000	0.000
78	0.000	0.000	0.000
80	0.000	0.000	0.000
90	0.000	0.000	0.000
67	0.000	0.000	0.000
68	0.726	0.000	0.000
65	9.999	1.000	0.000
66	9.999	9.999	1.000

APPENDIX E

MATRIX OF SIMILARITY COEFFICIENTS

SIMILIARITY COEFFICIENTS FOR THE INDICATORS WITH COMMUNALITIES ON THE DIAGONAL

	1	3	11	12	82	17	19	27	84	49	51	52	59	88	78	80	90	67
1	0.649	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.985	0.514	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	0.959	0.960	0.460	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	0.979	0.963	0.956	0.430	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
82	0.970	0.954	0.964	0.979	0.617	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17	-0.897	-0.859	-0.815	-0.883	-0.844	0.680	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	-0.806	-0.756	-0.709	-0.798	-0.758	0.967	0.543	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
27	-0.819	-0.766	-0.710	-0.800	-0.749	0.973	0.976	0.614	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
84	-0.817	-0.774	-0.705	-0.789	-0.736	0.975	0.967	0.980	0.660	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49	0.971	0.946	0.915	0.956	0.934	-0.970	-0.913	-0.915	-0.919	0.822	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
51	0.960	0.928	0.900	0.944	0.927	-0.973	-0.924	-0.926	-0.927	0.996	0.842	0.000	0.000	0.000	0.000	0.000	0.000	0.000
52	0.970	0.942	0.909	0.958	0.940	-0.964	-0.913	-0.914	-0.911	0.996	0.996	0.621	0.000	0.000	0.000	0.000	0.000	0.000
59	0.964	0.935	0.902	0.954	0.929	-0.974	-0.918	-0.914	-0.923	0.994	0.992	0.989	0.623	0.000	0.000	0.000	0.000	0.000
88	0.962	0.933	0.907	0.952	0.930	-0.974	-0.926	-0.922	-0.920	0.997	0.997	0.997	0.994	0.850	0.000	0.000	0.000	0.000
78	0.918	0.888	0.818	0.882	0.838	-0.979	-0.935	-0.958	-0.970	0.971	0.970	0.965	0.969	0.968	0.833	0.000	0.000	0.000
80	0.921	0.889	0.822	0.890	0.846	-0.980	-0.936	-0.961	-0.970	0.974	0.975	0.970	0.970	0.971	0.998	0.766	0.000	0.000
90	0.879	0.843	0.767	0.845	0.802	-0.977	-0.956	-0.975	-0.981	0.952	0.958	0.951	0.949	0.954	0.992	0.992	0.766	0.000
67	0.880	0.846	0.769	0.863	0.812	-0.970	-0.946	-0.967	-0.968	0.948	0.955	0.951	0.947	0.951	0.983	0.987	0.991	0.726
68	0.887	0.854	0.776	0.857	0.809	-0.974	-0.944	-0.969	-0.974	0.952	0.959	0.952	0.950	0.953	0.991	0.994	0.994	0.996
65	0.827	0.772	0.715	0.781	0.743	-0.911	-0.894	-0.925	-0.908	0.880	0.876	0.868	0.884	0.878	0.925	0.920	0.924	0.902
66	0.850	0.819	0.712	0.772	0.742	-0.890	-0.849	-0.897	-0.902	0.888	0.879	0.878	0.870	0.872	0.937	0.931	0.933	0.898

SIMILIARITY COEFFICIENTS FOR THE INDICATORS WITH COMMUNALITIES ON THE DIAGONAL

	68	65	66
1	0.000	0.000	0.000
3	0.000	0.000	0.000
11	0.000	0.000	0.000
12	0.000	0.000	0.000
82	0.000	0.000	0.000
17	0.000	0.000	0.000
19	0.000	0.000	0.000
27	0.000	0.000	0.000
84	0.000	0.000	0.000
49	0.000	0.000	0.000
51	0.000	0.000	0.000
52	0.000	0.000	0.000
59	0.000	0.000	0.000
88	0.000	0.000	0.000
78	0.000	0.000	0.000
80	0.000	0.000	0.000
90	0.000	0.000	0.000
67	0.000	0.000	0.000
68	0.726	0.000	0.000
65	0.906	1.000	0.000
66	0.918	0.903	1.000

APPENDIX F

MATRIX OF INTER-ITEM CORRELATIONS

MATRIX OF INTER-ITEM CORRELATIONS

V#	1	3	11	12	82	17	19	27	84	49	51	52	59	88	78	80	90	67	68	65	66
1	1.00																				
3	0.63	1.00																			
11	0.56	0.48	1.00																		
12	0.47	0.48	0.42	1.00																	
82	0.63	0.50	0.54	0.57	1.00																
17	-0.33	-0.28	-0.34	-0.41	-0.30	1.00															
19	-0.19	0.09	-0.10	-0.14	-0.28	0.60	1.00														
27	-0.26	-0.16	0.07	-0.27	-0.23	0.60	0.62	1.00													
84	-0.21	-0.23	-0.13	-0.13	-0.01	0.72	0.55	0.63	1.00												
49	0.63	0.59	0.53	0.46	0.58	-0.71	-0.45	-0.45	-0.54	1.00											
51	0.61	0.54	0.44	0.40	0.55	-0.59	-0.61	-0.46	-0.53	0.82	1.00										
52	0.49	0.47	0.40	0.43	0.59	-0.50	-0.41	-0.41	-0.41	0.72	0.72	1.00									
59	0.60	0.49	0.64	0.42	0.49	-0.63	-0.48	-0.54	-0.52	0.73	0.73	0.61	1.00								
88	0.57	0.50	0.52	0.46	0.67	-0.63	-0.54	-0.47	-0.61	0.83	0.85	0.73	0.72	1.00							
78	0.50	0.46	0.36	0.30	0.31	-0.63	-0.41	-0.53	-0.67	0.64	0.65	0.53	0.62	0.67	1.00						
80	0.52	0.52	0.30	0.31	0.31	-0.63	-0.44	-0.55	-0.66	0.71	0.69	0.57	0.65	0.67	0.80	1.00					
90	0.37	0.26	0.18	0.24	0.26	-0.56	-0.49	-0.57	-0.63	0.62	0.62	0.59	0.54	0.64	0.80	0.76	1.00				
67	0.35	0.25	0.13	0.32	0.29	-0.52	-0.41	-0.51	-0.50	0.52	0.52	0.50	0.46	0.53	0.63	0.72	0.67	1.00			
68	0.40	0.32	0.15	0.31	0.22	-0.50	-0.43	-0.49	-0.61	0.54	0.61	0.48	0.54	0.55	0.69	0.72	0.67	0.71	1.00		
65	0.32	0.17	0.19	0.18	0.19	-0.41	-0.35	-0.47	-0.38	0.40	0.35	0.29	0.39	0.40	0.49	0.49	0.46	0.35	0.36	1.00	
66	0.41	0.34	0.12	0.11	0.19	-0.36	-0.26	-0.39	-0.42	0.46	0.37	0.37	0.29	0.36	0.57	0.54	0.53	0.32	0.43	0.44	1.00

APPENDIX G

PRELIMINARY CONTACT LETTER FROM THE CHAIRMAN OF THE DISSERTATION COMMITTEE

DEPARTMENT OF MARKETING AND TRANSPORTATION
College of Business Administration
University of Tennessee
Knoxville, 37996-0530
Telephone: (615) 974-5311

October 28, 1983

Dear Mr. :

By way of this letter, I would like to introduce Mr. Rammohan Pisharodi, who is one of our doctoral candidates in Marketing and Logistics. Mr. Pisharodi is at the dissertation stage of his studies, and his topical area is that of customer service in the grocery industry. His research effort will require some information from industry representatives and he will be in touch with you by letter in two or three days to see if you can be of assistance to him. Any help which you can provide will be most appreciated.

Please let me know if there is any way in which the University of Tennessee can ever be of assistance to you. Thank you very much for your interest in this project.

Sincerely,

C. John Langley, Jr., Ph.D.
Professor of Marketing and
Logistics

APPENDIX H

PRELIMINARY CONTACT LETTER FROM THE RESEARCHER

COLLEGE OF BU[SI]NESS

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVER[SI]TY

Blacksburg, Virginia [2]4061

DEPARTMENT OF MARKETING (703) 961-6949

November 4, 1983

Dear Mr. :

As indicated recently in a letter to you from Dr. C. John Langley, Jr., I am conducting dissertation research in the area of customer service. My goal is to evaluate the extent to which grocery manufacturers and grocery wholesalers agree or disagree on the quality of distribution service. The findings of my study will be useful to grocery manufacturers in their continuing efforts to provide acceptable levels of service to their customers.

Your participation is very important for the success of this research. I will need to have you identify a person or persons in your organization who could complete a brief questionnaire. For your convenience, I have enclosed a reply-paid, self-addressed postcard so that you could let me know if you will be able to participate in this study.

All responses received by us will be kept strictly confidential. Participants who indicate an interest in receiving a summary of our findings and recommendations will be sent a copy of it upon the completion of the research project.

I am looking forward to a favorable response from you. I hope to be in touch with you by telephone after I have received your postcard. If you have any questions, please feel free to contact me at (703) 961-4692/6949.

Sincerely,

Rammohan Pisharodi

Rammohan Pisharodi
Assistant Professor
(Doctoral Candidate, University of Tennessee)

Dissertation Committee Members
C. John Langley, Jr., Ph.D., Professor, University of Tennessee
Gary N. Dicer, D.B.A., Professor, University of Tennessee
R. J. Woodruff, D.B.A., Professor, University of Tennessee
E. R. Cadotte, Ph.D., Assoc. Professor, University of Tennessee

APPENDIX I

PRELIMINARY CONTACT REPLY POSTCARD

PLEASE MAIL THIS CARD TODAY

☐ YES — We are interested in participating in the described customer service study.

☐ Please send us a summary of your findings and recommendations.

☐ NO — Unfortunately we are unable to participate in the described customer study.

Name: ____________________

Title: ____________________

Company: ____________________

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY CARD

FIRST CLASS PERMIT NO. 10 BLACKSBURG, VA 24060

POSTAGE WILL BE PAID BY ADDRESSEE

Virginia Polytechnic Institute
and State University
R. Pisharodi
Assistant Professor
Department of Marketing
Blacksburg, Virginia 24060

APPENDIX J

INITIAL LETTER TO MANUFACTURER KEY INFORMANTS

A LAND-GRANT UNIVERSITY

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

Department of Marketing

March 8, 1984

Dear Mr. :

As a part of my doctoral dissertation, I am working with Professor John Langley of the University of Tennessee on a nationwide study of distribution customer service. My goal is to evaluate the extent to which grocery manufacturers and grocery wholesalers agree or disagree on the quality of distribution service. The findings of my study will be useful to grocery manufacturers in their continuing efforts to provide acceptable levels of service to their customers.

A few months ago, I had sent letters to several distribution executives with a brief description of our study and its goals. In response to my letter, of your company indicated that your company is interested in participating in our study. You were identified as the person whom we should contact in order to collect the necessary information. I wish to apologize for my delay in getting in touch with you. A copy of my questionnaire and a reply envelope have been enclosed with this letter.

The enclosed questionnaire is actually not as lengthy as it may initially appear. The layout of the questionnaire makes it possible for you to answer questions regarding your service relationships with four different grocery wholesalers. Once you have provided responses regarding one wholesaler, answering the same questions regarding another wholesaler will demand very little extra effort. We prefer to receive responses regarding as many wholesalers as is possible. However, you can contribute towards the success of this study by providing us with information regarding your service relationship with at least one wholesaler.

Please try to answer all the questions listed in this questionnaire. You may use approximate estimates if you are unable to provide the more exact figures requested. Your responses will be kept strictly confidential. Under no circumstances will your answers be divulged.

Nearly one hundred grocery manufacturing companies are participating in this study. After we have received completed questionnaires from these manufacturing companies, we shall be sending similar questionnaires to a selected list of grocery wholesalers. Upon the completion of this research study, we shall send each participant a summary of our findings and recommendations.

I wish to thank you for your interest in participating in this study. If you have any questions, please feel free to contact me at (703) 961-4692/6949.

Sincerely,

Rammohan Pisharodi
Assistant Professor
(Doctoral Candidate,
University of Tennessee)

Dissertation Committee Members
C. John Langley, Jr., Ph.D., Professor, University of Tennessee
Gary N. Dicer, D.B.A., Professor, University of Tennessee
R.J. Woodruff, D.B.A., Professor, University of Tennessee
E.R. Cadotte, Ph.D., Associate Professor, University of Tennessee

APPENDIX K

FIRST FOLLOW-UP LETTER TO MANUFACTURER KEY INFORMANTS

A LAND-GRANT UNIVERSITY

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

Department of Marketing

April 2, 1984

Dear Mr. :

As a part of my doctoral dissertation, I am working with Professor John Langley of the University of Tennessee on a nationwide study of distribution customer service. My goal is to evaluate the extent to which grocery manufacturers and grocery wholesalers agree or disagree on the quality of distribution service. The findings of my study will be useful to grocery manufacturers in their continuing efforts to provide acceptable levels of service to their customers.

About three weeks ago, I had sent you a questionnaire seeking information regarding your customer service levels. If you have already completed and returned it to us, please accept our sincere thanks. If not, please consider this letter to be a reminder. It is extremely important that your responses be included in our study if the results of our study are to accurately represent a cross section of American Grocery Manufacturers.

Before returning the completed questionnaire, please write down the name of your company as well as the name and telephone number of the person who completed the questionnaire on its back cover. This will aid us in contacting the right person if we have any questions.

If by some chance you have not received the questionnaire, please call me at (703) 961-4692/6949, and I shall mail you another copy immediately.

Sincerely,

Rammohan Pisharodi
Assistant Professor

APPENDIX L

SECOND FOLLOW-UP LETTER TO MANUFACTURER KEY INFORMANTS

A LAND-GRANT UNIVERSITY

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

Department of Marketing

May 30, 1984

Dear Mr. :

As a part of my doctoral dissertation, I am working with Professor John Langley of the University of Tennessee on a nationwide study of distribution customer service. My goal is to evaluate the extent to which grocery manufacturers and grocery wholesalers agree or disagree on the quality of distribution service. The findings of my study will be useful to grocery manufacturers in their continuing efforts to provide acceptable levels of service to their customers.

More than two months ago, I had sent you a questionnaire seeking information regarding your customer service levels. If you have already completed and returned it to us, please accept our sincere thanks. If not, please consider this letter to be a reminder. <u>It is extremely important that your responses be included in our study</u> if the results of our study are to accurately represent a cross section of American Grocery Manufacturers.

If by some chance you have not received the questionnaire, or in the event that your questionnaire has been misplaced, a replacement is enclosed. Before returning the completed questionnaire, please write down the name, and telephone number of the <u>person who completed the questionnaire</u> on its back cover. This will aid us in contacting the right person if we have any questions.

Your coooperation is greatly appreciated. If you have any questions, please feel free to contact me at (703) 961-4692/6949.

Sincerely,

Rammohan Pisharodi
Assistant Professor

APPENDIX M

INITIAL LETTER TO WHOLESALER KEY INFORMANTS

A LAND-GRANT UNIVERSITY

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

Department of Marketing

July 26, 1984

Dear Mr. :

As a part of my doctoral dissertation, I am working with Professor John Langley of the University of Tennessee on a nationwide study of distribution customer service. Our goal is to evaluate the extent to which grocery manufacturers and their customers (wholesalers and chain retailers) agree or disagree on the quality of the manufacturer's distribution service. The findings of our study will be useful to the grocery industry in its continuing efforts to improve distribution customer service.

Nearly fifty major grocery manufacturers from all over the United States are participating in this study. Your company has been identified by as an important customer for some of their products. We would like to find out your perceptions of the service levels which the above manufacturers have been providing you. I have enclosed a separate questionnaire for each one of the above manufacturers. Please answer the questions in the attached questionnaires and mail them to me in the enclosed reply envelopes.

Your participation is very important for the accuracy of this study. We need your responses. Non-response can bias the results of our study and make it less useful to the industry. <u>You can be assured of complete confidentiality</u>. Under no circumstance will your answers be divulged to anyone, including the manufacturers who identified your company for this study.

Please try to answer all the questions listed in the questionnaires. You may use approximate estimates if you are unable to give us the more exact figures requested. After we have received your responses, we will combine them with the responses of all the other respondents, and analyze them together. Upon the completion of this study, we shall send you a summary of our findings and recommendations.

Page 2
July 26, 1984

I am looking forward to your response. If you have any comments, please feel free to make them on the questionnaires themselves. I would be most happy to answer any questions you might have. Please write or call. My telephone number is (703) 961-4692/6949.

Thank you for your assistance.

Sincerely,

Rammohan Pisharodi

Rammohan Pisharodi
Assistant Professor of Marketing
(Doctoral Candidate,
University of Tennessee)

RP/wwb

APPENDIX N

FIRST FOLLOW-UP LETTER TO WHOLESALER KEY INFORMANTS

A LAND-GRANT UNIVERSITY

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

Department of Marketing

August 23, 1984

Dear Mr. :

As a part of my doctoral dissertation, I am working with Professor John Langley of the University of Tennessee on a nationwide study of distribution customer service. Our goal is to evaluate the extent to which grocery manufacturers and their customers agree or disagree on the quality of the manufacturer's distribution service. The findings of our study will be useful to the grocery industry in its continuing efforts to improve distribution customer service.

More than three weeks ago, I had sent you a questionnaire seeking information regarding the customer service levels provided to you by . If you have already completed and returned the questionnaire to us, please accept our sincere thanks. If not, please consider this letter to be a reminder. It is extremely important that your responses be included in our study if the results of our study are to accurately represent a cross section of American grocery distribution.

If by some chance you have not received the questionnaire, please call me at (703)-961-4692/6949, and I shall mail you another copy immediately.

Thank you for your assistance.

Sincerely,

Rammohan Pisharodi
Assistant Professor of Marketing
(Doctoral Candidate,
University of Tennessee)

APPENDIX O

SECOND FOLLOW-UP LETTER TO WHOLESALER KEY INFORMANTS

A LAND-GRANT UNIVERSITY

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

Department of Marketing

September 21, 1984

Dear Mr. :

As a part of my doctoral dissertation, I am working with Professor John Langley of the University of Tennessee on a nationwide study of distribution customer service. Our goal is to evaluate the extent to which grocery manufacturers and their customers agree or disagree on the quality of the manufacturer's distribution service. The findings of our study will be useful to the grocery industry in its continuing efforts to improve distribution customer service.

About eight weeks ago, I had sent you a questionnaire seeking information regarding the customer service levels provided to you by . If you have already completed and returned the questionnaire to us, please accept my sincere thanks. If not, please consider this letter to be a reminder. It is extremely important that your responses be included in our study if the results of our study are to accurately represent a cross section of American grocery distribution.

If by some chance you have not received the questionnaire, or in the event that your questionnaire has been misplaced, a replacement is enclosed.

Your cooperation is greatly appreciated. If you have any questions, please feel free to contact me at (703)-961-4692/6949.

Thank you for your assistance.

Sincerely,

Rammohan Pisharodi
Assistant Professor of Marketing
(Doctoral Candidate,

APPENDIX P

HANDWRITTEN FOLLOW-UP LETTER TO WHOLESALER KEY INFORMANTS

COLLEGE OF BUSINESS

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061

DEPARTMENT OF MARKETING (703) 961-6949

October 16, 1984

Dear Mr. ,

A few weeks ago I had mailed you a questionnaire seeking your opinion about the customer service provided to you by . If you have already completed and returned the questionnaire, please accept my sincere thanks. If not, please return it as soon as possible.

Nearly fifty grocery manufacturers and their customers are participating in this study. The purpose of this study is to improve customer service in the grocery industry and your responses are very important for its success.

Sincerely,

Rammohan Pisharodi

RAMMOHAN PISHARODI

ASSISTANT PROFESSOR OF MARKETING

APPENDIX Q

SHORTENED NAMES OF CONSTRUCTS AND INDICATORS

	Shortened Name
Constructs	
Supplier-customer differences the perception of customer service comparison levels	Difference in Norms in or DIFNORM
Supplier-customer differences in the perception of actual customer service levels	Difference in Actual or DIFACT
Departure from customer service comparison levels	Evaluation against Norms or EVALNORM
Market Response	(No change in name)
Indicators of Customer Service	
Percent of total cases (or cartons, bags, etc.) ordered which encounter delayed shipment due to product stock-out	Stock-out percent[11]
Percent of total number of orders placed which are shipped complete	Order completion
Percent of total cases (or cartons, bags, etc.) ordered which are shipped to meet wholesaler's delivery date.	Delivery percent
Order Entry to Shipment (Average Time)	Entry to Ship-Av Time
Order Entry to Shipment	Entry to Ship-Consist (Consistency)
Transit Time (Average)	Av. Transit Time
Transit Time (Consistency)	Cons. Transit Time

[11]The name of each indicator is followed by the name of the construct which it measures. For instance, the indicator of Difference in Norms which represents the difference in norm regarding stock-out percent is written "Stock-out percent (DIFNORM)". A similar procedure is followed for other indicators of customer service.

	Shortened Name
Expedite Order Response Time	Exp. Ord. Resp. Time
Back-order Response Time	Back-ord Resp. Time
Percent of invoices with billing/ invoice errors	Billing Errors
Percent of shipments with loading/ shipping errors	Shipping Errors
Percent of shipments with some damaged goods	Damage
Order Status Request Response Time	Info Resp Time
Order Status Handling Completion	Info Handling Completion
<u>Indicators of Market Response</u>	
Annual Volume of purchases from the manufacturer	Purchase volume
Percent of purchases (in cases or other store units) purchased from the manufacturer	Manufacturer's share
Change in manufacturer's share of customer's purchases of the selected product category in the past two years	Past Trend
Expected change in manufacturer's share of customer's purchases of the selected product category in the next two years	Future Trend

	Shortened Name
Evaluation of the performance of the supplier on selected customer service issues	C.S. Evaluation
Overall satisfaction with the customer service being provided by the manufacturer	Satisfaction
Relative preference ranking of manufacturers on the basis of the quality of their customer service	Preference

APPENDIX R

SELECTED CAUSAL MODELING TERMS AND SYMBOLS

Symbols/Terms		Explanation
η(eta)	:	Endogenous variable (unobservable dependent variable). It is causally dependent on other endogenous variables and/or exogenous variables.
ξ(xi)	:	Exogenous variable (unobservable independent variable). It is determined outside the model and is not explained by the model.
γ(gamma)	:	Structural coefficient relating an exogenous variable to an endogenous variable.
β(beta)	:	Structural coefficient relating an endogenous variable to another.
y	:	Operationalization of an endogenous variable.
λ_y(lambda y)	:	Factor loading (measurement coefficient) of a y on its underlying endogenous variable (η).
x	:	Operationalization of an exogenous variable.
λ_x(lambda x)	:	Factor loading (measurement coefficient) of an x on its underlying exogenous variable (ξ).
ε(epsilon)	:	Error in the operationalization (y) of an endogenous variable (η).
θ_ε(theta epsilon)	:	A value from the variance-covariance matrix of ε's.
δ(delta)	:	Error in the operationalization (x) of an exogenous variable (ξ).

Symbols/Terms	Explanation
θ_δ(theta delta)	: A value from the variance-covariance matrix of δ's.
ζ(zeta)	: Error in structural equation--it is associated only with η.
ψ(psi)	: A value from the variance-covariance matrix of structural equation errors (ζ's)
ϕ(phi)	: A value from the variance-covariance matrix of exogenous variables.

APPENDIX S

MEANS AND STANDARD DEVIATIONS OF ALL ORDINAL-SCALED OR INTERVAL-SCALED INDICATORS (WITHOUT EXCLUDING OUTLIERS)

Indicator as coded	No. of Responses	Mean	Standard Deviation	Computed from manufacturer Questionnaire Item	Computed from customer Questionnaire Item	Was direction reversed?
DFI1	91	0.5549451	3.1758206	Q-1	Q-1	Yes
DFI2	91	-2.4934066	6.8404159	Q-2	Q-2	No
DFI3	91	0.0912088	5.7360003	Q-3	Q-3	No
DFI4A	91	0.9395604	2.4752499	Q-4A	Q-4A	Yes
DFI4B	91	-0.9505495	2.2706521	Q-4B	Q-4B	Yes
DFI4C	91	-0.3516484	4.1368899	Q-4C	Q-4C	Yes
DFI4CB	91	-0.5989011	3.8146063	(Q4C - Q4B)	(Q4C - Q4B)	Yes
DFI5A	91	0.6813187	2.9006862	Q-7A	Q-5A	Yes
DFI5B	91	-1.0989011	2.1202984	Q-7B	Q-5B	Yes
DFI5C	91	0.2527473	4.8358463	Q-7C	Q-5C	Yes
DFI5CB	91	-1.3516484	4.5175550	(Q7C - Q7B)	(Q5C - Q5B)	Yes
DFI6	83	0.7650602	2.3919802	Q-8B	Q-6B	Yes
DFI7	35	0.1857143	2.9607375	Q-9B	Q-7B	Yes
DFI8	91	0.7527473	4.9622876	Q-10	Q-8	Yes
DFI9	91	0.5005495	3.2335094	Q-11	Q-9	Yes
DFI10	91	1.0302198	4.9652004	Q-12	Q-10	Yes
DFI11BF	91	1.0039560	2.7026460	Q-13BF	Q-11BF	Yes
DFI11AF	91	0.7401099	2.7061656	Q-13AF	Q-11AF	Yes
CDFI1	91	0.8720330	2.4557491	(Q13BF + Q13AF)/2	(Q11BF + Q11AF)/2	Yes
DFI12BF	91	2.1758242	3.2680045	Q-14BF	Q-12BF	No
DFI12AF	91	1.1648352	4.7264357	Q-14AF	Q-12AF	No
CDFI2	91	1.6703297	3.6348772	(Q14BF + Q14AF)/2	(Q12BF + Q12AF)/2	No
DFC1	91	2.1027473	7.2216711	Q-1	Q-1	Yes
DFC2	91	0.8843956	11.2780836	Q-2	Q-2	No
DFC3	91	3.3687912	11.2421513	Q-3	Q-3	No
DFC4A	91	1.1989011	2.8555402	Q-4A	Q-4A	Yes
DFC4B	91	-1.1868132	2.0502688	Q-4B	Q-4B	Yes
DFC4C	91	-0.9065934	5.4374790	Q-4C	Q-4C	Yes
DFC4CB	91	-0.2802198	5.0117688	(Q4C - Q4B)	(Q4C - Q4B)	Yes
DFC5A	91	1.4197802	2.9805003	Q-7A	Q-5A	Yes
DFC5B	91	-1.1593407	2.0410770	Q-7B	Q-5B	Yes
DFC5C	91	-1.2142857	4.2694931	Q-7C	Q-5C	Yes
DFC5CB	91	0.0549451	3.6775978	(Q7C - Q7B)	(Q5C - Q5B)	Yes
DFC6	83	1.1674699	2.0556352	Q-8B	Q-6B	Yes
DFC7	35	0.4542857	2.7843410	Q-9B	Q-7B	Yes
DFC8	91	0.1626088	5.4084157	Q-10	Q-8	Yes
DFC9	91	0.7807692	3.0183123	Q-11	Q-9	Yes
DFC10	91	2.9027198	7.4639721	Q-12	Q-10	Yes
DFC11BF	91	1.5747253	3.1807278	Q-13BF	Q-11BF	Yes
DFC11AF	91	1.1331868	2.8650941	Q-13AF	Q-11AF	Yes
ADF11	91	1.3539560	2.6661301	(Q13BF + Q13AF)/2	(Q11BF + Q11AF)/2	Yes
DFC12BF	91	2.4175824	3.4482393	Q-14BF	Q-12BF	No
DFC12AF	91	2.5000000	5.4853340	Q-14AF	Q-14AF	No
ADF12	91	2.4587912	4.0670191	(Q14BF + Q14AF)/2	(Q12BF + Q12AF)/2	No
CGC1	91	-0.0346154	7.9196826		Q-1	Yes
CGC2	91	0.2692308	10.4698795		Q-2	No
CGC3	91	-0.6615385	11.8391607		Q-3	No

Indicator as coded	No. of Responses	Mean	Standard Deviation	Computed from manufacturer Questionnaire Item	Computed from customer Questionnaire Item	Was direction reversed?
CGC4A	91	0.0824176	2.6397219		Q-4A	Yes
CGC4B	91	0.1813187	1.7135351		Q-4B	Yes
CGC4C	91	-0.1043956	4.0923482		Q-4C	Yes
CGC4CB	91	0.2857143	3.4489474		(Q4C - Q4B)	Yes
CGC5A	91	-0.0769231	2.2272592		Q-5A	Yes
CGC5B	91	0.1483516	1.3874327		Q-5B	Yes
CGC5C	91	-0.3461538	3.7056206		Q-5C	Yes
CGC5CB	91	0.4945055	3.2287721		(Q5C - Q5B)	Yes
CGC6	86	-0.1860465	1.5127818		Q-6B	Yes
CGC7	52	-0.4519231	1.7071350		Q-7B	Yes
CGC8	91	0.4587912	5.0251125		Q-8	Yes
CGC9	91	0.7912088	3.6725831		Q-9	Yes
CGC10	91	-0.4532967	7.5682957		Q-10	Yes
CGC11BF	91	0.1318681	2.9541263		Q-11BF	Yes
CGC11AF	91	0.1318681	2.3128087		Q-11AF	Yes
CGC11	91	0.1318681	2.4233645		(Q11BF + Q11AF)2	Yes
CGC12BF	91	0.5439560	4.5950749		Q-12BF	No
CGC12AF	91	0.5824176	4.8877760		Q-12AF	No
CGC12	91	0.5631868	4.6268530		(Q12BF + Q12AF)/2	No
DAYSINV	91	13.8840659	12.6062945		Q-18	No
SUPIMPT	91	2.0219780	0.7145787		Q-19	Yes
PURCHVOL	91	243.7607582	276.4081109		Q-20	No
MFCSHARE	91	33.3230769	25.1282182		Q-21	No
PASTREND	91	7.1538462	2.2257237		Q-22	Yes
FUTREND	91	6.9120879	1.9128127		Q-23	Yes
SATIS	91	3.4945055	0.9930159		Q-25	Yes
PREF	91	8.0219780	2.1549840		Q-28	Yes
CSEVAL	91	5.5836386	0.6977513		Q-24	Yes
C15	90	2.3222222	1.0367167		Q-15	Yes
C16	89	2.8764045	0.5996254		Q-16	Yes
C26	91	2.0000000	0.7302967		Q-26	Yes
C27	91	2.8021978	0.8846817		Q-27	Yes
COMPNUM	89	8.3764045	13.2446990	Q-17		No
RELPRICE	89	3.4943820	0.6238370	Q-18		Yes
DLRPRICE	84	25.4251190	40.6829230	Q-19		No
DCNUM	90	14.6111111	12.3967144	Q-23		No

APPENDIX T

MEANS AND STANDARD DEVIATIONS OF THE INDICATORS USED IN THE TESTS OF THE RESEARCH HYPOTHESES (EXCLUDING OUTLIERS)

Indicator as coded	No. of Responses	Mean	Standard Deviation	Computed from manufacturer Questionnaire Item	Computed frm customer Questionnaire Item	Was direction reversed?
DFI1	91	0.4917582	2.8282922	Q-1	Q-1	Yes
DFI3	91	0.0692308	5.3556552	Q-3	Q-3	No
DFI9	91	0.3659341	2.7392302	Q-11	Q-9	Yes
DFI10	91	0.5280220	3.1808647	Q-12	Q-10	Yes
CDF12	91	1.5769231	3.2471552	(Q14BF + Q14AF)/2	(Q12BF + Q12AF)/2	No
DFC1	91	1.2291758	2.4721230	Q-1	Q-1	Yes
DFC3	91	2.1600000	4.8314985	Q-3	Q-3	No
DFC9	91	0.6846154	2.6841685	Q-11	Q-9	Yes
ADF12	91	2.3543956	3.5600144	(Q14BF + Q14AF)/2	(Q12BF + Q12AF)/2	No
CGC1	91	0.7071429	3.5594598		Q-1	Yes
CGC3	91	0.4659341	6.0461782		Q-3	No
CGC4A	91	0.1758242	2.3539254		Q-4A	Yes
CGC9	91	0.8296703	3.5704962		Q-9	Yes
CGC12	91	0.5989011	4.4965850		(Q12BF + Q12AF)/2	No
SATIS	91	3.5054945	0.9675126		Q-25	Yes
PREF	91	8.0549451	2.0554137		Q-28	Yes
CSEVAL	91	5.5922100	0.6737786		Q-24	Yes
PASTREND	91	7.1538462	2.2257237		Q-22	Yes
FUTREND	91	6.8901099	1.8526291		Q-23	Yes
PURCHVOL	91	215.9585604	187.0845862		Q-20	No
MFCSHARE	91	33.3230769	25.1282182		Q-21	No

APPENDIX U

Q-PLOT OF NORMALIZED RESIDUALS

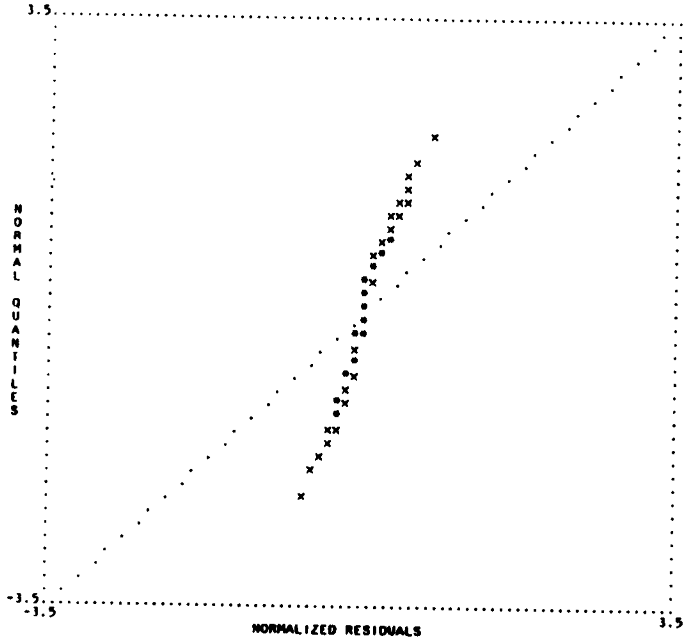

Figure 18: Q-plot from the Test of Hypothesis 1.

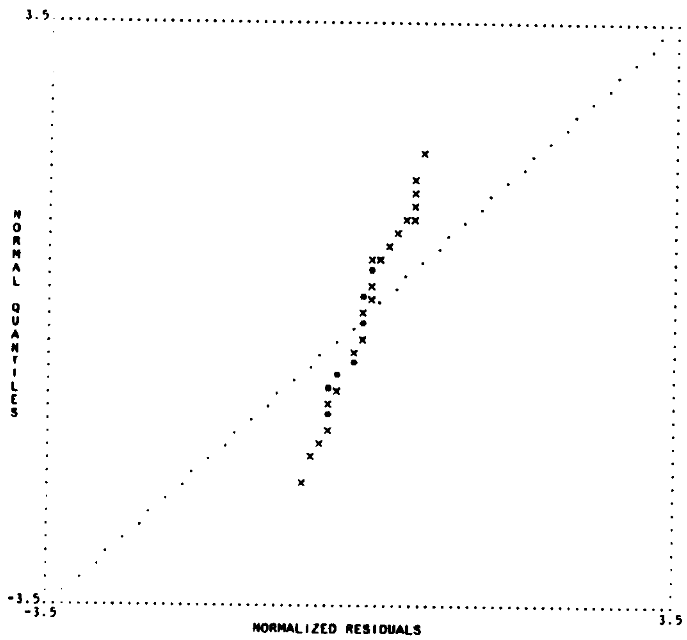

Figure 19: Q-plot from the Test of Hypothesis 2.

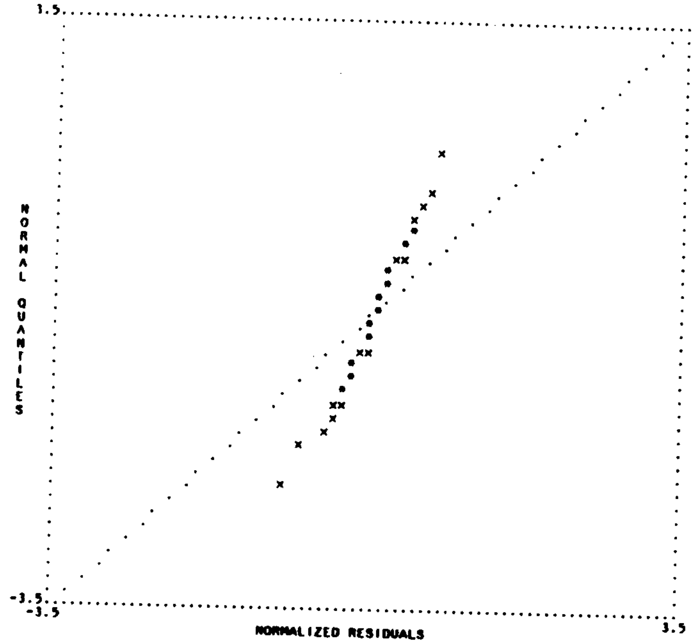

Figure 20: Q-plot from the Test of Hypothesis 3.

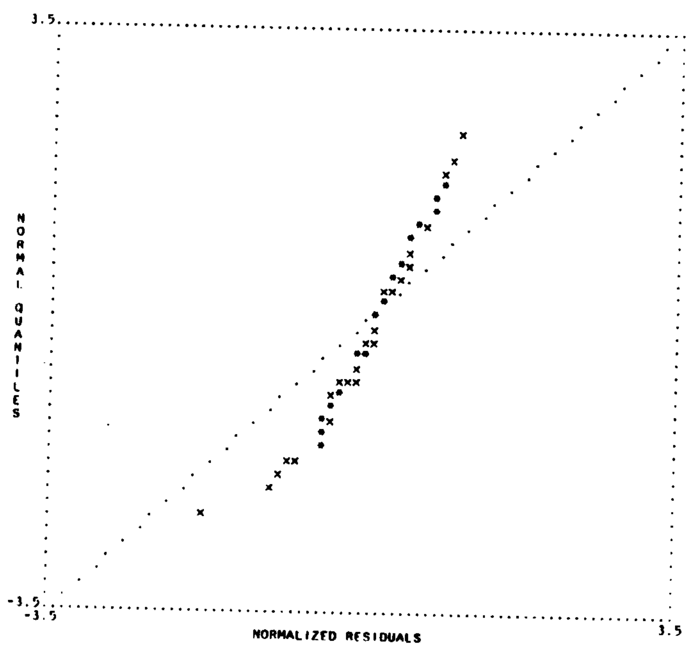

Figure 21: Q-plot from the Test of Hypothesis 4.

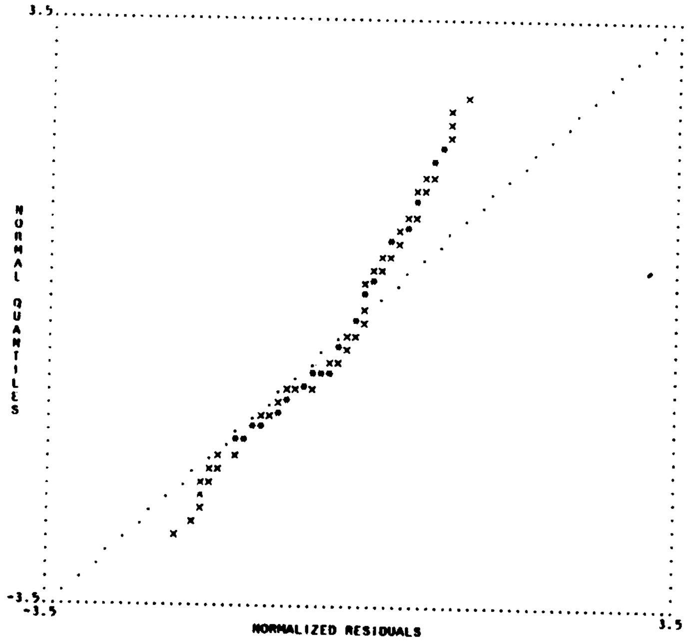

Figure 22: Q-plot from the Analysis of the Complete Model

VITA

Rammohan Pisharodi was born in Tripunithura, Kerala, India, on September 23, 1952. He completed his high school education at Model High School, Trichur. He was awarded the Government of India National Merit Scholarship in 1968 and the National Science Talent Search Scholarship in 1970.

The author received the Bachelor of Science (Honors) degree in Agriculture from Haryana Agricultural University in 1974 and the M.B.A. degree from Panjab university in 1976. From 1976 to 1977 he was employed as a Management Trainee.

He received a second M.B.A. degree from the University of Western Ontario, Canada, in 1980. During his graduate study at the University of Western Ontario, he was a recipient of the Plan for Excellence Fellowship.

The author joined the University of Tennessee as a doctoral student in Business Administration in September 1980. From 1980 to 1983 he was employed as a graduate teaching assistant. During his doctoral studies he was awarded the Capital Gifts Fellowship (1980), the Burlington Industries Fellowship (1981, 1982), the American Marketing Association Doctoral Consortium Fellowship (1982), and the Walter Melville Bonham Fellowship (1983).

He received the degree of Doctor of Philosophy with a major in Business Administration in 1985. His academic major is in Transportation and Logistics and his minor is in Marketing. He is a member of the Council of Logistics Management, the American Marketing Association, the Southern Marketing Association, and Division 23 of the American Psychological Association

The author joined the faculty of Virginia Polytechnic Institute and State University as an Assistant Professor in September 1983.