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AN INVESTIGATION OF THE EFFECTS OF
ORGANIZATIONAL AND ENVIRONMENTAL VARIABLES
AND SOURCE LOYALTY
ON THE MOTOR CARRIER SELECTION DECISION

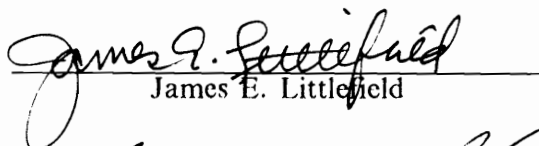
by

Satya Prasad Chattopadhyay

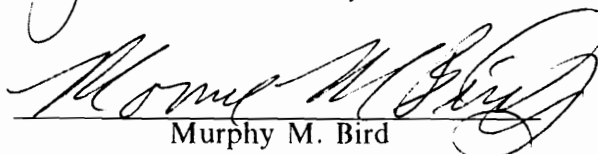
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APPROVED:


John T. Mentzer, Chairman


James E. Littlefield


Kent B. Monroe


Murphy M. Bird


Loren P. Rees

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(ABSTRACT)

Recent interest in logistics and physical distribution has fueled a move to position such activities as mainstream marketing functions. Transportation has been of particular interest due to the changes in the regulatory environment in the United States in the last decade. The changes have resulted in an extremely competitive market facing the carriers, and have provided shippers with a strategic opportunity to use physical distribution as a competitive tool in the marketplace.

Research in the past in the area of transportation purchasing has focussed on identification of carrier characteristics that are considered important in the selection process. The present study viewed purchasing of transportation as an organizational service buying phenomenon. The carrier selection decision was viewed within the framework of the Sheth (1973) model of industrial buying behavior.

Organizational characteristics, environmental variables and source loyalty toward existing carriers were empirically investigated to determine their influence on the locus of the shippers carrier selection decision. The impact of the variables above on the development of criteria for carrier selection was also investigated. The impact of

shippers' source loyalty toward existing carriers on the buyclass variable, and the decision outcome were also investigated.

Organizational variables such as terms of shipment used, nature of firms business, and usage of intermodal carriage were found to have significant relationship to the locus of the carrier selection decision. Among environmental variables, sources of information that were utilized had a significant relationship to the locus of the carrier selection decision. Source loyalty toward existing carriers was found to be positively related to the frequency of purchase situations that were classified as routine purchase. Carrier selection criteria used by shipper firms were found to differ as the firms differed in their organization characteristics and environmental variables facing them.

The results of the study provide an empirical test of a portion of the industrial buyer behavior model (Sheth 1973). The results provide carrier companies with tools to segment their potential market, and knowledge of the shippers carrier selection decision process.

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CHAPTER 1

INTRODUCTION

RATIONALE FOR RESEARCH

The physical distribution and logistical functions of a firm have received increased attention from researchers in the past 25 years, as is evidenced by the concerted effort to draw logistics into the mainstream of the marketing literature (Stewart 1965; Stephenson and Willett 1968; Saleh and LaLonde 1972; Perreault and Russ 1976; Anderson and Constantin 1978; Dempsey 1978; Krapfel and Mentzer 1982; Mentzer and Pisharodi 1988). A recession in the economy in the 1970's, profit squeeze and increasing awareness that scarce resources have to be utilized to their maximum potential have forced marketers to evaluate critically all facets of their activities. In the 1980's, and going into the 1990's, growing pressure of foreign competition and the streamlining of operations necessitated by corporate mergers and buyouts resulting in

huge debt burdens have made increased profitability a priority. Reduction in physical distribution and logistics costs go a long way to improve the bottom line performance of a firm. A relatively small reduction in distribution and logistics expenses can have the effect of increasing the firm's profitability that would otherwise have been possible only through a large increase in sales (the leveraged effect of logistics economies). This thrust for strategic cost control that businesses have been subjected to, coupled with the leveraged effect of economies achieved in the area of logistics and physical distribution on the firm's overall profitability has been an added incentive for focussing interest of practitioners and academicians alike (Coyle and Bardi 1968; Walters 1988). This area, which comprises the decisions related to the 'place' utility that a marketing mix aims to provide, appears to have substantial scope for improvement.

Side by side with the recognition of the importance of the distribution function in marketing, the deregulated environment brought about by various legislation in the last two decades has had a significant effect on the transportation industry in general. The transportation purchaser now has the opportunity to exercise significant market buying power through negotiation on price and service characteristics with competing transportation providers (Bardi, Bagchi and Raghunathan 1989). Transportation purchasing before deregulation had been a seller's market, and with very few options, almost an uncontrollable element as far as the firm was concerned. On the supply side, the transportation market now offers a wider variety of choice in terms of intermodal possibilities, competing carriers within a mode and a wide spectrum of service characteristics. It is of interest to understand how the shippers' freight purchasing process has been affected in view of this deregulated environment. This understanding will be of importance to transportation providers who will find the information useful in identifying and catering to the needs of the customers for which they now have to compete.

ROLE OF TRANSPORTATION PURCHASING IN MARKETING

The framework of decision-making in transportation choice is shown in Figure 1. The strategic marketing objectives and plans together with the more specific product objectives and plans translate into the strategic distribution objectives. Tactical decisions are then made regarding the mode and legal forms of transportation that will meet the distribution objectives. At the next level, the decision to select a particular carrier within a given mode and legal form is taken. In the deregulated environment, the proliferation of intermodal service, and the blurring of competitive distinction between modes, choice of carrier companies have become increasingly important (Coyle and Bardi, 1980). Baker (1984) predicted that choice of carrier, rather than choice of mode will be the premier transportation decision. The focus of this research is to examine the carrier selection decision.

The motor carrier transportation industry has undergone a major restructuring during the past decade. Rate bureaus have ceased to be the ultimate authority for setting transportation rates. Passage of the Motor Carrier Act of 1980 removed the stringent barriers to entry and exit, throwing open the industry to competitive pressures for the first time in almost 50 years (Raghunathan, Bagchi and Bardi 1988). This mode of transportation accounts for a large portion of manufactured products as well as more than 75% of the tonnage of agricultural products such as fresh and frozen meats, dairy products and bakery products. Most consumer goods are transported by motor carriers at some point in their distribution (Stock and Lambert, 1987). Common carriage is the most used legal form within this mode. In view of the pre-eminence of motor carriage usage in physical distribution, the focus of this research is specific to carrier selection for common carriage to meet the firm's physical distribution goals.

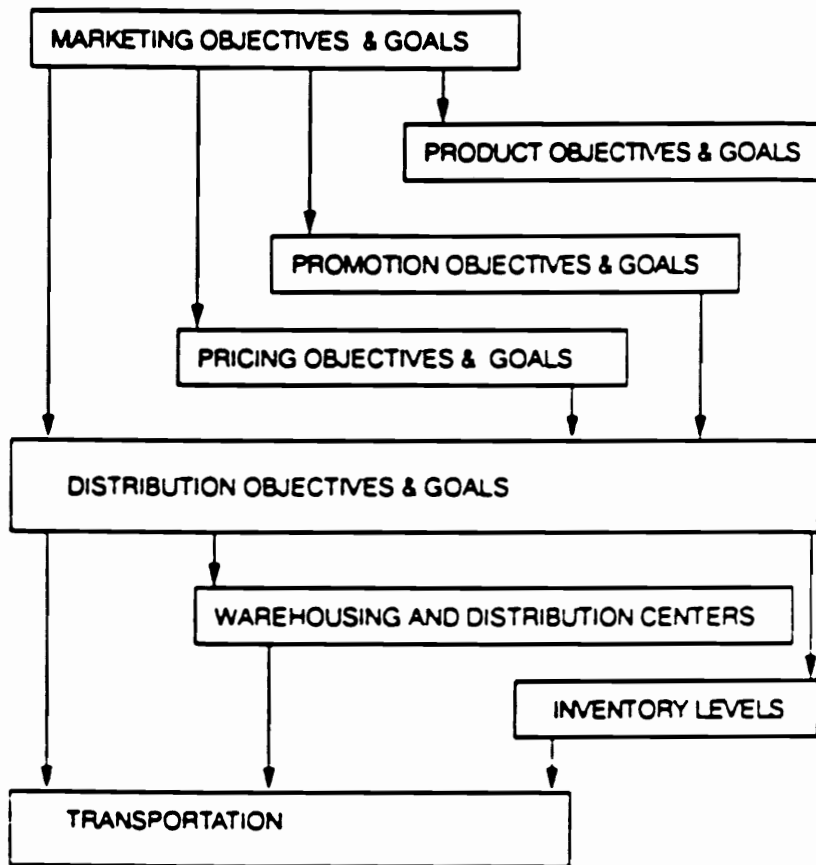


Figure 1. Role of Transportation in Marketing Strategy (Source: Lambert and Stock, 1982)

With the transition of the common carriage purchasing market from being seller dominated to one that is buyer dominated in the deregulated environment, providers of the service now recognize the need to have greater understanding of the carrier selection process in order to segment the shipper market, and create unique price and service attribute bundles to serve their customers and differentiate themselves from their competitors.

The objective of this research was to examine the carrier selection decision in purchasing of common carriage transportation. Transportation purchasing was investigated as an industrial service purchasing phenomenon. The effect of organizational characteristics and environmental variables on the carrier selection decision was examined. The effect of source loyalty on the carrier selection decision was also of interest. From a theoretical standpoint, the study provided insights as to the role of various influences on industrial buying behavior. Empirical evidence in support of the Sheth (1973) model was also found. Such a model of the carrier selection decision in transportation purchasing will have extensive practical application in this vital area of business operations. It will provide guidance to transportation providers in segmenting the motor carriage purchasing market, and achieve unique product-market fits with one or more of such segments. It will also provide support to establish transportation purchasing as a legitimate industrial purchasing phenomenon, which can draw on the theoretical base of the literature in organizational buying.

CARRIER SELECTION RESEARCH OVERVIEW

The literature in the area of carrier selection in transportation purchasing is relatively sparse, and particularly so in terms of empirical work that specifically addresses the issue in the deregulated era of the 1980s. The major studies that were located from before 1980 are few. Saleh and Lalonde (1972), Evans and Southard (1974), Stock (1976), Stock and Lalonde (1977) and Anderson et al. (1978), dealt with transportation purchase relevant to the search. Since 1980, some of the published research relevant in terms of conceptual and empirical examination of the domain were those of Krapfel and Mentzer (1982), Slater (1982), Mentzer and Pisharodi (1988), Raghunathan, Bagchi and Bardi (1988) and Bardi, Bagchi and Raghunathan (1989). While the first of these studies examined both modal choice as well as carrier selection within a mode, the second study dealt only with the impact of deregulation on the modal choice decision of the shipper, that is, the buyer of transportation. Mentzer and Pisharodi (1988) advocate the study of transportation purchasing as an industrial service purchasing phenomenon. Only Raghunathan et al. (1988), specifically looked at transportation purchasing in a deregulated environment, seeking to identify the key factors that affect supplier choice in the motor carriage purchasing market.

In reviewing this literature, it was felt that only a very superficial treatment of transportation choice has been provided. A reason for that is probably the fact that there has been no systematic attempt to link the research to a theoretical basis. As a consequence, no substantial knowledge as to how managers decide on a particular mode of transportation for their products¹, or how they make a choice among alternate vendors of such service within a given mode is available. Specifically there appears to

¹ Except for Krapfel and Mentzer (1982) which will be discussed later.

be no knowledge as to how the criteria of various parameters involving transportation purchasing came to be developed.

The research stream has focussed on attempts to identify the various important carrier selection determinants. These determinants have generally fallen under the broad categories of cost, transit time, reliability, capability, accessibility and safety considerations. The decision-making process of choice has been the evaluation of these criteria in terms of their respective impact on the overall logistics costs.

There has been little attempt to investigate how the relative importance of criteria change among transportation buyers. There has been evidence that relative importance of various criteria have changed with recent changes in the regulatory environment (Bardi et al. 1989).

The application of models to transportation selection has been driven by cost minimization algorithms. The classical economic model of comparing the total of fixed and variable costs over relevant operating ranges has been used to predict choice between competing carriers as well as modes. An inventory-theoretic model (Baumol and Vinod 1970) attempts to minimize the sum of transportation costs and inventory related costs such as carrying costs and ordering costs. Further generalization resulted in models that classified all costs as transportation and non-transportation, and transportation selection is based on different trade-offs that may be possible.

These models are all economic models and provide for least cost solutions to the transportation choice decision. However they all lack the theoretical and conceptual ability to look at non-cost variables, and their impact on the choice decision. It is only in recent years that there has been an effort to integrate transportation purchasing as a mainstream "industrial service purchasing phenomenon" (Mentzer and Pisharodi 1988). Such integration opens the door to a conceptual basis for research into the phenomenon.

If the scope of the discussion is further broadened, the literature in industrial buying itself took a long time to reach out beyond the realm of the rational economic behavior explanation, which is the implicit basis for the various transportation choice models described above. What was studied was a so called logical and sequentially executed series of rational decision making stages and the tasks associated with each of them. The criticism of this stream of research has been that the preoccupation of research with the activity components of the buying process has resulted in the systematic neglect of the understanding of "who" performs which activity, and why there are differences across firms (Nicosia and Wind 1977). The research stream substantially ignored the impact of interpersonal communication that goes on behind each purchase decision, and focused instead on intrapersonal dynamics and attempts at maximizing the individual expected utility.

A second stream of research has argued that there is nothing inherent in the organizational buying process that would preclude the the role of non-task factors such as interpersonal influence, power, reputation, ego-enhancement and the like from being major mediating factors. This class of non-task models would answer the Bonoma and Zaltman (1978) criticism regarding preoccupation with individuals and individualistic variables in the study of organizational buying behavior. They refer to it as 'reductionist' and contend that "it only serves to take a rich and complex problem and break it down into component parts. The process is not productive, leads to spurious conclusions, and the transactional aspects of the process are lost beyond recovery". The non-task models pave the way for moving from the individualistic to the dyadic and organizational group perspectives.

The emphasis, in industrial buying, on the need to systematize procedures and activities, it is felt, should not undermine the necessity to understand the underlying organizational processes involved.

The research stream of the so called "complex" models that incorporate the features of both the task and the non-task models have gained increased acceptance in the literature as the preferred representations of the organizational buying process. Models of organizational buying behavior have been successfully applied to the context of purchasing of services (Uhl and Upah, 1983). Mentzer and Pisharodi (1988) provide support for presenting transportation purchase as an industrial purchasing phenomenon, and utilizing the conceptualizations of complex organizational buyer behavior models to study transportation purchase and carrier selection. Knowledge of the interactions of the various elements of the phenomenon will lead to a better understanding of the process.

Finally, from a methodological standpoint, use of sophisticated statistical tools have become increasingly common in the area of industrial buying behavior research, allowing for analysis of the complex relationships hypothesized by the hybrid models now being used to describe the domain. In contrast, the tools employed in transportation purchase research, more often than not, have been limited to elementary descriptive statistics. Now that more powerful multivariate analysis techniques are available, collection instruments and methods need to be such that the data generated is of the level where such sophisticated analysis is appropriate.

Lack of large samples and constraints on the type of sampling procedures have also often prevented rigorous testing of the few models that have been developed. Research in the area of transportation purchasing must now meet the established standards of rigor for industrial buyer behavior research at the present time. This will require carefully designed studies with appropriate sampling plans, and special attention needs to be paid to reliable instrument design in the context of inference procedures that address critical reliability and validity issues.

RESEARCH OBJECTIVES

The objective of this research was to examine the motor carrier selection decision in transportation purchasing as an industrial purchasing phenomenon. The locus of the carrier selection decision, whether it is internal or external to the shipper organization was to be examined. The effect of relationships of organizational characteristics and environmental variables to the locus of the carrier selection decision was to be examined so as to provide carrier companies with a better understanding of their market. The information would also provide carrier companies with information leading to meaningful market segmentation allowing for efficient target marketing.

A second objective of the research was to refine and implement a scale to measure source loyalty in the context of motor carrier transportation purchasing. The impact of source loyalty on the locus of the carrier selection decision was also of interest. Impact of source loyalty on the buyclass classification of the carrier selection decision was examined to see if higher source loyalty was associated with more carrier selection decisions being classified as routine purchase situations. The effect of source loyalty on the carrier selection decision in terms of retention of existing carriers in the event of a reevaluation of purchase situation was examined.

Finally, it was of interest to see if the criteria used to evaluate carriers for selection differed when the shippers differed in terms of the characteristics of their organization, the environmental variables facing them, and the source loyalty exhibited toward existing carriers. Effect of the relationships were investigated for both new purchase and reevaluation of purchase situations in all cases.

It was also an objective of this research to provide a realistic setting of traffic managers who actually make the transportation selection decision for this study. The

results of the study were also intended to provide empirical verification of the industrial buying behavior model of Sheth (1973) in the transportation purchasing setting.

OVERVIEW OF RESEARCH METHODOLOGY

A mail questionnaire survey was conducted to gather information from a population of commercial and industrial traffic executives in United States. Detailed information regarding organizational and environmental characteristics faced by the shipper as well as carrier evaluation criteria employed were obtained. The questionnaire also measured the extent and nature of source loyalty towards existing carriers. There is support in the literature for a mail survey under these circumstances (Kanuk et al. 1975; Armstrong et al. 1977; Dillman 1978; Pressley 1980).

The sampling method employed was probability sampling in order to enhance statistical conclusion validity and estimate sampling error for the research. This also ensured that the sample was representative of the population.

The analytical techniques used were t-tests, chi-square tests, and regression analysis. In addition, canonical correlation was used to test some of the hypotheses. Both SAS and SPSSX statistical packages were used to run the data analysis routines.

SUMMARY

This chapter has briefly introduced the research topic and the rationale behind it. The ensuing review of the literature lays out the different conceptualizations of the

industrial buying process and identifies the particular structure of a model that is an appropriate starting point for developing a realistic model of the transportation purchase process for firms. The review of the current knowledge base in the area of transportation purchasing provides the necessary background for the model development phase. Specifically, the model explicates the role of environmental variables, organizational characteristics and industrial source loyalty in the supplier selection process in motor carrier transportation purchasing.

The model contributes to the understanding of the transportation purchasing phenomenon in that it goes beyond a simple enumeration of the parameters of transportation purchasing, and establishes a basis of why the parameters become relevant, using organizational and environmental variables and industrial source loyalty as explanatory constructs. Contribution has been made in the form of developing and refining a measure for industrial source loyalty in the context of transportation purchasing.

The model developed has value in terms of managerial implications. The transportation companies will now have a better handle in segmenting their market and developing superior products in a competitive marketplace. The results will also add to the body of knowledge in the area of the organizational buying behavior through an empirical verification of the Sheth (1973) model. Increased understanding of the role of source loyalty in the context of purchasing of services in organizational buying is another notable contribution.

In the schema presented by Wind and Thomas (1980), this study contributes in the areas A, B, and C directly, in the context of purchasing of motor carrier transportation (See Figure 2).

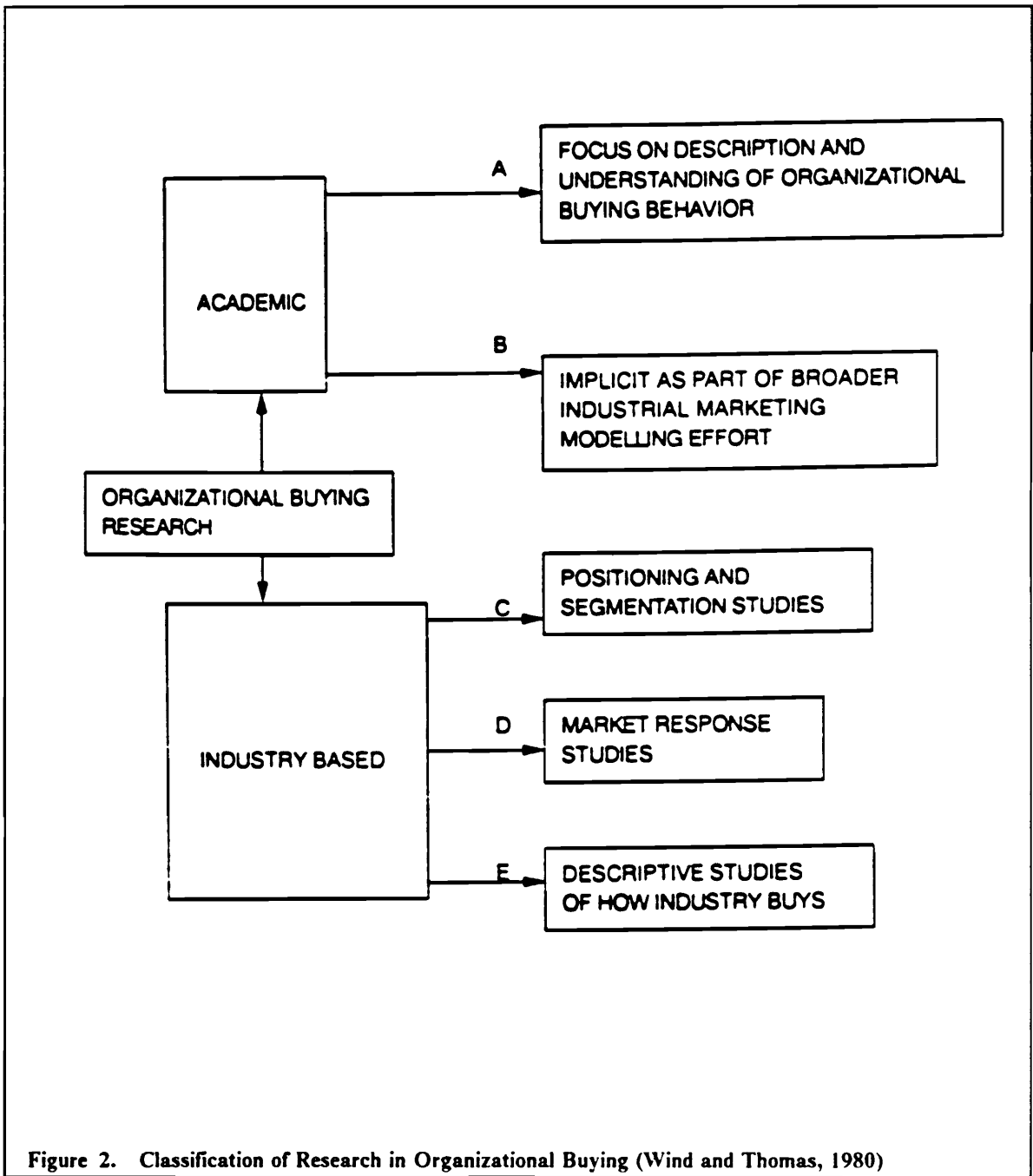


Figure 2. Classification of Research in Organizational Buying (Wind and Thomas, 1980)

OVERVIEW OF CHAPTER 2

The next chapter is devoted to a review of the available literature in the area of organizational buying and the issue of transportation purchasing. The various methodological approaches that were used to study the phenomenon of transportation purchasing are also reviewed and critiqued. A critical assessment of the substantive knowledge about the carrier selection process is then presented. Based on the above review, a model of motor carrier selection is presented together with the conceptual definitions and discussion of the constructs. The model

- a) Relates the internality / externality of the carrier selection decision to organizational variables, environmental variables and source loyalty of the buyer towards the carrier, and
- b) Criteria for carrier selection to the firm's organizational variables, the environmental characteristics it faces and its source loyalty towards existing carriers with which it does business.

Following from the model, several propositions describing relationships among the variables are also presented.

OVERVIEW OF CHAPTER 3

Chapter 3 briefly reviews the conceptual premise for the model, and develops the hypotheses tested in this study. A detailed research design for empirically testing the

hypotheses is then described. The development of the research instrument is presented, as are the methods for collecting and analyzing the data.

OVERVIEW OF CHAPTER 4

Chapter 4 presents the procedures used for the analysis of the data and the findings from the tests of the hypotheses. The results of each test is presented and discussed.

OVERVIEW OF CHAPTER 5

Chapter 5 presents a brief overview of the study, followed by the major conclusions. Contributions and implications for both the theory and practice of marketing is discussed. Finally a discussion of the limitations of the study together with directions for future research are presented.

CHAPTER 2

LITERATURE REVIEW

LITERATURE SEARCH METHODS

The literature search undertaken for this review was meant to be exhaustive so far as the area of primary interest i.e. transportation purchasing, was concerned. However it was realized that the results would be meager and attempts at explicating concrete information from such a small and fragmented body of research was futile. It was then decided that the objective should be to establish instead the current state of knowledge in the area organizational buying, then establish which conceptualization is best suited for the purpose of modeling the transportation purchasing function. In this case however the problem was that of an overabundance of studies. More than one thousand references can be obtained for this area as Bonoma et al. (1977) report.

Marketing sources have been the principal source of retrieval for studies for this review. The principal journals searched have been Journal of Marketing, Journal of Marketing Research, Industrial Marketing Management, International Journal of Physical Distribution Management, Transportation Journal, Journal of Purchasing, Journal of Business Research and the Journal of Business Logistics.

Another method that was freely used was the ancestry approach. A number of studies were retrieved working backwards from the bibliographies of certain relevant research work. Dissertation abstracts were another source of tracking down relevant past research. The intention was to present a broad spectrum of conceptualization across the literature, with an example of each type.

OVERVIEW

This chapter assesses the issues and factors that impact on a shipper's decision-making process that culminate in the selection of a motor carrier to meet the transportation needs of the firm. First, the literature in the area of organizational buying behavior in marketing is reviewed in order to establish a conceptual base for building the carrier selection model. The literature on transportation purchasing, and purchasing of motor carrier transportation in particular is examined in detail in the next section. Together, the discussion of the two areas, and the proper synthesis, provide the basis necessary to build the model for this research. In the last section the model is developed together with the conceptual definitions of the constructs.

ORGANIZATIONAL BUYING BEHAVIOR

Webster and Wind (1972) discussed at length complex mechanisms and dimensions involved in the buying decision in an organizational context. The framework they provided is still a very relevant basis to begin this discussion. They defined organizational buying behavior as "the decision-making process by which formal organizations establish the need for purchased products and services, and identify, evaluate and choose among the alternative brands and suppliers."

Following their direction and also that provided by Bonoma et al. (1977), the existing streams of research in the Organizational Buying Behavior area can be classified into three types:

1. Task Models
2. Non-Task Models
3. Complex Models

TASK MODELS

Task models have been in the past the mainstay for those trying to deal with the phenomenon of organizational buying. In part, maybe owing to the roots of the marketing discipline in economics, the image of the "rational man" has had an enduring appeal. This approach to the problem has been to view organizational purchasing as an organizational task. "Task" is the work to be performed in accomplishing the objectives of the organization (Levitt 1965).

In these task models the objective of the industrial buyer is to perform certain "tasks" as: obtain the lowest price and cost-in-use (Ammer 1962i), meet reciprocal arrangement requirements (Ammer 1962ii), or obtain the best combination of price, quality and delivery of service. This simplistic view of the purchasing agent as a clerk matching "requisitions" from management and "information" from salesmen and supplier catalogs, and matching specifications for the lowest priced alternative and completing the paperwork, is criticized strongly in the literature as being unable to explain situations where "emotional" variables intervened, and a purchasing agent went with a supplier with other than the lowest price.

A "task model" such as described is useful as a descriptive tool in understanding the basics of organizational buying behavior as a series of sequential activity oriented decision making. The question as to why some of the tasks are performed differently by different individuals in different organizations under different circumstances is not addressed. The conceptual richness of the interpersonal, interorganizational and intraorganizational aspects of the decision-making process is largely ignored by this stream of research (Webster and Wind 1972).

Questions such as what sources of information are utilized by the buyers, how criteria are developed, how criteria are evaluated, and what actions can be taken to affect the outcome of a modified rebuy or a new task buying situation were not adequately addressed by these task models. These models lacked the focus on the process of how each buy phase was executed.

NON-TASK MODELS

The models that try to explain organizational buying behavior using "non-rational" or emotional criteria, fall into the category of non-task models as

described by Webster and Wind (1972). These models emphasize variables such as perceived risk, personal goals, internal politics and interpersonal relationships. These models also attempt to account for the influence of environmental and organizational variables. Among the older studies of this type, the purchasing agent's interest in obtaining promotion and personal favors (Matthews et al. 1972), ego enhancing behavior and risk reducing behavior (Levitt, 1965) were examined and found to have significant effect on the buying decisions.

Peters and Venkatesan (1973) documented the impact of company size and nature of the industry on the organizational buying decision in terms of the degree of formalization of the buying process and the sophistication and size of the buying center. Gronhaug (1976) concluded that perceived competition and perceived scarcity of budgets were both related to differences in buying behavior. Spekman and Stern (1979) found increased influence of purchasing agents over the purchasing decision with higher levels of environmental uncertainty.

The groundbreaking work of Wind (1970) introduced the concept of source loyalty² as a potential explanation for purchase patterns in the industrial markets. As a behavior, loyalty is so common in industrial markets, that Morris and Holman (1988) argue that it has come to be viewed as a norm, and relegated to a low priority in terms of potential for further investigation. This probably explains why until the recent works of Morris and Holman (1988) and Morris, Avila and Burns (1989) there has been a noticeable lack of research in that area.

² Source loyalty is defined as the behavioral pre-disposition of the buyer towards repurchasing a vendor's product or service.

The Webster-Wind Model

Webster and Wind (1972) conceptualize organizational buying behavior as a decision-making process carried out by individuals, in interaction with other people in the context of a formal organization, and the environment. The model identifies four categories of variables: individual, social, organizational and environmental, that influence buying decisions as described by the task models. These categories affect the buying decision in the context of a buying center that comprises the set of individuals who interact to effect resolution of the decision making process. Buying center members were seen playing various roles in the process, and multiple roles are not ruled out for any one or more individuals. The authors enumerated organizational variables such as nature of business, performance, hierarchical structure, technological sophistication and employment characteristics as affecting the dynamics within the buying center. Gronhaug (1976) suggested that not only do the variables describe the organization, but may also “partly map its environmental relationships.”

Environmental variables comprising of socio-cultural, political, regulatory, economical and competitive conditions also were identified as sources of influence on the behavior of the members of the buying center. The authors suggested environmental variables influence the buying decision in four ways:

1. by defining availability of the product sought, physical and technological factors are accounted for
2. general economic conditions faced by the buyer, as well as the end customer, including economic and political indices

3. the values and norms that govern interorganizational and interpersonal relationships mediate organizational buyer behavior, and are the product of cultural, social, legal and political forces.
4. control of the information sources that are open to the organization through mass media and other personal or impersonal sources.

The important contribution of the model is that it provides a comprehensive enumeration of the various factors of a non-task nature that are relevant to the organizational buying situation. However, it does not specify the linkages between the non-task variables it identifies and the task variables of the earlier models.

Zaltman and Bonoma (1977) suggested intrafirm and intradepartmental considerations will have a strong influence on the locus of the industrial buying decision. They suggested strongly that how judgments are made in the buying center and how they are integrated amongst members from different functional areas, needs to be evaluated. The phenomenon of joint purchasing, and the interpersonal dynamics of people attaching differential weights to different criteria when making decisions on organizational buying requires a thorough investigation of organizational variables and their effect on the decision process.

The implications of the above to marketing strategy is still that careful and thorough investigation will have to be made when a seller attempts to market to the buyer, as to the nature and extent of the environmental variables, and the institutions that are instrumental in exerting that influence.

COMPLEX MODELS

An understanding of this type of a model can be accomplished by reviewing two of the most well known examples: the buygrid model and the industrial buyer behavior model.

The Buygrid Model

The buygrid model developed by Robinson, Faris and Wind (1967) describes the organizational buying decision as a sequential decision process. The authors identify eight stages or phases, whose existence and duration depend upon the purchase situation. The eight phases are:

1. Anticipation or recognition of a problem (need);
2. Determination of the characteristics and quantity of the needed item;
3. Description of the characteristics and quantity of the needed item;
4. Search for and qualification of potential sources;
5. Acquisition and analysis of proposals;
6. Evaluation of proposals and selection of suppliers;
7. Selection of an order routine;

8. Performance feedback and evaluation;

The choice criteria has, in these models, been designed to minimize cost, minimize price paid, or in the case of a constrained choice, employ some optimization routine such as minimizing total cost. A good example of this is the Ballou and DeHayes (1967) model which has shippers evaluating inventory carrying costs and cost of damage to inventory as trade-offs against low tariff options, looking for a lowest total cost of distribution.

The purchase situations were conceptualized as buyclasses:

1. New-task
2. Modified Rebuy
3. Straight Rebuy.

These buyclasses were defined on the basis of three dimensions: 1) the newness of the particular purchasing problem, 2) the amount and kind of information required, and 3) the extent to which new alternatives were considered. The buyphases and buyclasses will now be discussed in detail, to see how the model works.

Phase I is the problem recognition stage, where a change has been perceived, requiring some kind of action. The change would be anything from a reorder from an existing customer for a product which is currently being purchased by that customer, who is also at the present time satisfied with the order of things, to the order for a new product from a new customer. Any change that falls within this continuum can be the trigger that sets the model in motion. The change potentially kicks off the problem solving behavior.

Phase II is an evaluation of what actions are necessary, and an internal specification of such requisite action as determining the characteristics and quantity of the item sought. In the event such description and knowledge of the item sought is not readily available, Phase III will consist of developing the same.

Phase IV consists of the search for, and if necessary, pre-qualification of potential sources. Acquisition and analysis of the proposals from such pre-qualified sources consists of phase V.

Phase VI consists of evaluating, and if necessary determining a criteria for the evaluation of the proposals in order to select the supplier. Phase VII is the selection of the supplier and setting in motion the formal ordering process.

Phase VIII is the post-purchase evaluation of the decision that impacts on whether the supplier will be considered as a potential source should the same or a similar need arise in the future.

Having looked at the "Buyphase" aspect of the Buygrid model, it is now useful to look at the "Buyclass" aspect in the context of transportation purchasing.

A "straight rebuy" situation occurs when a shipper is faced with a repeat order from an existing customer who is satisfied with the level of service from a previous experience. In purchasing transportation, the shipper is faced with a routine transaction in which there is no need to change from previous response to a similar situation. The shipper has sufficient knowledge that the previous carrier has the service characteristics and ability to meet the need. As such the previous supplier is chosen without any further reevaluation. Such routine decisions are usually autonomous rather than joint.

A "modified rebuy" takes place when there arises need for additional information to make the purchase decision. Situations where there is some change in the buyer-seller domain are generally the triggers for this type of situation. A change in

the shipper's market definition resulting in realignment of routes, minor change in freight characteristics, change in service characteristics of the previous carrier or availability of improved price and or service characteristics will necessitate a search for more information to reevaluate suppliers. Alternatives available may have changed, but that information is available. As the terminology suggests, a limited amount of reevaluation is done, and the previous decision may or may not change. A modified rebuy decision is more likely to be a group decision than a straight rebuy decision.

A "New task" is a situation where a new product that has not been previously shipped, or a new destination that was not served before or a new product-market configuration or a combination of such events triggers the decision process to select a new carrier. Little or nothing may be known about the constraints of the situation, and a thorough investigation will probably be required to develop a set of new carrier specifications. Additionally, information may also have to be obtained as to the availability of specified carriers in the market. Finally, a new set of criteria may have to be developed for evaluation and selection of the carrier as parameters of the transportation needed and the characteristics of available alternatives may have changed radically.

While the above model is empirically based and, in a case study approach, verified the existence of multiple buying participants and identified the eight stages, the statistical significance of the model, was not tested with a large scale data base (Bellizzi and McVey 1983). Even though the model is a staple in any discussion of organizational buying, its lack of empirical validation is a constant source of criticism. Bellizzi and McVey (1983) found a general non-significance of the buyclass variable as a predictor of industrial buying influence. Webster and Wind (1972) criticized the model for offering "little insight into the complex interplay between task and non-task variables."

The Industrial Buyer Behavior Model

The industrial buyer behavior model developed by Sheth (1973), and used by Krapfel and Mentzer (1982) is another example of the complex models of organizational buying behavior. The model seeks to explain the broad spectrum of industrial buying decisions of a wide range of complexity, presenting the interactions of a large number of variables in a complicated stimulus response format (See Figure 3). The model focuses on joint decision-making phenomenon among the participants in the decision process. The model considers individual differences of the buying center participants and other company specific and product specific variables to predict the locus of the evaluation of alternatives and selection decision. Criticism of the Sheth model, similar to that of the Buygrid model is that of lack of empirical testing in a systematic manner.

Other Models of Organizational Buying Behavior

In their industrial market response model, Choffray and Lilien (1978) used variables such as information availability and consumption, organizational requirements, external constraints, individual perception and evaluative criteria to determine the external measure component. These, and the marketing support given to the product involved as controllable variables, affect the locus of the decision process component. The last consists of the four sub-models depicting awareness, acceptance, individual evaluation and group decision process.

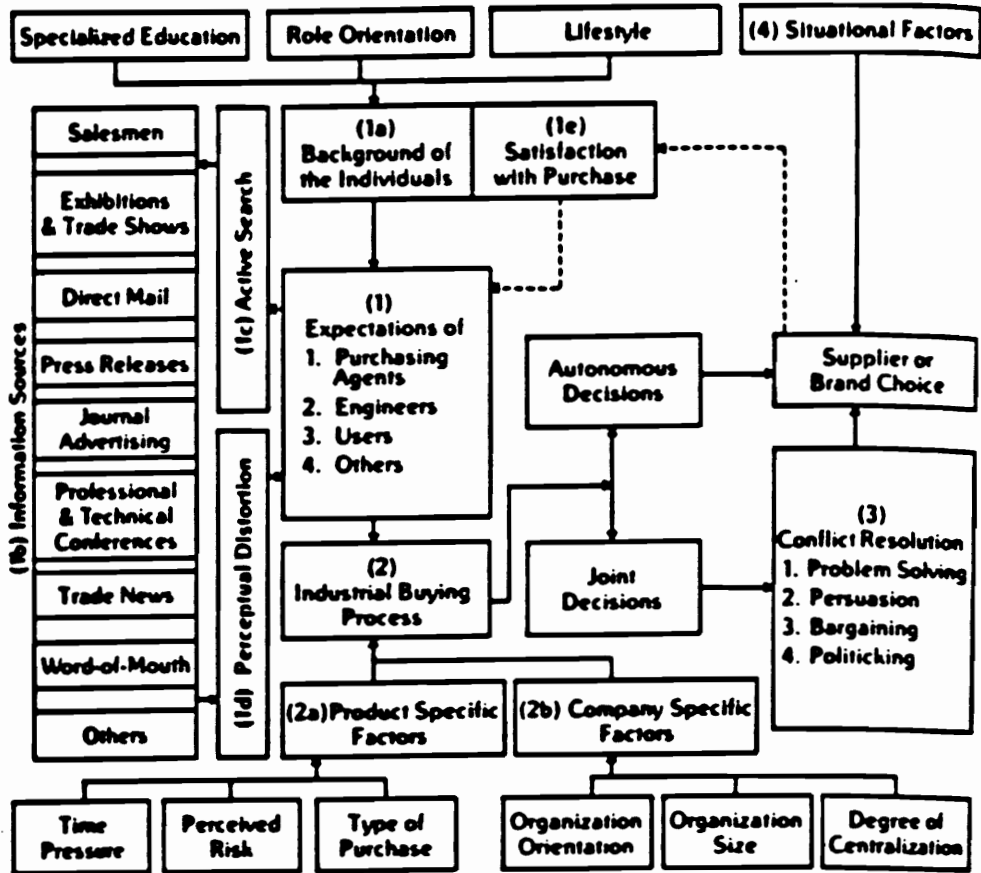


Figure 3. Industrial Buyer Behavior Model (Sheth, 1973)

Choffray and Lilien (1978) suggested that the awareness sub-model will account for the differences in information sources of the different categories of decision participants in the buying center or the decision-making unit. The influence of the environmental factors specifically affect the acceptance sub-model as constraints defining a feasible set of product alternatives, as do individual preferences and perceptions the individual evaluation sub-model. The strength of this model is that it provides a means of operationalization of the buying process suitable for empirical validation as opposed to the other complex models.

Spekman (1977) in his model conceived of a decision making unit as the buying center whose structure is determined by the nature of the communication flow associated with the industrial buying process. Spekman and Ford (1977) saw the structural determinants as various organizational factors such as:

- Centralization- the degree to which authority, responsibility and power are concentrated in the organization.
- Formalization- the extent to which activities in an organization are defined by rules and procedures.
- Complexity- the degree to which tasks are differentiated by a division of labor.
- Participation in decision-making - the extent to which organizational members are involved in decision-making.
- Size - how large is the organization in comparison to other organizations.

Johnston (1981) suggested that a particular organizational profile would affect the flow of communication in the buying center and, as such, affect the organizational buying process itself.

ORGANIZATIONAL BUYING BEHAVIOR MODELS

ASSESSMENT

The overview of the literature in the area of Organizational Buying seems to suggest that there is an agreement in a basic sense as to what the important concepts associated with the phenomenon are. There are multiple influences such as environmental factors, group factors, organizational factors and individual factors, which affect the purchasing decision. However, the degree to which empirical investigation of these concepts has taken place varies. Roles of individuals in the buying process, at various stages, have been examined. The composition of the buying center has been marked as a relevant factor determining the outcome of the process. The role of organizational and environmental factors has also been shown to impact the organizational buying task.

The literature review also suggested, however, that there is a considerable need for empirical testing of the relationships that are the product of the various models that have been put forward. The review suggests that the knowledge base in the area of organizational buying will benefit substantially from the development of more precise operational definitions of the major concepts. Moriarty and Galper (1978) agree that the lack of precise and generalizable concept definitions in this area provide an opportunity for significant research. Case studies, and in some instances, small

sample studies have been the mainstay of the methodologies employed, and as a result statistical significance for the propositions have been difficult to achieve.

The present study by testing some of the relationships fills gaps in the existing knowledge base, and also complements, substantiates and reinforces some of the previous findings. Specifically, this research contributes in the following areas of the literature in organizational buying by seeking to answer these questions:

1. What are the key triggers that set off the organizational buying decision process?
2. What is the nature and extent of the impact of environmental variables on the organizational buying decision?
3. What is the nature and extent of the impact of organizational variables on the organizational buying decision?
4. What is the nature and extent of the impact of source loyalty on the organizational buying decision?

TRANSPORTATION PURCHASING LITERATURE

TRANSPORTATION PURCHASING AND THE REGULATORY ENVIRONMENT

The proper management of the "place" decision requires that freight transportation services be arranged to solve the problem of spatial separation that exists in the marketplace. The impact of transportation services on marketing as a

whole is underscored by the fact that the best product in the world with the most efficient promotional campaign and the right price, will still not sell unless it is available at the right time, at the right place. Historically transportation (freight) purchasing has been the function of the traffic manager, who made all the decisions regarding the mode, negotiation and selection of carriers and routing of the shipments. Having explored the area of Organizational Buying Behavior in the previous section of this chapter, this section will focus on the literature in the area of transportation purchasing, looking specifically at the carrier selection decision.

Past research in the field of carrier selection for transportation purchasing was restricted largely to the issues of regulation, transportation policy, rate setting and mode selection (Brooks 1983). A common view of such research was that the model of the rational economic man was universally applicable to the freight transportation purchasing decision. One plausible reason is that the domain of the decision was fairly straight-forward until the late 1970s. In the deregulated environment, the complexities of the choice process have increased dramatically. In the remaining part of this section, the scope of the transportation purchasing decision before and after deregulation is covered.

Prior to deregulation, full range of modal choice if available, consisted of air, water, rail, truck and occasionally pipeline. There existed, apparently, very clear-cut trade-offs between speed, reliability and cost amongst them. Within a particular mode, the choice was between three alternative legal forms:

1. Common carrier - carriers traveling specified routes at specified times, and theoretically providing service to any shipper as needed

2. Contract carrier - shipper and carrier enter into a contract to carry specific freight between specified locations over a contractual period
3. Private carriage - shippers who choose to own or lease the fleet and perform the transportation function themselves.

Given the capital intensive nature of fleet operations other than trucking operations, the private carriage option is usually restricted to the latter. Having thus picked a mode and a legal form, the next stage of the decision process involves selecting a vendor or supplier to provide either common or contract carriage as needed.

Until the various regulatory reform acts came into force in the late 1970's and the early 1980's, the Interstate Commerce Commission exercised very rigid control over the entire transportation industry. In that era the actual number and type of carriers that were to be available to particular shippers was decided through the the ICC administrative process, as well what carriers could serve what routes and at what rates (Krapfel and Mentzer, 1982).

In the previous regulatory environment, the transportation choice was directly an act of making economic trade-offs, and minimizing total costs of the distribution system as required by the logistics concept (LeKashman and Stolle 1965). Taking an inventory theoretic approach, Baumol and Vinod (1970) modeled transportation purchase using rates, speed of delivery, reliability and loss/damage as the variables of interest. The purpose of the model again was to optimize the inventory carrying costs.

In an early analysis of competition in the transportation industry Meyer et al. (1959) found rates and inventory costs to be important determinants of the transportation purchasing decision. Ballou and DeHayes (1967) investigated reliability and its effect on inventory levels as a determinant of transportation choice.

The radical change in the regulatory environment of the transportation industry started with the Airline Deregulation Acts of 1977 and 1978. The 1978 TOTO decision of the Interstate Commerce Commission permitting private carriers to act as common or contract carriers under certain conditions, the Motor Carrier Act of 1980 and the Staggers Rail Act of 1980 highlighted the significant changes in the political and legal environment of the transportation industry (Mentzer and Krapfel, 1981).

The operational implications of deregulation were that many restrictions for market entry and market abandonment were removed. Barriers to introduction of new services decreased and flexibility of rate-making increased, resulting in the proliferation of a large variety of rates and services. The protective barriers removed, structural realignment in the form of service curtailment, carrier bankruptcy, and new entrants made the transportation purchasing decision suddenly very complicated (Mentzer and Pisharodi, 1988). The shipper in the new deregulated environment is expected to make sophisticated decisions about carrier options from a wide range of modal and intermodal possibilities covering a spectrum of prices and service characteristics.

These changes in the regulatory and competitive environment were instrumental in redefining the role of the traffic manager in the scheme of physical distribution management. Lambert and Stock (1982) suggested that traffic management may now include consolidation of both outbound and inbound freight, given the backhaul opportunities provided by the deregulation.

The next part of this chapter will look at the various models of transportation choice that have been used in the past. Both choice of a mode as well as a carrier within a mode will be considered.

MODELS OF TRANSPORTATION CHOICE

McGinnis (1989) identifies four general models that have been used in the freight transportation literature in the past. These models are:

- a) Classical Economic Model
- b) Inventory-Theoretic Model
- c) Trade-off model
- d) Constrained Optimization Model

The classical economic model evaluates the fixed and variable costs of competing modes over operating distances, together with a cost estimate of the service differentials between the modes. The point of indifference³ between the modes shifts when the estimate of service advantage is included in the analysis (See Figure 4). The model has been tested with Census of Transportation data by Morton (1972) and Roth (1977). Both failed to pin down a meaningful point of indifference and found a wide band where railroad and trucks remained competitive.⁴ Between 32 and 78 percent of intercity traffic of manufactured goods were competitive in terms of modal choice, once the data had been split by length of haul, characteristics of freight and shipment size (especially for small shipments). Morton blamed the "idiosyncratic needs of shippers and consignors" for obscuring the cost driven analysis of modal split, but the

³ that is the distance below which one mode has a cost advantage over the other, and beyond which the other mode has the cost advantage

⁴ A category was considered competitive if both modes enjoyed at least 10% of the category traffic.

problem lay with the model assumption that transportation service was an undifferentiated industrial commodity.

The inventory-theoretic approach (Baumol and Vinod, 1970) used a cost function to optimize modal choice. The assumption of the model is that gross revenue is independent of the modal choice. So the mode with the lowest cost, given the function:

$$\text{Cost} = \text{direct shipping cost} + \text{carrying cost} + \text{ordering cost} + \\ \text{recipient's inventory carrying cost} + \text{safety stock cost}$$

became the optimum mode. The optimization is based on the trade-offs among freight rates, speed, dependability and enroute shrinkage. Roberts (1975) relaxed the gross revenue assumption and includes the effects of shipment size on selling price (shipment size would possibly differ by mode) and the cost implications of stockouts or higher levels of customer service that could result from a modal split. While variations of these models are mathematically elegant, the problem they still face is the inability to account for non-quantitative and non-cost behavioral differences among shippers, and the characteristics of the shipper market.

The trade-off model proposed by Roberts (1970) introduces into the analysis, the dimension of non-transportation cost differentials. In this model, costs are expressed as transportation costs and non-transportation costs (See Figure 5). A point of indifference can then be constructed, between two modes, in the vein of the classical economic model using the formula:

$$\text{Transportation cost}_1 + \text{Non-transportation cost}_1 = \text{Transportation cost}_2 + \\ \text{Non-transportation cost}_2$$

While an improvement over the previous models, the model implicitly assumes non-transportation costs to be quantifiable and additive to the transportation costs,

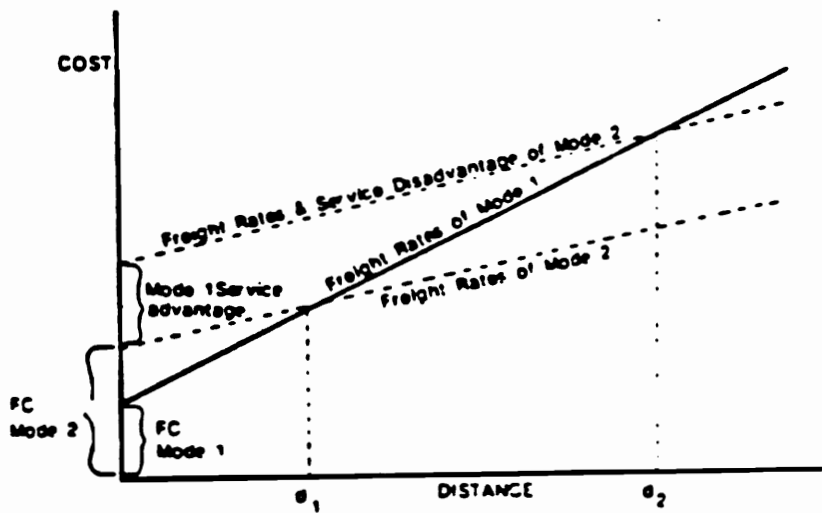


Figure 4. Classical Economic Model of Modal Choice in Transportation Purchasing (McGinnis, 1989)

and still ignores behavioral differences between shippers and between shipper market characteristics.

McGinnis, Corsi and Roberts (1981) recognized the non-cost and qualitative nature of some of the non-transportation variables in their constrained optimization model. The model is represented as:

Minimize TR (Transportation rates)

Subject to SPC (Product constraint)

SDP (Distribution pattern constraint)

SSN (Service need constraint).

The constrained optimization model also does not provide a basis for determining what the constraints are, or how they can be predicted.

MODAL CHOICE

Most of the literature on mode selection does not focus on the process through which the decision is made, but rather, tends to provide a comparison of the five available modes based on certain characteristics. Most introductory texts in marketing provide the criteria which include factors such as cost, transit time, versatility, reliability, accessibility, convenience and availability. Table 1 provides a typical comparison. While such a table is fairly standard information, its usefulness in mode selection is open to question. In the simplest possible weighted average model, the

TC= TRANSPORTATION COSTS
NT= NON - TRANSPORTATION COSTS
OC= OVERALL COSTS

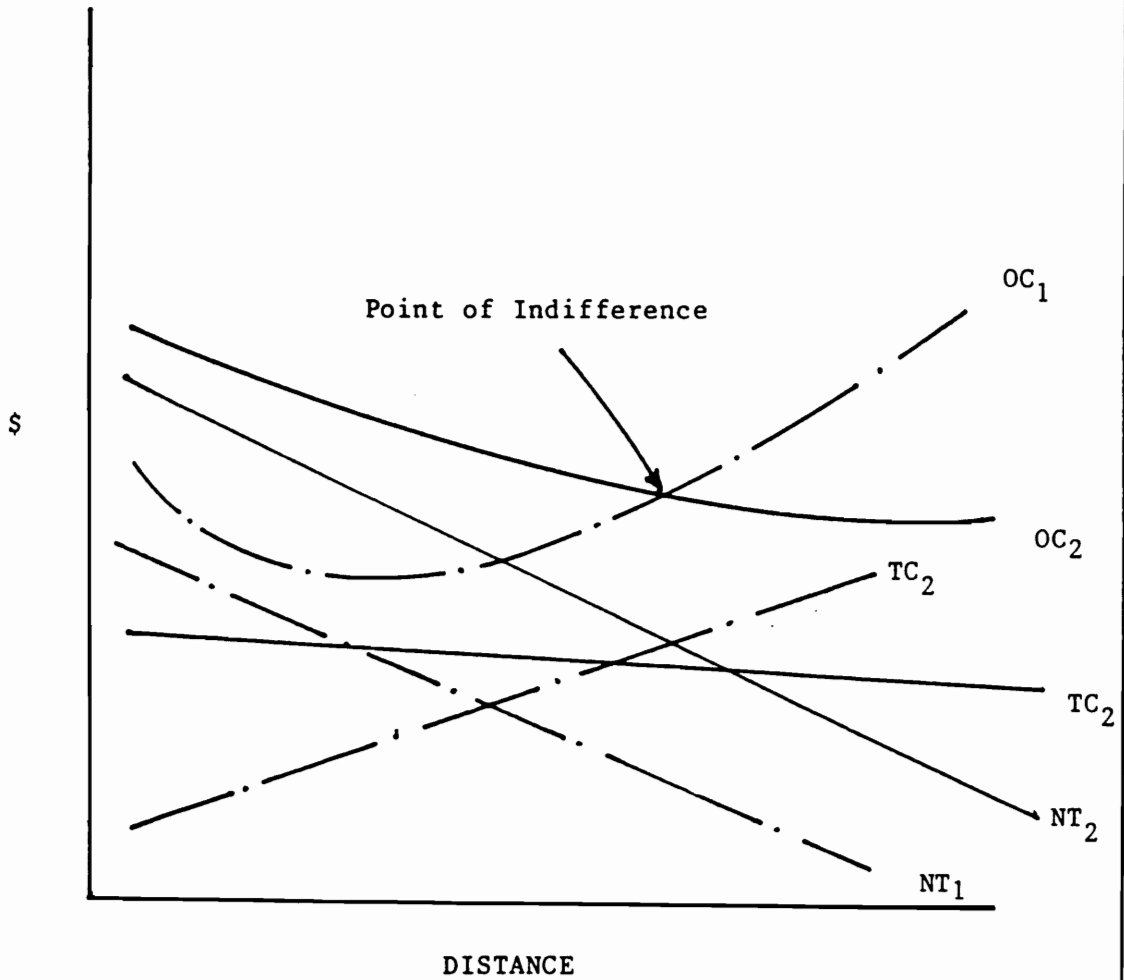


Figure 5. The Trade-off Model of Carrier Choice in Transportation Purchasing

assignment of weights to the factors would be very problematic across modes, as the factors are measured using different standards when using different modes. Comparison across different product lines cause the same type of problems. Whether the investment structure for the mode is capital intensive or not may play havoc with attempts to make cost/ton-mile comparisons (Mentzer and Konrad 1988).

Mattson (1987) suggested that the mode selection decision in transportation purchasing, in the past, has always been driven by what is available in terms of the transportation infrastructure, and not by the requirements of the market to be served.

While most firms do not seem to act as if a modal choice exists, Stock & LaLonde (1972) using large finished goods suppliers who already used several modes, came up with a set of criteria for mode selection. The results of their study are reported in Table 2⁵. Lambert & Stock (1982) reported a 1977 study by Ronald Roth that developed a matrix for competitiveness between motor-carrier and railroad modes based on tonnage and distance shipped. Roth concluded that the modes are competitive for tonnages between ten and sixty thousand pounds shipped over distances greater than 500 miles. The trucking mode is preferable for smaller tonnages going less than 500 miles. The railroad mode becomes the predominant mode for heavier shipments over longer distances.

Stenger & Cunningham (1978) developed a logarithmic relationship defining the truck/rail competitive range. They used value per pound and distance shipped as the principal criteria. Magee, et al. (1985) also concluded that value per pound was an indicator of which mode was selected.

Stock (1976) reported that the mode/carrier selection decision was not subject to top management influence, and traffic managers, marketing managers, distribution

⁵ Respondents were asked to rate the importance of each item on a scale of zero (0) to one hundred (100), with the most important factor being given the highest score. Then the items were ranked by mean importance score

Table 1. Typical Marketing Considerations of the Transportation Modes

(Source: Berkowitz, Kerin and Rudelius 1986)

Mode	Relative Advantages	Relative Disadvantages
Rail	Low Cost Full Capability	Sometimes Slow Not Always Complete Pickup and Delivery Poor Reliability High Damage
Motor Carrier	Fairly Fast Complete pickup and Delivery Extensive Routes	Higher Cost Size and Weight Restrictions More Weather Sensitive
Airline	Fast Frequent Departures	High Cost Limited Capabilities
Pipeline	Low Cost Very Reliable	Slow Limited Capability and Routes
Water	Low Cost Huge Capacities	Slow Limited Routes More Weather Sensitive

Table 2. Reasons For Changing Mode & Criteria for Mode Selection

(Source: Stock and LaLonde 1972)

Rank	Reason for Altering Mode	Score	Criteria for Mode Selection	Score
1	Desire to Improve Customer Service	84.4	Consistent, On-time Pickup and Delivery	92.4
2	Deterioration of Service Provided	79.8	Freight Charges	79.8
3	Desire to Reduce Distribution Costs	77.2	Time in Transit	79.1
4	Poor Pickup Delivery	76.3	Points Served and Routing Authority	73.9
5	Customer Complaints	76.1	Frequency of Service	72.1
6	Desire to Reduce Transit Time	72.2	History of Loss or Damage	69.2
7	Changing Needs of Customers	64.7	Timely Acceptance of Shipments of all sizes	65.6 65.6
8	Poor Claims or loss Experience	63.5	Door-to-door Delivery Service	61.9
9	Changing Areas	53.5	Shipment Tracing Ability	61.8
10	Ability to Solve Emergency Problems	48.6	Prompt Claim Service	60.8

managers and customers influenced the decision in that order of importance. Bayliss & Edward (1970) and Gilmour (1976, 1977) also looked at the mode selection decision, and failed to find causal determinants of mode choice. However, they did find factors that were perceived to be important in the selection process as did the other studies. Correlation of such factors to actual choice has not been established in the literature. Bayliss & Edward (1970) also found that shipper specific factors such as location and size, shipper perception of advantages and disadvantages of available options were important in the mode selection decision.

Krapfel & Mentzer (1982) studied the mode choice process under deregulation and developed a micromodel predictive of modal change. The results obtained through exploratory stepwise multiple regression modeling are presented in Table 3, Table 4 and Table 5. While the study failed to find significance for all of the variables individually, there was overall significance for the groups of predictor variables. The results suggested that potential for intermodal service availability (specifically, trailer on flat car), reduced damage and improved service reliability would favor a change of mode from motor carrier to rail. Slow service and reduced shipment tracking capability would pull in favor of motor carriage however (Table 3). Increased availability of contract carriage service and flexibility of consolidated truckload service were useful in predicting a change in the legal form from common to contract carriage (Table 4). Availability of alternative carriers, freight rates and increase in common carrier service are the important predictors of change of carriers within the mode (Table 5).

In summary, most of the literature on mode selection comprises rules of thumb comparison procedures. The deregulated environment of the 1980's and beyond will see the appearance more and more, of multi-modal carriers that strive to screen out the disadvantages associated with individual modes, and capitalize on the advantages

Table 3. Predictor Variables for Transportation Mode Change

(Source: Krapfel and Mentzer 1982)

Variable	Beta	F Ratio	R Square	P < = 0.001
<i>Product</i>				
Trailer on flat car service	0.25	9.00	0.07	Yes
Damage in transit	0.39	8.70	0.06	Yes
Speed of service	-0.31	11.04	.04	Yes
Shipment Losses	-0.18	2.06	.01	
<i>Individual</i>				
Perceived deregulation effect on Service reliability	0.18	4.94	0.03	
<i>Company</i>				
Firm size	-0.11	1.74	0.01	
<i>Overall</i>		5.4	0.22	Yes

Table 4. Predictor Variables for Change from Common to Contract Carriage

(Source: Krapfel and Mentzer 1982)

Variable	Beta	F Ratio	R Square	P < = 0.001
<i>Product</i>				
Mixed consolidated Truck load shipments	0.29	9.90	0.08	Yes
Shipment losses	-0.14	2.46	0.01	
Reliability of service	0.14	2.10	0.01	
Availability of Common carrier services	-0.11	1.47	0.01	
<i>Individual</i>				
Increased availability of Contract services	0.22	6.68	0.06	Yes
<i>Overall</i>		4.95	0.17	Yes

Table 5. Predictor Variables for Change in Carriers within Mode

(Source: Krapfel and Mentzer 1982)

Variable	Beta	F Ratio	R Square	P < = 0.001
<i>Product</i>				
Availability of Common carrier service	0.31	13.08	0.06	Yes
Freight Rates Increase in	-0.22	6.46	0.05	Yes
Common carrier service	-0.33	8.51	0.02	Yes
<i>Individual</i>				
Perceived deregulation impact on Motor carrier availability	0.30	6.58	0.02	
Perceived deregulation impact on Shipment losses	0.11	1.33	0.02	
<i>Overall</i>		5.34	0.19	Yes

through judicious combinations such as piggy-back (TOFC - trailer on flat car), fishy-back, containerization and other similar developments.

One of the reasons why, traditionally, mode changes were not contemplated once a selection was made was the fact that investments by both the shipper and carrier to make the operations mutually compatible, had implications for a long term commitment for both parties.

The next section of this chapter will deal with the literature specific to carrier selection.

CARRIER SELECTION WITHIN A MODE

Howard (1963) was the earliest article located in this area. He concluded that carriers needed to understand the process of selection that shippers engaged in, so as to be able to become more responsive to their needs.

Saleh & Lalonde (1972) investigated the motor carrier selection decision in light of the Buygrid framework. They found a preponderance of straight rebuy decisions (52% of the respondents). For those whom the decision was that of a new task, the authors found, interestingly enough, that sources of information that were utilized was very important. However, even as carrier features were mentioned as selection criteria, they concluded that service and price offerings of individual carriers were essentially perceived to be homogeneous. Though this may have been true then there is a strong reason to believe that in the present deregulated environment, such differentiations do exist and are perceived significant for the purposes of carrier selection.

Evans and Southard (1974) in their study of transportation purchasing in Oklahoma found significant differences in the way carrier attributes were perceived and evaluated by shippers and carriers. In particular, strong differences existed in the

evaluation of handling routing requests. Frequency of sales calls by carrier representative was seen as more important by the carriers than by the shippers, who valued in turn, the proximity of the carrier office as much more important than did the carriers themselves. The study pointed out the implications for carrier management to focus on what is relevant to the shipper.

Jerman et al. (1978a, 1978b) and Anderson et al. (1978) reported the findings of their in-depth analysis of the transportation purchasing decision. They required respondents to report perceived importance of specified selection variables. Using a population of both shipper and carrier representatives, the factors identified as very important were ability to trace shipments, cooperation between buyer and seller in terms of routing requests, change in rate classifications and assistance in understanding of the same, total transit time, reputation and dependability of the carrier and also the proximity of the carrier office to the shipper. The fact that both the carrier and the shipper respondents agreed on the last, contradicted the findings of Evans & Southard (1974) who saw only shippers being interested in that.

Using the findings of the study described above, Anderson et al.(1978) found support for the hypotheses that no attitudinal differences exist between hierarchical types of buyers, as regards importance/relevance of criteria, and that differences did exist between carriers and shippers in evaluation of service orientation and carrier image. As in past studies, knowledge of shipper needs and regularity of sales calls were important attributes from a carrier standpoint. On the other hand shippers emphasized handling of routing requests and less-than-containerload (LCL) shipments as primary determinants of service orientation.

While Evans and Southard (1974) looked at a large number of variables, and funneled down to six factors using factor analysis (charges and privileges, past performance, rate adjustment, routing capabilities, carrier knowledge and carrier

image), they did not attempt to correlate the criteria to the actual choice. While contributing to the introduction of non-task attitudinal variables to the transportation literature, they did not go beyond establishing the perceptual differences of criteria evaluation of carriers and shippers to the actual determination of carrier choice by the shipper.

McGinnis (1977, 1978, 1979) also did a thorough review of shipper attitudes, and transportation marketplace characteristics. It is interesting that market competitiveness, company policy, customer influence and external market influence explained so little of the variance of shipper attitudes towards carriers. One reason is probably the regulated environment in which the study was conducted. Another possible reason could be that terms of sale, which did not figure in the research explicitly, probably captured the domain of customer influence and company policies that were in effect.

Mentzer and Krapfel (1982) found the effect of perceived impact of deregulation on carrier selection from within a mode significant. They argued that the reason was the diversity in availability of service and rate characteristics in the deregulated environment.

Raghunathan, Bagchi and Bardi (1988) investigated transportation purchasing in the deregulated era. Their study was “to determine the relative importance of various parameters involved in carrier selection and/or carrier evaluation decisions as perceived by transportation buyers in the deregulated environment”. The study utilized factor analysis to come up with four interpretable factors. These factors were:

Rate related

Customer-service related

Claims handling and follow-up related

Special equipment availability and service flexibility related.

Their results suggested that customer service related variables were the most important in carrier selection and evaluation decisions. They were followed in that order by rate related variables, claims handling and follow-up related variables, and equipment availability and service related variables. The authors conducted t-tests on differences between means and found significance for the above rankings at the .05 level.

Raghunathan et al. (1988) also did a regression analysis of factor importance in routine evaluation of carriers. While again the results were significant at the .01 level, only 16% of the variance in the data was explained by the regression ($R\text{-sq} = .16$) for all respondents. When the analysis was done for the retailing industry in particular, as much as 31.5% of the variance was explained by the model, but there was still a large amount of variance that was left unexplained. These analyses were done for routine evaluations only, and did not look at “new purchase” or “modified rebuy” situations. The results of their study are reported in Table 6, Table 7 and Table 8. The respondents were asked to report the importance of the various carrier selection items on a scale of 1 to 5, 1 being very high importance and 5 being very low importance. The items were then ranked according to their mean importance scores (Table 6). The variables were then reduced to a set of four factors using factor analysis technique (Table 7). Test of difference between the means to prioritize the factors showed customer service factor to be the most important, followed by the rate related factor, claims handling and follow-up factor and special equipment and service flexibility factor in that order (Table 8).

Table 6. Mean Importance and Rank of Carrier Selection Determinants

(Source: Raghunathan, Bagchi and Bardi 1988)

Item	Description	Mean	Rank
1	Door-to-door transportation rates or costs	1.405	2
2	Willingness of the carrier to negotiate rate changes	1.611	4
3	Transit time reliability or consistency	1.301	1
4	Total door-to-door transit time	1.551	3
5	Frequency of service	1.892	7
6	Claims processing	2.338	16
7	Freight loss and damage	2.037	9
8	Equipment availability	1.878	6
9	Special equipments	3.476	18
10	Quality of operating personnel	2.108	11
11	Quality of carrier salesmanship	2.635	17
12	Shipment tracing	2.118	12
13	Pickup and delivery service	1.899	8
14	Shipment expediting	2.054	10
15	Willingness of carriers to negotiate service changes	2.162	13
16	Line-haul service	2.389	15
17	Scheduling flexibility	2.267	14
18	Financial Stability of the carrier	1.807	5

Table 7. Factors and the Carrier Evaluation Variables They Contain

(Source: Raghunathan, Bagchi and Bardi 1988)

Factor	Variables	Factor Loadings
<i>Factor-1</i> (Rate related)	Door-to-door transportation rates or costs	0.821
	Willingness of the carrier to negotiate rate changes	0.769
<i>Factor-2</i> (Customer service)	Transit time reliability or consistency	0.694
	Total door-to-door transit time	0.708
<i>Factor-3</i> (Claims handling and follow-up)	Claims processing	0.669
	Freight loss and damage	0.619
	Pickup and delivery service	0.692
	Shipment tracing	0.714
	Shipment expediting	0.721
<i>Factor-4</i> (Special equipment and service flexibility)	Equipment availability	0.693
	Special equipment	0.706
	Quality of operating personnel	0.672
	Line-haul service	0.508
	Scheduling flexibility	0.573

Table 8. Priortization of Factors by T-test on Difference of Means

(Source: Raghunathan, Bagchi and Bardi 1988)

Set	Factors	Mean	T-Value	P-Value
Set I	Factor 2	1.43257	-2.12	0.035*
	Factor 1	1.5084		
Set II	Factor 1	1.5084	-13.59	0.0*
	Factor 3	2.0892		
Set III	Factor 3	2.0892	-7.29	0.0*
	Factor 4	2.4236		

(Number of Cases = 296) *Significant at .05 level

TRANSPORTATION PURCHASING LITERATURE ASSESSMENT

It appears from the literature review above, that the domain of motor carrier transportation purchasing has undergone a radical change in the past decade as a result of regulatory reforms brought about by the Motor Carrier Deregulation Act (1980). The purchase of transportation service is not the cost driven choice among undifferentiated offerings as was previously assumed. Organizational factors and the competitive market environment influence the choice process by mapping out segments with different needs that are to be met by the carrier companies. Whereas there have been consistent attempts in the past (See Table 9) to identify various important factors in the carrier selection process, limited attention has been paid to why the factors were important or how the factors were determined. Insights into the various factors as well as what influences their importance to the buyer of transportation services are not very clear. These gaps in the knowledge about the carrier selection process become pressing in the highly competitive environment of the post deregulation era. It is also important to note that the few studies that have been undertaken failed to account for a large proportion of the variance in the selection process. This would support the argument for additional research in the area to develop models which are better specified and provide more insight into the process.

One of the important observations (Mentzer and Pisharodi 1988) was that in a deregulated environment, transportation purchasing is more likely to be assimilated into the existing purchasing function and cease to exist as a separate entity. This research is an attempt to validate that implication, and to examine transportation purchasing from an organizational buying point of view. Specifically, this research will attempt to answer the following questions:

1. How do organizational variables affect carrier selection in transportation purchasing?
2. How do environmental variables affect carrier selection in transportation purchasing?
3. What constitutes source loyalty in carrier selection in transportation purchasing?
4. What role does source loyalty play in carrier selection in transportation purchasing?

The answers to these questions will prove useful at the workbench level for practitioners as well as marketing scientists studying the phenomenon in the future. The answers will be especially useful to the carrier organizations in a competitive market. They will be better able to understand the needs of their customers and use information on organizational and environmental characteristics as tools for segmenting their markets. A better understanding of the role of source loyalty in shipper-carrier relationships will have implications for maintaining market share. This will occur when the duration of source loyal relationships will be extended, and vendor switching based on short term fluctuations of price and service will be potentially avoidable. From a theoretical standpoint, the answers will seek to provide evidence in support of the Sheth (1973) model of industrial buyer behavior in a transportation purchasing setting, and garner empirical support for consideration of freight transportation purchasing as an industrial service purchasing phenomenon. In addition, contribution will have been made in developing, refining and validating scales for the measurement of the constructs involved.

Table 9. Variables Affecting Transportation Choice

(Source: McGinnis, 1989)

Variables	Authors								
	Saleh (1970)	Bardi (1972)	Evans et. al (1974)	Jones (1975)	Gilmour (1977)	Stock et. al (1985)	McGinnis (1985)	Burdg et. al (1987)	Brand et. al Quinn
Freight Rates	Y	Y	Y	Y	Y	Y	Y	Y	Y
Reliability	Y	Y	Y	Y	Y	Y	Y	Y	Y
Transit Time	Y	Y	Y	Y	Y	Y	Y	Y	Y
Shrinkage	N	N	Y	Y	N	Y	Y	Y	Y
Damage Claims	N	N	Y	Y	N	Y	Y	Y	Y
Tracing	N	N	Y	Y	N	Y	Y	Y	Y
Availability	N	Y	Y	N	Y	Y	N	Y	Y
Capability	N	Y	Y	N	Y	Y	N	Y	Y
Reputation	N	Y	Y	N	Y	Y	N	Y	Y
Equipments	N	Y	Y	N	Y	Y	N	Y	Y

RATIONALE FOR TRANSPORTATION PURCHASING MODEL

The previous sections have introduced the purpose of the research, and discussed the pertinent theoretical constructs of the industrial buying behavior literature in marketing. A case has been made for viewing the carrier selection decision in transportation purchasing as an industrial buying phenomenon. The review of the literature in Chapter 2 has determined that, historically, transportation purchasing has been looked upon as a rational decision making process with fairly straightforward stages that have to be addressed.

Mentzer and Pisharodi (1988) present a strong case for the inclusion of transportation purchasing in the mainstream of research into organizational purchase of services. They demonstrate that transportation purchasing is a special type of organizational purchase and, thus, is a viable subject for application of purchasing management. They suggest as directions for future research “testing of dominant paradigms and models of organizational buying behavior upon the transportation service purchasing scenario”.

Brooks (1983) suggests that actual shipper response will vary with the buyclass of the purchase (i.e, modified rebuy or new task), and in the case of containerized seaborne traffic, freight forwarders and other external sources were responsible for specifying the carrier of choice (i.e. external carrier selection decision). When the carrier selection decision was internal (i.e. the shipping firm was responsible for carrier selection), criteria for choice were largely found to be price, frequency of sailing, and non-task or emotional variables. The first two did not have sufficient strength to be able to differentiate between carrier choices, but did correlate with the choice.

Saleh and LaLonde (1972), Bellizzi (1981), Krapfel and Mentzer (1982), Granzin, Jackson and Young (1986) and Mattson (1988) found organizational characteristic variables to have significant influence on industrial purchasing decisions.

Sheth (1973), Bonoma and Zaltman (1978), Stock and LaLonde (1978), Krapfel and Mentzer (1982) found environmental variables to have significant influence on the organizational buying decision. Mentzer and Pisharodi (1988) suggest that environmental variables be included in modeling transportation purchasing decision-making.

Cavinato and Stenger (1983) call for active nurturing of a supply network of carrier services in the post deregulation era, thereby alluding indirectly to the importance of development of loyalty amongst buyers and sellers of carrier services. Salmond and Spekman (1986), Spekman and Johnston (1986) and Dwyer et al. (1987) found vendor loyalty, long term buyer-seller relationships to be significant determinants of organizational buying decisions.

This research examines the determinants of shipper choice in different buyclasses of motor-carrier transportation purchasing. The relationship of organizational variables, environmental variables and source loyalty of shippers towards current carriers with the selection decision is examined. The effect of these variables on the locus of the carrier selection decision (whether the decision is internal to the firm or not), as well as their effect on the development of criteria for selection from among alternative carriers is investigated. In the competitive environment of deregulated motor-carrier industry in the United States, it will be of interest to practitioners (both carriers and shippers) to understand the nature and extent of the determinants in the carrier selection process. The model development for purchasing transportation will contribute to the theoretical base of knowledge in industrial marketing literature in general, and transportation purchasing literature in particular.

This dissertation views transportation buying as an industrial service purchase decision, and investigates the effects of organizational characteristics, environmental characteristics and industrial source loyalty on the carrier selection decision process.

MOTOR CARRIER TRANSPORTATION PURCHASING MODEL DEVELOPMENT

The Sheth (1973) model of industrial buying behavior is used as the broad framework for the purpose of this research. The first stage in the model has to do with the initiation of the transportation purchasing process. The sequential decision model envisions that various types of changes in the firm's operation, and an attempt by the decision maker to link changes to causes, will result in triggering the model (See Figure 6). Based on the various practitioner oriented literature on transportation purchasing, the following is a list of potential changes that result in triggering possible carrier selection decisions.

1. **Product-line changes:** In the event of introduction of new products into the line or dropping of products that change significantly the weight and volume patterns of a firm's shipments.
2. **Route changes:** In the event of redefinition of a firm's market or a realignment of traffic such as introduction of backhauling, relocation or addition of warehouses or plants, the spatial structure of the shipment origin and destinations may need to be reorganized. Addition of new markets may significantly change the route structure.

3. Service considerations: Either dissatisfaction with the nature and/or the quality of service available from the present carrier, or availability in the market of vendors with superior service characteristics.
4. Price consideration: In the event of dissatisfaction with prices charged by the current vendor and/or terms of payment, or availability in the market of vendors with lower prices and/or better terms of payment.

It is posited that determination of the buyclass situation of the purchase will be determined by the presence/absence of these triggers, and their evaluation will in turn be related to the organizational variables, the environmental variables and the source loyalty of the decision making unit.

It should be noted that it is quite possible that the need for carrier selection may not lead to the actual selection process taking place within the firm. Under certain circumstances, such as contractual obligations, consignee specifications or other factors, organizational and environmental in nature, the decision may be made externally (determination is made by source other than the shipper firm).

Following the Buygrid model of Robinson et al. (1973) the straight rebuy type of situation will not result in a carrier selection decision problem at that point in time, as there will only be a routinized response. In the other two situations (modified rebuy and new task) however, two decisions need to be made:

1. whether a modal choice is necessary,
2. whether a freight forwarder (a transportation middleman) will be utilized or a specific carrier needs to be selected.

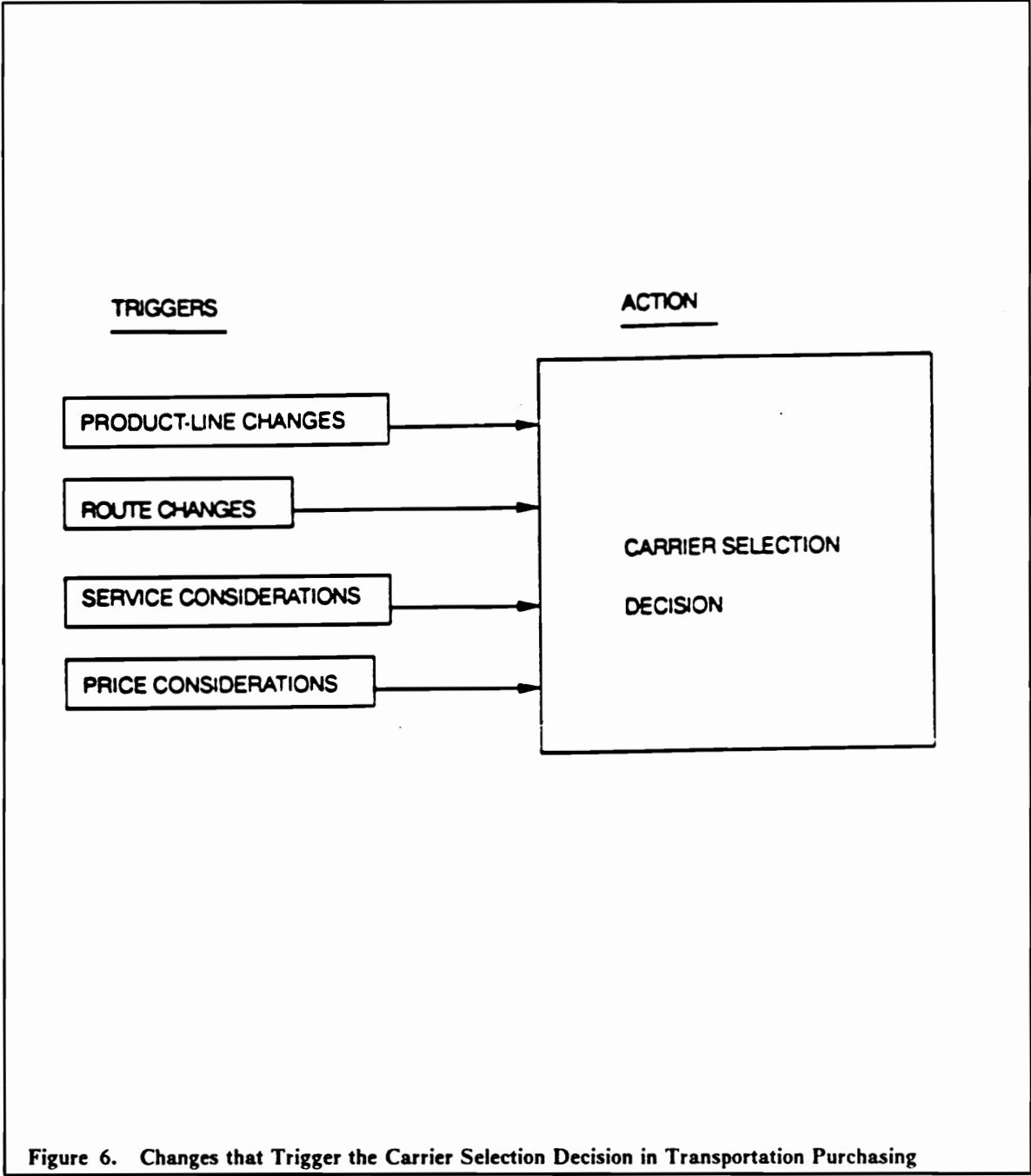


Figure 6. Changes that Trigger the Carrier Selection Decision in Transportation Purchasing

It is posited that both modal choice and decision to select a carrier or a freight forwarder will be influenced by organizational factors, environmental factors and source loyalty of the decision making unit towards existing carrier or carriers.

Previous research has treated the decision to use freight forwarders as making the carrier selection decision external and removed from the firm (Brooks, 1983). It is argued that a freight forwarder is really a pseudo carrier, and is evaluated with respect to identical criteria from an universe of carrier choices.

In the event that there exists a carrier selection decision problem at this stage, i.e more than one carrier is available, the set of carriers which meet the appropriate qualifying criteria, become the domain of choice.

Anderson et al. (1978), Pearson (1980), and Krapfel and Mentzer (1982) have outlined a typology for the qualifying criteria:

- Awareness, through carrier promotion, trade media and word of mouth, that there exists a set of carriers that have the potential to be considered
- The origin, destination and intermediate stops required for shipment
- Availability of specific capacity, LTL service, product specific equipment
- Company policy does not restrict business with any of the carriers in the choice set.
- Consignee specification of carrier requirements

The selection of carrier is made after evaluation of the carriers in the choice set is made.

CARRIER SELECTION CRITERIA

A list of criteria that can be used for evaluation purposes has been mentioned in the literature: Evans and Southard (1974), Stock and Lalonde (1976), Jerman et al. (1978), McGinnis (1979), Pearson (1980), Krapfel and Mentzer (1982), Harrington (1983), Mentzer and Gomes (1986), Sheffi et al. (1988), and Mentzer and Pisharodi (1988).

Frequency of service: This has to do with scheduling shipments as and when needed. This avoids having to wait longer time periods between scheduled deliveries.

Directness of service: This reduces the chances of delay at intermediate stops and reduces handling of shipments that may cause damages in transit.

Number of destinations served: The same carrier can then be used to schedule shipments to a variety of destinations, thereby reducing paperwork and administrative costs.

Transit time: From a customer service point of view, this allows the shipper to respond more quickly to customer needs.

Pick-up and delivery: Door to door service can be very useful, when delivery to, or pick-up from carrier terminals may not be economical, specially for smaller shipments.

Back-haul availability: This would be very useful if there are reciprocal arrangements with customers. Increased overall capacity utilization by filling up what would otherwise have been an empty run may also help reduce overall transportation costs.

On time service: This ensures consistency of delivery times, and improves customer service delivery.

Shipment tracing capability: Ability to track and report the status of shipments provides increased control, and enhances customer service delivery.

Material handling capability: Capability to handle the specific product being shipped, compatibility with the shippers' loading and unloading facilities are important characteristics that shippers look for in a carrier. This becomes particularly important when goods to be shipped need special handling.

Range of available equipment: This is important when the shipper has a range of shipment characteristics and / or locations with different equipment capabilities.

Intermodal capability: This capability may allow the shipper to access the different benefits intrinsic to different modes while developing a distribution strategy.

Cost of TL service: The rates are important in projecting overall distribution costs.

Cost of LTL service: This becomes very important if the shipper frequently has relatively small consignments to a variety of locations.

Past loss and damage experience: Is an important aspect of customer service delivery, affecting the condition of shipments on arrival.

Fast claims response: It is important in terms of quickly settling customer complaints regarding freight, and ensuring prompt restitution.

Carrier reputation for reliability and financial security: This enhances the prospect of long term relationship, and adds to the shipper image in providing quality and consistent service to customers.

Carrier long term commitment to shipper and response to emergency shipments: Establishes close working relationship, and enhances mutual cooperation resulting in superior overall performance.

Proximity of carrier's office, and information support and high level of service by carrier representative: These factors enhance the cooperative nature of the relationship, and enhance the overall level of performance of the transportation function.

The next stage is the development of the constructs of organizational variables, environmental variables and source loyalty.

ORGANIZATIONAL VARIABLES

Sheth (1973) reported that logical deduction suggests that organizational characteristics are related to industrial buyer behavior. In attempting to obtain

empirical support for the relationship, Crow and Lindquist (1985) found organizational characteristics such as number of employees, firm function and average purchase volume have significant relationship to the behavior of the buying center. They concluded that organizational influences were stronger than the influences of the buyer characteristics.

Saleh and LaLonde (1972) in their investigations in a regulated environment found that some firms tended to take their transportation function more seriously than others. These firms would look to put in place sophisticated vendor evaluation procedures involving methods such as value analysis and statistical quality control checks. The other firms would simply carry on doing business with existing carriers.

Bellizzi (1981) investigated the effect of size of the firm on industrial buying behavior. The study found that the relationship between organization size and buying center influence was significant at the .05 level. There was support that purchasing decisions tended to involve larger numbers of people in larger organizations, and were more autonomous in the smaller ones.

Krapfel and Mentzer (1982) did not find firm size (measured in sales dollars) a significant predictor of transportation mode change. However the direction of the relationship indicated that large firms did not consider mode change favorably.

Granzin, Jackson and Young (1986) investigated the relationship of organizational characteristics to the information processing characteristics of the decision maker in the transportation purchasing process and by extension to the industrial buyer behavior phenomenon itself. They found that there existed a significant relationship between organizational characteristics and buyer behavior. Number of persons involved in the decision making unit, importance of the decision to the firm, importance of cost criteria to the firm, perceived time pressure, flexibility

of organizational structure and size of the firm were found to have significant relationship to organizational buying behavior.

Mattson (1988) found managerial levels of decision participants in organizational buying behavior to be significantly related to the influence exerted by the buying center.

Following Saleh and LaLonde (1972), Stock (1976), Stock and LaLonde (1978), Bellizzi (1981), Krapfel and Mentzer (1982), Granzin, Jackson and Young (1986) and Mattson (1988), the following variables were initially chosen as independent variables.

1. Buying Center Variables

Number of decision-makers involved

Managerial level of decision-makers involved

However during preliminary investigations, it was determined that the titles used to designate managerial levels in traffic management varied widely in their actual significance. It was not therefore possible to determine the nature of this variable through a mail survey. Role (that of user, influencer, decider or gatekeeper) (Webster and Wind, 1972) was not used as it is not clear as to who, for example, within the firm is the user of transportation for outbound freight as opposed to being in a influencer or a decider role (Mattson, 1988).

2. Procurement Process Variables

Firm experience in purchasing transportation

Terms of sale: whether f.o.b. origin or f.o.b. destination and also whether shipments are freight pre-paid or not.

Experience is determined based on volume of shipments, percentage of shipments on motor carriers, intermodal shipment, predominant purchase situation context and nature of the principal business of the firm.

3. Other Organization Characteristics

Size of the firm as determined by sales volume and number of employees

Freight characteristics(product related attributes such as value, weight/volume ratio, special needs etc.)

ENVIRONMENTAL VARIABLES

The effect of environmental constraints on the industrial buyer behavior phenomenon has been accepted in existing literature starting with the framework proposed by Robinson, Faris and Wind (1967). Sheth (1973) categorized uncontrollable environmental influences as “situational variables” and treated them as temporary conditions intervening between actual choice and prior decision making (Mentzer and Pisharodi 1988). Sheth (1977) included legal and political considerations, business climate, and personal relationships among variables that impact upon industrial buying behavior. Bonoma and Johnston (1978) include the effects of “situational variables” in support of their dyadic framework of industrial buying behavior. Moriarty and Galper (1978) included environmental influences in “buying

determinants” which was one of the four building blocks in their model for studying industrial buying behavior.

Peters and Venkatesan (1973) in their study of purchase and adoption of small computer systems, found that in industrial purchase settings, increased levels of environmental uncertainty was associated with increased levels of influence of purchasing agents over the purchasing decision. Gronhaug (1976) found significant effects for the variables “perceived competition” and “perceived scarcity in budgets”. In conclusion, he found that “results demonstrate differences in buying behavior due to variations in environmental influences”. The differences were in the amount of information search and buying motives and criteria.

The environmental variables that will affect the transportation purchasing decision can best be dealt with along the lines of the model developed by Webster and Wind (1972). Their general model of organizational buying behavior explicitly took into account the effects of the following:

information about suppliers in the form of received marketing communications

availability of goods and services

general business conditions

values and norms

Mentzer and Pisharodi (1988) suggest that such influences are exerted through suppliers, customers, competitor organizations and also through social economic, political and legal institutions. Choffray and Lilien (1978) present the convincing argument that both environmental and organizational influences act as constraints,

defining a feasible set of alternatives from which the final choice is made. This conceptualization is very specific and helps account for establishment of product/service selection criteria.

Following the discussion of various conceptualizations of Sheth (1973), Bonoma and Zaltman (1978), Stock and LaLonde (1978), Choffray and Lilien (1978) and Mentzer and Pisharodi (1988), the variables chosen for measurement and inclusion in the model are as follows:

number of carriers available for specified routes

the perceived variety of service characteristics available

perceived economic conditions (general as well as end-user market and market faced by the buyer)

regulations, business practices and codes applicable

information sources available to buyer

nature of information available

extent of information available

proximity of carrier hub

During preliminary investigations it was found that queries regarding economic conditions produced very general information that was not very useful. The regulations and applicable codes of practice was sought to be identified by determining

the location of the corporate headquarters of the shipper. However that information too was not very useful as a high percentage of the carrier selection decisions were made outside of the corporate headquarters.

SOURCE LOYALTY

The existence of source loyalty is widespread in buyer-seller relationships in organizational markets and can be intuitively seen as playing an important role in exchange transactions. However, there is a dearth of empirical work that has been done to measure source loyalty. Morris, Avila and Burns (1989) suggest that the lack of empirical research may be the result of difficulties in defining and measuring of the construct. Paucity of research in the area of behavioral aspects of organizational buying has contributed to the lack of direction regarding how to measure attitudinal and behavioral dimensions of source loyalty.

In contrast to "repeat buying," the Jacoby and Chestnut (1978) definition of brand loyalty:

the biased behavioral response expressed over time by some decision-making unit with respect to one or more alternative brands, (which) is a function of psychological (i.e decision-making, evaluative) processes

can be a spurious surrogate for source loyalty in the absence of such an attitudinal bias. The attitudinal component that has to be in place before the actual act of repeat purchase can take place is what makes source loyalty distinct.

Morris and Holman (1988) underscored the need for research into the concept of source loyalty in organizational buyer behavior. They have added considerably to the richness of the original work of Wind (1970). Establishing the role of source loyalty

in the arena of industrial service (transportation) purchasing will be a highlight of this research.

Jackson (1985) points out that a typography exists for examining the dimensions of loyalty in industrial markets. Loyalty can be to a technology, to a product class, to a vendor's brand, to a vendor or to a person or persons in the selling organization (See Figure 7).

Source loyalty is also characterized in terms of three distinct criteria:

investment

durability

consistency

following the arguments of Dwyer, Schurr and Oh (1987). In the organizational market, transactions are typically worth large dollar amounts. Because of these high dollar volumes, it is quite common to find sellers customizing their products or services to suit the specific application needs of the customer. Proper performance of these products or services are of paramount importance to the buyer organization in pursuing its own day-to-day operations as well as long term economic viability. This consideration on the buyer's part makes the supplier selection decision one with a high degree of risk, and requiring a correspondingly high level of commitment on the part of the seller. The high volume may also represent a significant portion of the seller's business, and as such may as justify the commitment. Subject to outcomes satisfactory to both parties, there is subsequent development of loyalty as a result of ongoing investments made by both (Jackson, 1985). Such investments can take various forms, such as provision for dedicated sales and service personnel at the buyer's facilities, or

Loyalty to a technology
(e.g. digital vs. analog)

Loyalty to a product class
(e.g. private branch exchanges, PBX's)

Loyalty to a manufacturer's brand
(e.g. System 75)

Loyalty to a vendor (source)
(e.g. A.T. & T)

Loyalty to a person
(e.g. Mr. Wheeler, Sales Mgr.)

Figure 7. A Typography of Loyalties (Source: Morris and Holman 1988)

providing application engineering services on the part of the seller. The buyer in turn may invest in plants and equipment to be compatible with the seller, and possibly design operating procedures and personnel practices that provide a fit with those of the seller.

The mutual investments having been made, there is an interest for both parties to continue to reap the benefits over a prolonged period to justify the same. So the durability characteristic of source loyalty follows logically, and once in place, source loyal relationships tend to persist over a period of time. Other than the loss on the value of investments in the relationship, the simplification in the buyer's job that source loyalty brings about is also an incentive to maintain the relationship (Cunningham and Kettlewood 1975,1976).

The consistency criteria refers to the stability of the investments that are made by the buyer and seller over time. Strong fluctuation from any one party may make it very difficult for the other to adjust it's own operations. In absence of extraordinary situations, the tendency is to reorder at the same levels with identical specifications that have been mutually agreed to in the past.

Even though it is becoming more acceptable in these days of interest in JIT (Just in time) inventory policies, sole source dependency is not common in industrial markets, and loyalty, when it exists, tends to be divided amongst more than one supplier (Morris et al. 1989). Dowst et al. (1984) suggest that it is more time consuming for sellers to establish industrial source loyalty than consumer brand loyalty, but source loyal relationships are less prone to dissolution in the former case.

Finally, as discussed earlier, a dimension of source loyalty (that exhibited towards the individual members of the organization) causes further complexities. If the composition of the buying center or the decision making unit changes over time, that may undermine source loyalty too.

Following a typology provided by Morris and Holman (1988), it is posited that variables for measurement will be:

ongoing relationship

vertical compatibility with seller's facilities

number of existing vendors (in supplier base) with ongoing business

cooperative development of new product/s

compatibility with supplier sales force

regular exchange of information.

RELATIONSHIP AMONG THE CONSTRUCTS

TRANSPORTATION PURCHASING AND ORGANIZATIONAL VARIABLES

It is proposed that the transportation choice criteria will be affected by the characteristics of the organization of which the buying center is a part. The organization characteristics will be reflected in the size and composition of the buying center. More specifically, the managerial levels of the decision-makers involved as well as their functional specializations within the organization will be an important determinant of the composition of the buying center (Bellizzi 1981). Larger

organizations tend to have a large and diversified buying center, whereas smaller organizations tend to have buying centers with fewer personnel involved, which operate in an autonomous manner (Granzin, Jackson and Young 1986). Large organizations tend to plan ahead more, and as such have longer time frames in which to make the transportation purchasing decision. The larger organizations will therefore be more likely to have extensive experience in purchasing transportation, and also have in place sophisticated formal procedures and policies for carrier selection (Saleh and LaLonde 1972).

The nature of the freight that needs to be hauled will significantly influence the transportation choice criteria. Various product related attributes such as value, bulk density (weight/volume ratio) and any other special needs, will affect the selection criteria (Mattson 1988).

TRANSPORTATION PURCHASING AND ENVIRONMENTAL VARIABLES

Influence due to environmental variables will be exerted on the transportation purchasing decision through customers, competition and various regulatory and quasi-regulatory bodies. The general business climate, the competitive situation faced by the shipper as well as that faced by the shipper's customer and the carrier will affect the carrier selection criteria. The amount of choice that is available to the shipper, the relative importance of the various carrier evaluation criteria, and the values and norms of the decision participants as well as the shipper and carrier organizations are affected by environmental conditions (Krapfel and Mentzer 1982, Choffray and Lilien 1978).

TRANSPORTATION PURCHASING AND SOURCE LOYALTY

Industrial source loyalty is a phenomenon, the existence of which has been widely accepted (Wind 1972, Morris and Holman 1988). However, there is not much empirical evidence for that in the literature, and none at all to validate its role in transportation purchasing. Because of the investment in developing compatibility with each other's operations, the carrier and shipper with an ongoing relationship will strive to maintain the durability of that relationship. The shipper will value the consistency and stability of its own operations, and the source loyalty developed will significantly reduce the scope of the carrier selection process, and skew the outcome towards the existing carrier/s in use.

SOURCE LOYALTY AND ENVIRONMENTAL VARIABLES

Factors in the environment such as economic forces, changes in patterns of supply and demand, need for strategic cost control in the face of stiff competition, and rapid advances in technological aspects as well as improved management techniques, also affect the nature and extent of source loyalty that shippers exhibit towards carriers. The objective of reducing perceived risk due to factors mentioned above will act as an incentive to establish long term source loyal relationships, as a hedge against the uncertainties in the environment (Morris and Holman 1988, Morris, Avila and Burns 1989).

SOURCE LOYALTY AND ORGANIZATIONAL VARIABLES

Sole source dependency has been frowned upon in the literature (Morris, Avila and Burns, 1989) as a means of exposing an organization to a considerable amount of risk when there is reliance on a single vendor for an essential item. It is usually observed that loyalties tend to be divided amongst a few vendors rather than only one vendor (Corey 1978). Organizations that are bigger are more likely to have a larger number of vendors that they are source loyal to (Bellizzi 1981). Due to the diversity of the buying center, and changes in the membership of the buying center over time, source loyalty to a carrier is likely to be undermined, and consequently weaker (Morris, Avila and Burns 1989).

SUMMARY OF MODEL DEVELOPMENT

In this chapter, the literature on organizational buying , transportation purchasing and measurement of source loyalty has been presented. A case has been made for investigating the motor carrier selection decision as an industrial buying decision. This allows investigation of the circumstances under which the carrier selection decision is internal to the shipper firm (the locus of the carrier selection decision), which was not possible before. Using the industrial buying model also allows investigation of the effects of various independent variables on the evaluative criteria used in motor carrier selection. This is an improvement over previous carrier selection research which merely identified and enumerated such criteria. This knowledge will be of importance to carrier companies when they position their product in different markets. In summary, the model developed above looks specifically at:

a) the effect of organizational characteristics, environmental variables and source loyalty on the locus of the motor carrier selection decision, whether the decision is internal or external to the shipper firm (See Figure 8), and

b) the effect of organizational characteristics, environmental variables and source loyalty on the criteria used to evaluate motor carriers for selection (See Figure 9).

In Chapter 3 a set of hypotheses is developed based on the conceptualization described above. A research design and methodology is then presented for empirical testing of the hypotheses.

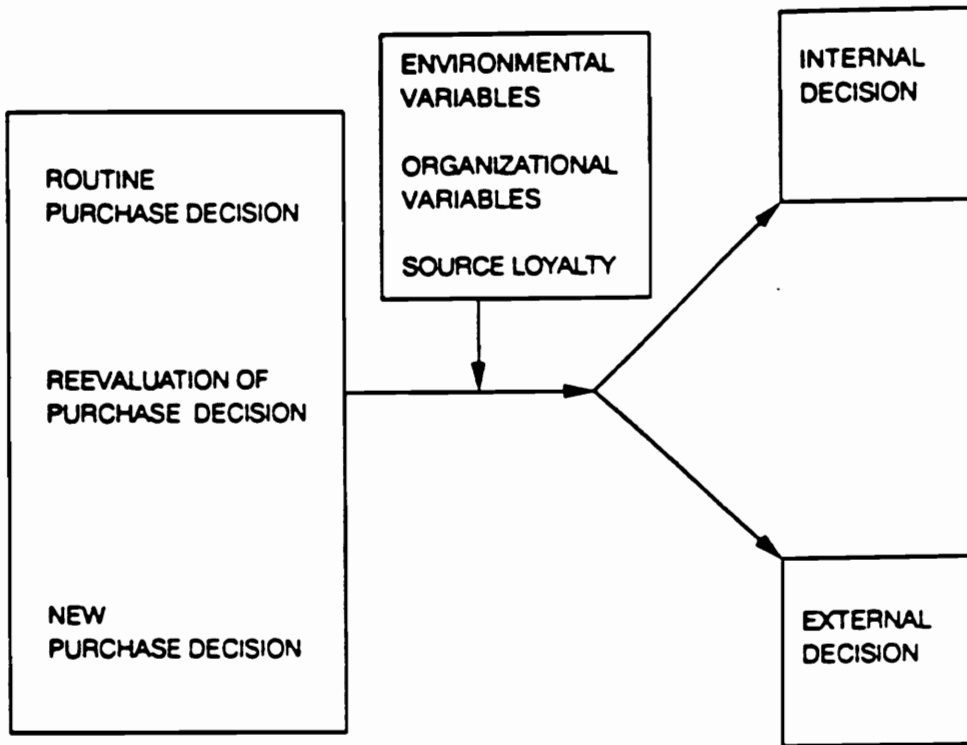


Figure 8. Locus of Carrier Selection Decision: Relationship of Organizational and Environmental Variables and Source Loyalty with Locus of Carrier Selection Decision

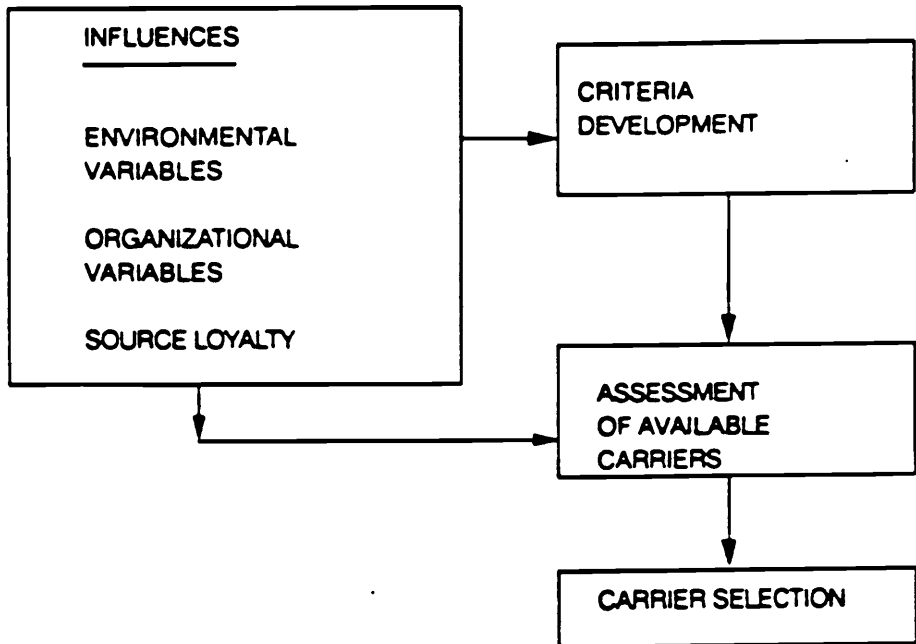


Figure 9. Carrier Selection Criteria in Transportation Purchasing: Relationships with Organizational and Environmental Variables and Source Loyalty

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

The purpose of this section is to develop the methodology which was used to test the model that has been conceptually presented in the previous chapter. A brief overview of the model is first presented, and then the specific hypotheses that were tested in this study are developed. A brief discussion precedes each of the hypothesis statements. In the remaining portion of the chapter, operationalization of the variables presented in the model, and the design and methodology for testing of the hypotheses is presented.

OVERVIEW OF THE CONCEPTUAL MODEL

The model for purchasing motor carrier freight is presented in two parts. The first part of the model has to do with the locus of the motor carrier freight purchasing

decision. The decision can be external or internal to the firm. If the decision is external to the firm, then the motor carrier to be used is specified by a source other than the firm, and as such there is no decision problem for the firm in terms of selecting a carrier. In case however, the decision of selecting a carrier is internal, then the firm has to choose a carrier to meet its transportation needs. It is important to understand under what conditions the carrier selection decision is more likely to be internal than external to the firm. This will enable carrier companies to identify and segment the shippers that are in their potential target market. The organizational characteristics of the shipper company, the environmental variables and source loyalty of shipper to carrier or carriers with which they currently do business will be related to the locus of the carrier selection decision.

The second part of the model examines the role of organizational characteristics, environmental variables and source loyalty on the development of criteria for selection of motor carrier. The weights for different criteria are related to the difference in organizational characteristics of the shipper, the difference in environmental variables and the level of source loyalty of the shipper towards existing carrier or carriers. The relationship of source loyalty to the actual carrier selection decision is also examined.

DEVELOPMENT OF RESEARCH HYPOTHESES

HYPOTHESES SET A

The decision to purchase motor carrier services can be made within the firm by designated buying center members, in which case it is an internal decision for the firm. However, if the carrier selection decision is made by an outside agency such as a

broker or a freight forwarder, or if the consignee specifies the carrier to be used, or the terms of sale are f.o.b⁶ origin - freight collect, then the decision is said to be external to the firm. The locus of the decision is related to organizational characters of the shipper firm.

The organizational characteristics that were investigated in this study are percentage of total shipments that was carried on motor carriers, use of inter-modal carriage, terms of sale, purchase situation context, size of the buying center, nature of the principal business of the firm, the number of manufacturing and storage/distribution facilities and proportion of traffic shipped LTL. The following are the hypotheses regarding the nature of the relationship.

Relationship with Organizational Variables

If a high percentage of total freight of a company is carried by motor carriers, then such transportation is an integral part of the customer service delivery. Under such circumstances, the company is more likely to retain control over the carrier selection decision.

HA1: The carrier selection decision is more likely to be internal than external to the firm as the percentage of total shipments of the firm that was carried on motor freight increases.

⁶ free on board

The decision to use intermodal carriage to reap the benefits of different modes is the result of thorough investigation of different options for transportation choice. This suggests that the company would be more likely to have control over the carrier selection decision.

HA2: The carrier selection decision is more likely to be internal than external to the firm when the firm uses intermodal carriage.

The shipper is responsible for ensuring the quality and reliability of transportation when the goods are shipped freight prepaid. The cost of freight is also a part of the price structure, and must be carefully controlled. Under such circumstances, the shipper is more apt to have control over the carrier selection decision.

HA3: The carrier selection decision is more likely to be internal than external to the firm when the firm uses "freight pre-paid" terms of sale more frequently.

The shipper who faces a higher proportion of new and reevaluation of purchase situations is more likely to consciously view the carrier selection decision as a tool for implementing its distribution strategy, than one who faces mostly routine purchase situations. Hence, such a shipper would be more likely to retain control over the selection decision.

HA4: The carrier selection decision is more likely to be internal than external to the firm when a higher percentage of the purchase situations faced by the firm are new purchase situations or reevaluation of purchase situations.

The involvement of a larger number of members in the transportation purchasing decision signifies viewing the decision as important to the firm, and the expertise of the group would be utilized by keeping control over the carrier selection decision.

HA5: The carrier selection decision is more likely to be internal than external to the firm when the size of the buying center increases.

Firms whose primary business is manufacturing are less likely to have expertise in distribution than other firms whose principal business is wholesale and / or retail distribution. The latter group are more likely to seek to retain control over the carrier selection decision.

HA6: The carrier selection decision is more likely to be internal than external to the firm when the nature of the principal business of the firm is non-manufacturing.

Shipper firms that have to maintain a large number of manufacturing and / or storage and distribution facilities are more likely to have expertise in transportation planning. They will also want to retain control over the carrier selection decision.

HA7: The carrier selection decision is more likely to be internal than external to the firm when the number of manufacturing and/or storage and distribution facilities maintained by the firm increases.

The shipment of less-than-truckload quantities involves higher rates, and need relatively more monitoring of costs and service than truck load shipments, as they are also usually shipped on a rush basis. Shippers therefore seek to have control over the carrier selection decision under the circumstances so that cost and customer service objectives are better met.

HA8: The carrier selection decision is more likely to be internal than external to the firm as the proportion of motor carrier freight shipped less than truckload increases.

Relationship with Environmental Variables

The locus of the carrier selection decision is also related to environmental variables such as the trigger to the carrier selection decision, available pool of carriers, information availability on the carriers and their service characteristics, and perceived variety of available price and service characteristics.

When the carrier selection decision is triggered by a product related reason, the shipper is more likely to have expertise in making the choice of a carrier, than if the

newness of the purchasing task is due to the incorporation of plants and/or destinations that were not previously served by the firm.

HA9: In the case of a new purchase situation, the carrier selection decision is more likely to be internal than external to the firm when the trigger to the carrier selection decisions are more often product related.

Dissatisfaction with service provided by existing carriers, or availability of carriers with better or more customized service characteristics will result in an internal reevaluation of the selection decision more often than if dissatisfaction is price related. Studies of carrier selection have shown that shippers are more concerned about service characteristics than price (Coulter et al. 1989).

HA10: In the case of a reevaluation of purchase situation, the carrier selection decision is more likely to be internal than external to the firm when the trigger to the carrier selection decision are more often service characteristics related.

The scope of firms to improve their customer service delivery level by taking advantage of superior service characteristics of carrier companies will likely result in the selection decision being internal when there is a wide variety of service characteristics among the available carriers.

HA11: The carrier selection decision is more likely to be internal than external to the firm when there is a greater perceived variety of service characteristics among the carriers available.

The opportunity to obtain competitive prices and better service increase with the availability of larger number of carriers. Firms are more likely to seek to have control of the carrier selection decision under such circumstances.

HA12: The carrier selection decision is more likely to be internal than external to the firm as the number of carriers available increases.

The availability and use of information sources about the carrier choices that are possible provide the shipper with a means to enhance the customer service level delivery, and also reduce costs. Thus in situations where such information is available and utilized, the carrier selection decision is more likely to be internal.

HA13: The carrier selection decision is more likely to be internal than external to the firm when more sources of information are available.

HA14: The carrier selection decision is more likely to be internal than external to the firm when more sources of information are utilized.

Finally, if there is a high degree of source loyalty towards the existing carrier/s, the shipper is likely to try to maintain the relationship by retaining control over the carrier selection decision.

HA15: The carrier selection decision is more likely to be internal than external to the firm when there is a high degree of source loyalty toward the existing carrier or carriers.

HYPOTHESES SET B

Source loyalty is defined as a behavioral pre-disposition towards existing vendors. If there is a high degree of source loyalty towards existing carrier/ carriers, they are more likely to be chosen each time a need arises. Even if there are alternatives, they are less likely to be considered, and the selection decision will qualify as a routine purchase more often.

HB1: If alternative choices exist, there will be a positive relationship between the degree of source loyalty toward the existing carrier or carriers and the frequency of routine transportation purchasing (i.e. the greater the degree of source loyalty, the more frequently will motor carrier freight purchasing be considered a routine decision).

By dint of a similar argument as was offered for the previous hypothesis, even when there is a reevaluation of purchase situation, the behavioral pre-disposition will make the selection of the previous carrier more likely, if the shipper has a high degree of source loyalty toward the previous carrier.

HB2: If there is a reevaluation of a transportation purchasing situation, there will be a positive relationship between the degree of source loyalty toward the existing carrier and the frequency of retention of the existing carrier.

HYPOTHESES SET C

The criteria for selection of a motor carrier from a set of available carriers will be related to the organizational characteristics of the shipper, the environmental variables that are in effect and the degree of source loyalty that the shipper has toward existing carriers. The specific nature of the relationships with the criteria cannot be a-priori predicted, but will be of interest as an exploratory exercise for future research.

HC1: The criteria for selection of a carrier from the choice set will differ when purchasing firms differ in their organizational characteristics. Specifically, these characteristics are: the proportion of the total shipments of the firm carried on motor carriers, proportion of motor carrier freight shipped less than truckload, usage of intermodal carriage, terms of sale predominantly used, predominant purchase situation context of transportation faced, size of buying center, nature of firm's business, size of

the firm, and the number of manufacturing and/or storage and distribution facilities maintained by the firm.

HC2: Criteria for selection of a carrier from the choice set will differ when the firms face different environmental variables. Specifically, these variables are: the trigger to the carrier selection decision, the perceived variety of service characteristics that are available, availability of carriers, sources of information available, sources of information utilized, distance of the average motor carrier shipment, and proximity of facilities to motor carrier hubs.

HC3: Criteria for selection of a carrier from the choice set will differ with the extent of the firm's source loyalty to the existing carrier or carriers.

The summary of the hypothesized relationships are shown in Figure 10, Figure 11, Figure 12 and Figure 13.

EXPLORATORY QUESTIONS

Some of the variables that are of interest to practitioners, and which will be useful segmentation dimensions for carriers evaluating their market were also investigated. However, as the nature of the relationships with these variables could not be hypothesized a priori, it was decided to investigate them as exploratory questions.

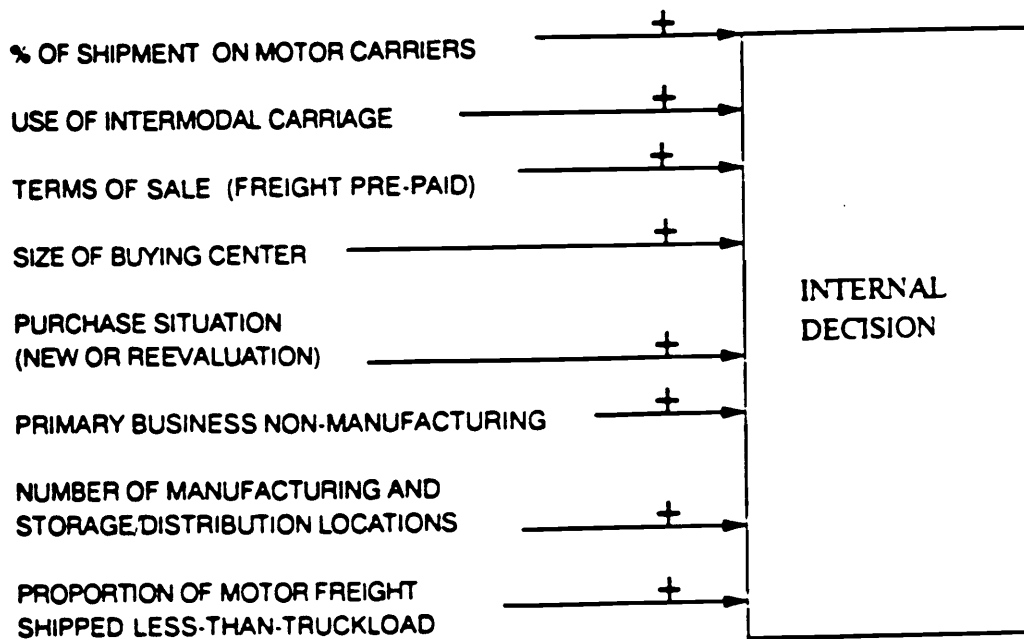


Figure 10. Relationship of Organizational Variables with Locus of Carrier Selection Decision

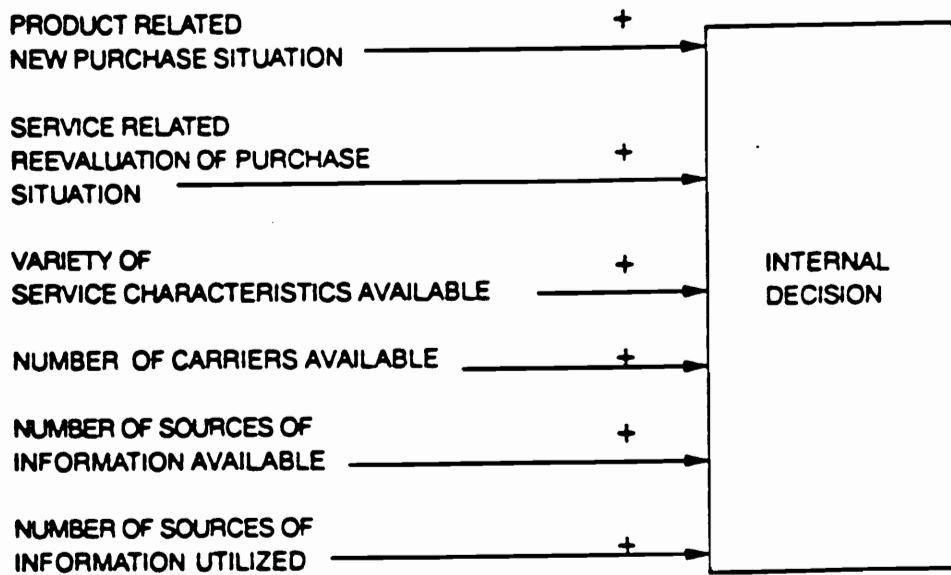


Figure 11. Relationship of Environmental Variables with Locus of Carrier Selection Decision

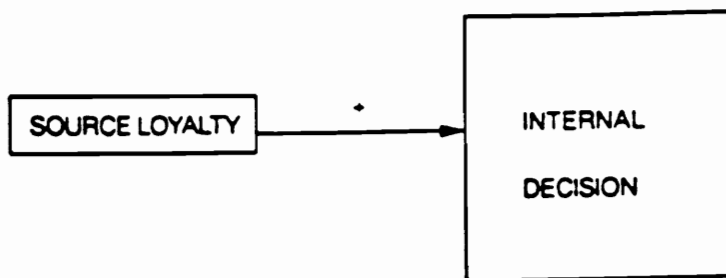


Figure 12. Relationship of Source Loyalty with Carrier Selection Decision

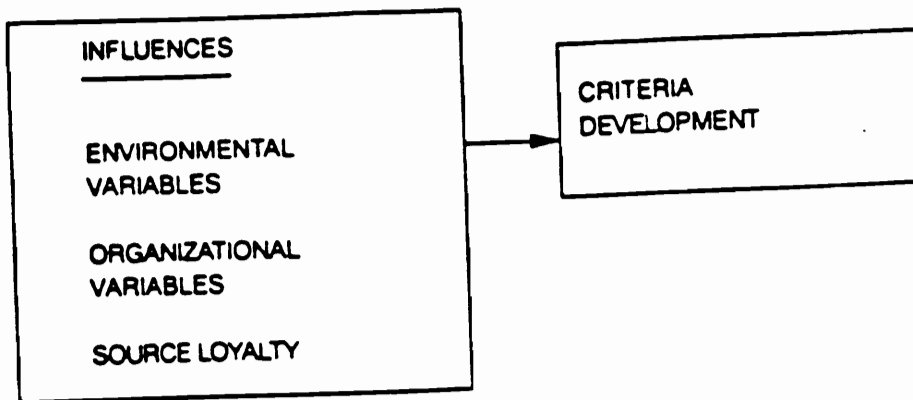


Figure 13. Carrier Selection Criteria: Relationship of Organizational and Environmental Variables and Source Loyalty on Carrier Selection Criteria

Exploratory Question 1: What is the relationship between the sales volume of a firm and the internality or externality of the transportation purchasing decision.

Exploratory Question 2: What is the relationship between the level of employment of the firm and the internality or externality of the transportation purchasing decision.

Exploratory Question 3: What is the relationship between the distance of the average motor carrier shipment and the internality or externality of the transportation purchasing decision.

Exploratory Question 4: What is the relationship between the average distance of the firm's facilities from transportation hubs and the internality or externality of the transportation purchasing decision.

METHODOLOGY

A mail questionnaire survey was conducted. The questionnaire was detailed and somewhat lengthy as it had to deal with the operationalization of the various independent and dependent variables, and as such a telephone interview was not found to be suitable. Personal interview, while useful and appropriate, would be too expensive. There is also support in the literature that a mail survey under these circumstances will yield acceptable results (Kanuk et al. 1975; Armstrong et al. 1977; Dillman 1978; Pressley 1980).

The questionnaire is in four parts including an introductory set of filter questions. Part I primarily deals with introductory and filter questions. Part II is geared to obtaining information on triggers for the carrier selection decision as well as criteria used for the same under different purchase scenarios. A section of Part II examines the New Purchase Situation and another section the Reevaluation of Purchase Situation. Part III of the questionnaire looks at the issue of "source loyalty," and uses the Morris and Avila (1989) scale to differentiate between a high level and a low level of loyalty. This section has two parts dealing with the most frequently used carrier and the least frequently used carrier respectively. Part IV of the questionnaire is largely respondent classification data. Items seeking information on "organizational variables" and "environmental variables" are interspersed throughout all four parts.

A purposive population was chosen for this study. The population consists of people who are involved in the purchase of transportation of goods, and are likely to, by virtue of the industry they are in, have been involved in circumstances which can be designated new task or modified rebuy.

The population studied was that of Traffic Executives in the U.S. The sample size reflects the extent and variability of the population, and the critical effect size considerations. The sampling frame used was the 1989 Official Directory of Industrial and Commercial Traffic Executives.

Sampling method was probability sampling in order to be able to estimate sampling error for the research, and also ensuring that the sample was representative of the population.

RESEARCH DESIGN

Preliminary research of exploratory nature was conducted by talking to experts, both academics and practitioners, over the phone. Given the constraints on the researcher in terms of funds available, the time frame of the study, the nature of information sought, and looking at traffic managers as the respondents, it was determined that a mail survey with a detailed questionnaire would best suit the purpose of this research.

There is extensive discussion in the literature regarding appropriate methods for conducting mail surveys in the industrial market, and also on how to improve the response rates in such surveys (Kanuk and Berenson 1975; Dillman 1978; Pressley 1978, 1980; Gentry and Hailey 1981; Jobber 1986; Walker, Kirschmann and Conant 1987). Following are some of the relevant findings of the integrative review undertaken by Kanuk and Berenson (1975).

1. Follow-ups appear to be a better investment as compared to prior notification for the purpose of increasing response rates.
2. There is a diminishing rate of return with respect to succeeding follow-ups, even though the absolute response rate improves with each.
3. "Prestigious" source and official sponsorship increase the response rate significantly. Zdep (1986) also found strong support for this when studying samples of business executives,

4. Personalized inside cover letter and type of postage (metered, commemorative stamp, multiple small denomination versus single) do not significantly affect response rates.
5. Return envelopes appear to increase response rates.

The Total Design Method (TDM) for industrial mail surveys (Dillman 1978; Walker, Kirschmann and Conant 1987) is a comprehensive approach to design mail surveys for the industrial market and as such will be discussed in some detail here. TDM is a two stage process model, the first part being the development of the survey instrument, and the second being the implementation of the actual survey. The model is shown in Figure 14. The framework of social exchange theory on which the model is based provides a cost-benefit approach to all the various decisions that have to be made at both stages of the process model. Walker, Kirschmann and Conant (1987) provide a succinct evaluation of such analyses in Table 10 and Table 11.

Jobber (1986) found support for promised anonymity, stamped return envelopes, monetary incentives and follow-ups as factors that increase response rates. He did not however find any support for prior notification, offer of copy of completed study and color of questionnaires. The findings were mixed for personalized cover letters and the type of outgoing postage.

Finally, Dillman (1978) favors a social-usefulness appeal rather than the more common "Would you do me a favor?" kind of altruistic appeal. There are merits to his argument that:

most survey instruments in the industrial market demand more effort than can be asked as a mere favor,

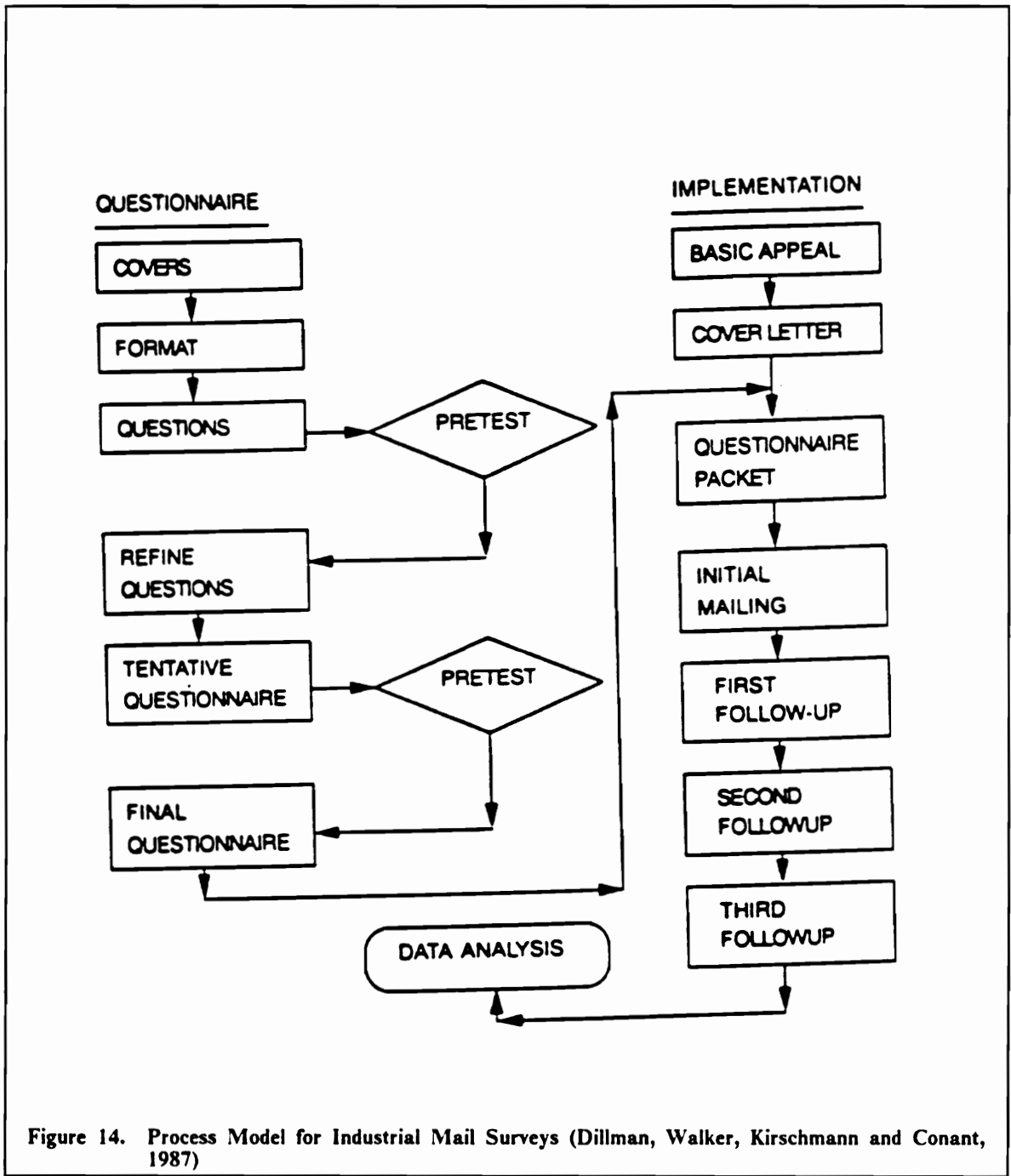


Figure 14. Process Model for Industrial Mail Surveys (Dillman, Walker, Kirschmann and Conant, 1987)

Table 10. Cost-Benefit Analysis in Questionnaire Phase of Survey Design

(Source: Walker, Kirschmann and Conant 1987)

Decision Area	Cost	Benefit
<i>Covers (front and Back)</i> Title Graphic Return address Additional comments Thank you No questions	- Space - Money,space - Space - Space - Space - Lost interest	+ Positive first impression + Set questionnaire apart from others + Can be returned if separated from the return envelope + Consulting approach (reward) + Verbal appreciation (reward) + Space economy
<i>Format</i> Size	- Space	+ Postage economy positive first impression
<i>Questions</i> Ice breaker Descending gradient of social usefulness Group questions Cognitive ties Objectionable questions last within groups	- Space - Time, effort - Time, effort -Time, effort - Time, effort	+ Relax respondent + Interest, commitment + Reduced mental effort + Encourage well thought out answers + Minimize feeling of unrelated questions + Commitment
<i>Page Formats</i> Fitting on page Distinguish questions from answers Vertical flow	- Time, effort - Time, effort - Time, effort	+ Impression, motivate to complete + Fewer omitted questions + Fewer omitted or mismarked responses

Table 11. Cost-Benefit Analysis in Implementation Phase of Survey Design

(Source: Walker, Kirschmann and Conant 1987)

Decision Area	Cost	Benefit
<i>Basic Appeal</i> Social Usefulness	- Time, effort	+ Provides a theme, feeling of being helpful increase 'demands' of questions
<i>Cover letter</i> Confidentiality Copy of results Size Personalized Real Signature	- Obligation for researcher - Time, money - Space - Time, money - Time	+ Builds trust + Builds trust, reward + Gains attention, impression of brevity + Feeling of importance + Feeling of importance
<i>Questionnaire packet</i> Numbered questionnaires Token incentive Metered postage First class postage Specially folded contents <i>Follow-ups</i> First Second Third	- Time, lack of anonymity - Money, value - none - Money - Time, effort - Time, effort and money - Time, effort and money - Time, effort and money	+ Facilitates follow-up + Reward, builds trust + Conveys aNormal business appearance + Conveys importance, address correction easy, can be forwarded, not delayed at post office + Differentiate from mass mailings, increased chance of reading cover letter first + Thank you, increased response (15 to 20%) + Importance of individual increased response, and initial mistakes may be remedied + Importance of individual increased response (12 to 15%)

follow-ups appear as persistent requests for more favors

perceived personal reward of having helped solve an important problem is more of a motivational aid than a token monetary incentive.

A cover letter incorporating the enhancing features discussed above was prepared for this survey. The letter was on white paper of 20% rag content with the prestigious seal of Virginia Tech on the letterhead. The purpose of the study was clearly explained and the importance of every single response emphasized. The social-usefulness appeal was utilized, and an offer of summary results was extended as an added incentive, to be on the safe side. The anonymity of the respondents was assured. The cover letters were signed in ink by the Chairman of the researcher's doctoral committee whose name is well known as an academician as well as a consultant in the logistics field. First-class return postage-paid, addressed envelopes were enclosed. The cover letter, the questionnaire and the addressed envelope were all folded together, and placed in a metered envelope, and mailed first-class in the last week of March 1990. The copy of the cover letter is in Appendix A.

Following the TDM model described earlier, the first follow-up in the form of a reminder post-card was mailed a week after the questionnaires were mailed. The second follow-up was a letter along with a copy of the questionnaire mailed out three weeks after the initial mailing. All stationary once again bore the Virginia Tech seal. The copies of the reminder post-card and the second follow-up letter are in Appendix B and Appendix C respectively.

QUESTIONNAIRE CONSTRUCTION

The preliminary work for the construction of the survey questionnaire for this research consisted of literature search, and personal interviews with practitioners and researchers who have had prior experience with carrier selection studies or other studies that were relevant. These diverse sources pointed out the various problems associated with empirical research in the area of transportation purchase in general, and motor carrier selection in particular. They provided several insights that turned out to be crucial to the successful design of the instrument as they aided question formulation, and enhanced the researcher's understanding of the domain of the problem.

Looking at the information requirements of the study, and following the typology provided by Churchill (1987), it was decided that the best format of the instrument would be "structured, undisguised." The questionnaire, while not repetitive, was fairly detailed. Kanuk and Berenson (1975) found that shorter questionnaires do not necessarily obtain higher response rates. Cannell, Oskenburg and Converse (1977) found that longer questions which provide respondents with more information about the type of information sought improve response rates. Following the general guidelines provided by Churchill (1987), the questions in the instrument were formulated with the objective of minimizing errors arising from

non-elicitation of the desired information

biased responses

reduction of response rates

Attention was paid also to the layout of the questionnaire and the sequencing of questions to provide facilitation in handling to both the respondent and the researcher. A balance was struck between having a very cluttered instrument and one that was too long, with unnecessary blank spaces. In general, the following checklist was used:

1. Contents of individual questions were carefully checked for relevance to the research.
2. The response formats were checked for adequacy.
3. In determining the wording of each question, simple words were used, and ambiguous words and questions were avoided as well as implicit alternatives and/or assumptions.

Information Sought By Questionnaire: The questionnaire sought information on shipper organizational characteristics, environmental conditions faced by the shipper, and relationships of the shipper with existing carrier organizations. The questionnaire also asks for information pertaining to shipper attitude toward relevance of various criteria that have been found in the past to have a bearing on carrier selection decisions. Information was gathered as well on the importance of such criteria as actual determinants of carrier selection.

Part I of the questionnaire dealt with questions that would qualify the respondent to be included in the study, as well as some classification questions. To be included in the study the respondent's organization must have purchased motor carrier transportation on at least ten occasions in the past twelve months (Q# 1), and not have been engaged solely in private carriage (Q# 6) or been restricted only to contract carriage (Q# 5) for all of the past twelve months. Appropriate branching instructions

were used to allow respondents who did not qualify to stop at that point. The classification questions had to do with the percentage of total shipments that involved motor carriers (Q# 2), use of intermodal carriage (Q# 7) and terms of sale for shipments requiring motor carrier transportation (Q# 3). There was also a question asking for the proportions of the carrier choices that result from various sources such as the shipper organization, consignees, freight forwarders or any other source not mentioned (Q# 4). This last question dealt with the environment in which the carrier selection decision is made.

Part II of the questionnaire started with a description of the various purchase situations that were explored in the research. The situations, which described the environment in which the decision is made, were as follows.

1. New Purchase Situation
2. Reevaluation of Purchase Situation
3. Routine Purchase Situation

This part of the questionnaire first sought to find the frequency with which the situations described above took place in the past twelve months (Q# 8), if modal change was ever a "Reevaluation of Purchase Situation" (Q# 9), and what was the proportion of time that a "Reevaluation of Purchase Situation" actually resulted in the selection of a carrier different from the one that was previously used for a similar need (Q# 10). The remaining portion of Part II was split into sections A and B. Section A dealt with "New Purchase Situation" and Section B dealt with "Reevaluation of Purchase Situation." The information sought about the two different situations were similar, and as described below.

- **Environmental Variables:**

The reason/s that triggered the carrier selection decision (Q# 11 and Q# 19)

Number of carriers available in the pool (Q# 14 and Q# 22)

Perceived variety of service characteristics offered by the carriers available (Q# 15 and Q#23)

Sources of information that were available and utilized to obtain information on carriers (Q# 16 and Q# 24)

- **Organizational Characteristics:**

Size and composition of the buying center, and perceived influence of individual members on the selection decision (Q# 12 and Q# 20)

Length of time for the carrier selection decision to be made (Q# 13 and Q# 21)

- **Carrier Choice Criteria:**

Relevance of various criteria to the carrier selection decision on a scale of 1 to 5: 1= very important, 2= somewhat important, 3= neither important nor unimportant, 4= somewhat unimportant and 5= not important. The items were assembled from ones used in past research as described in the literature review in Chapter 2 (Q# 17 and Q# 25)

Rating of the last carrier chosen along the criteria described above, provided on a 5 point scale: 1= Poor, 2= Less than average, 3= Average, 4= Above average and 5= Excellent. (Q# 18 and Q#26)

Part III of the questionnaire sought to gather information on the relationship of the shipper with the number of carriers (Q# 27) with whom it does business. This part was again split into two sections. Section A gathered information about the relationship with the carrier that is used most frequently. Section B gathered information about the relationship with the carrier that is used least. Information was gathered with respect to the duration of the relationship (Q# 28 and Q# 30). The nature and extent of source loyalty was examined in both cases using a modified version of the scale that was proposed by Morris, Avila and Burns (1989). Respondents were asked to indicate their agreement/disagreement to various statements on a scale of 1 to 5: 1= Strongly agree, 2= Somewhat agree, 3= Neither agree nor disagree, 4= Somewhat disagree and 5= Strongly disagree.(Q# 29 and Q# 31)

Part IV of the questionnaire largely sought to gather information on the various characteristics of the shipper organization. Items addressed were: the nature of the business undertaking of the shipper (Q# 32); number of manufacturing and/or storage/distribution locations the shipper uses (Q# 34); number of employees (Q# 33); annual revenue (Q# 39); average annual demand of the shipper for motor carrier transportation in tons and in US Dollars (Q# 35), and percentage of total motor carrier shipments that is shipped less-than-truckload (Q# 36). Finally this part also contained three questions on the environmental variables: the spatial extent of the market served by the shipper was determined by asking for the maximum distance shipped, and the distance shipped in the case of the average shipment (Q# 37); the range of distance of transportation hub cities from shipper locations (Q# 38); and the

state in which the corporate headquarters of the shipper is located, as a surrogate for legal constraints specific to that state (Q#40). The copy of the final questionnaire is in Appendix D.

SAMPLING DESIGN

The population used for this research consisted of traffic executives of U.S. companies. The sampling frame was the 1989 edition of The Official Directory of Industrial and Commercial Traffic Executives. The directory had a listing of approximately 16,447 names. Determination of sample size was based on the requirements of the study. The various analytical tools that were to be used for the analysis of the findings are sensitive to sampling error, thus the methodological requirements dictated the size of the actual sample to be used.

The sample size required for this study was based on the requirements of the Multiple Linear Regression model that was used to test hypotheses. The sample size selection was based on achieving a power of .80⁷. The power of the statistical test is determined by three parameters: a) the significance criterion (α level), b) the reliability of the sample results, and c) the "effect size," that is the actual strength of the phenomenon as it exists (Cohen 1977). The determination of actual sample size was according to Cohen (1977).

The effect size index f^2 was utilized. The general formula for f^2 then becomes:

⁷ Power of a statistical test of a null hypotheses is the probability that it will lead to the rejection of the null hypothesis, i.e., the probability that it will result in the conclusion that the phenomenon exists (Cohen 1977).

$$f^2 = PV_S / PV_E$$

where PV_S = proportion of variance due to source, and

PV_E = the error variance.

Therefore,

$$f^2 = R^2 / 1 - R^2$$

Cohen suggests that a medium effect size would be a case where $f^2 = .15$. This would translate to an R^2 of $.15 / (1 + .15) = .13$, as

$$R^2 = f^2 / 1 + f^2$$

To determine sample size, the power table is entered using the α -level, and the desired power, to determine L , which is the non-centrality parameter, a function of f^2 and v where v = error degrees of freedom.

$$L = f^2 \times v$$

Now, the sample size was given by:

$$N = (L / f^2) + p + 1, \text{ where } p = \text{number of independent variables.}$$

$$\text{i.e., } N = L \times (1 - R^2) / R^2 + p + 1$$

For this study, power = .80, α = .05, giving a value of $L = 18.81$, for $p = 15$. This resulted in a required sample size of 142 for the study using the formula above.⁸

Again, for the tests of correlation, it was expected that the correlation between purchase decision and source loyalty would be large, but as there was no previous empirical support, and due to measurement error in the scale for source loyalty, the required sample size calculations were on the basis of a medium effect size as defined by Cohen (1977). Medium effect size according to Cohen is $r = .30$, leading to $r^2 =$ proportion of variance explained = .09. From the sample size tables, for $r = .30$, for a one-tailed test at $\alpha = .05$, at power = .80, the required sample size was 68.⁹

Comparing the two estimates of sample size requirements, the higher number (i.e. 142) was chosen as the required sample size.

The literature reviewed on response rates of industrial mail surveys suggested 20% as a reasonable figure, under conditions of the Total Design Method (Dillman 1978). Krapfel and Mentzer (1978) using the same sampling frame, reported a completion rate of 44.3%. However, given the length of the questionnaire and the fact that respondents probably get a much larger number of requests for information now than they did in 1980, a 15% response rate was expected to provide a comfortable margin.

The method employed to select the sample was simple random sampling, and 1500 companies were chosen. The choice was based on a random number generating computer algorithm choosing 1500 numbers between 1 and 16447. The final set of numbers had 1434 entries as the remaining numbers had been chosen more than once. The Directory sometimes had multiple listings for a number of traffic executives from a single firm. The 1434 questionnaires were mailed out to the highest ranking traffic

⁸ See Cohen (1977) table, p.441

⁹ See Cohen (1977) table p.101

executive listed for the firm, with a request that it be routed to the most appropriate person, if the addressee was not the right person to respond. This was approximately 8.7% of the population. Such a percentage is a reasonable sample size in this type of research.

The first mailing of questionnaires and cover letters went out on March 30. A reminder postcard was mailed out on April 6, 1990. A second wave of questionnaires with cover letters were mailed out on April 20.

PRETESTING OF THE INSTRUMENT

The initial survey instrument was developed after discussion with academic researchers and practitioners in the area of transportation purchasing, as well as perusal of questionnaires used by past researchers (as discussed in the literature review). The instrument was pretested in two stages.

First Pre-test

The first stage involved mailing of the draft questionnaire to a group of ten experts. The group was split between academic researchers and practitioners, who had not been previously contacted for this research in any way, and who would not be included in the final study. The draft questionnaire was rewritten and edited based on the comments of the reviewers who were contacted over the phone. The reviewers were asked to provide a written assessment of the instrument also. The reviewers' comments helped remove ambiguities in some of the questions. Also some of the units to be used

for the responses were changed to reflect consistency of understanding across respondents. The scenarios for the three types of purchase situations used in the study were rewritten based on the reviewers' comments.

Second Pre-test

The revised questionnaire was then pretested again with a group of 18 respondents from the actual population used in the study. For this pretest, packets containing questionnaires, cover letters and return envelopes were sent to presidents of three traffic and transportation clubs in Virginia, Tennessee and North Carolina with a request to have members who were involved in motor carrier freight purchasing, respond. From this pretest, the reliability of the indicators used in the source loyalty scale developed by Morris and Avila (1989) was assessed, as well as the respondent groups' ability to comprehend and complete the instrument. The results of this second pretest was reviewed. No significant changes were necessary, in terms of wording or comprehension of the questionnaire by the respondents. The reliability of the source loyalty scale (Morris and Avila 1989) was checked. Chronbach's α for the twenty-five item scale was found to be 0.8454, while the value of α marginally increased to .8512 for a scale with 15 items. It was decided to keep the full complement of items for the final instrument. The reliability measure obtained, meets the criteria of Reliability ≥ 0.80 for basic research (Nunnally 1978, Peter 1979). The final instrument was then mailed to the selected sample. A copy of the final instrument can be found in Appendix B.

DATA ANALYSIS TECHNIQUES

The following discussion of the various statistical techniques follows Kachigan (1986).

1. Regression Analysis provides an equation which describes the nature of the relationship between two variables. Regression analysis further provides variance measures that allow assessment of the accuracy with which the regression equation can predict values on the criterion variable. Multiple regression analysis is an extension of the simple regression model, using more than one predictor variable to estimate values on the criterion variable. Key applications of the regression analysis technique that will be useful for this research are as follows.

Determination as to whether a relationship exists between two or more variables.

Description of such a relationship, should one exist, in the form of a mathematical equation.

Assessing the degree of description and/or prediction achieved by the regression equation.

Assessing, in the case of multiple regression, the relative contribution of various predictor variables to the variation in the criterion variable.

2. Canonical Correlation is the name given to the procedure for correlating two derived variables, each representing the weighted combinations of other variables.

It is, in other words, a tool to be used for situations where there are not only multiple predictor variables, but there are also two or more criterion variables. The canonical correlation reflects the variance shared by the linear composites of the sets of variables, not the variance extracted from the variables themselves. The method is a powerful tool for exploring relationships between multiple criterion and predictor variables. The technique is primarily for descriptive purposes, but may also be used for predictive purposes. Results obtained from Canonical Correlation Analysis should suggest answers to questions concerning the number of ways the two sets of multiple variables are related, the strength of the relationships and the nature of the relationships so defined.

HYPOTHESES TESTING

The hypotheses developed earlier had to be tested with the purpose of potential falsification, before the theoretical model could be validated. In the following section, the specific statistical testing procedures that were used to test the individual hypotheses will be briefly discussed.

HYPOTHESES SET A

A multiple regression model was used as a global test of the hypotheses in this set. The regression model was specified as follows:

$$\begin{aligned} IE &= C + B_{01} \times X_{01} \\ &+ B_{02} \times X_{02} \end{aligned}$$

$$\begin{aligned}
&+ B_{03} \times X_{03} \\
&+ B_{04} \times X_{04} \\
&+ B_{05} \times X_{05} \\
&+ B_{06} \times X_{06} \\
&+ B_{07} \times X_{07} \\
&+ B_{08} \times X_{08} \\
&+ B_{09} \times X_{09} \\
&+ B_{10} \times X_{10} \\
&+ B_{11} \times X_{11} \\
&+ B_{12} \times X_{12} \\
&+ B_{13} \times X_{13} \\
&+ B_{14} \times X_{14} \\
&+ B_{15} \times X_{15}
\end{aligned}$$

Where,

IE = Internality/Externality of the decision. The percentage of time the respondent reports that the carrier specification was left to the firm. (Q #4)

X_{01} = The percentage of the total shipments that was carried on motor carriers. (Q #2)

X_{02} = The use of intermodal carriage. (Q #7)

X_{03} = The percentage of times the terms of sale in which the company engages (Q #3) was "freight pre-paid".

X_{04} = The percentage of time the situation context faced by the firm (Q #8) was either a new purchase situation or a reevaluation of purchase situation.

X_{05} = The size of the buying center. This variable was further controlled for the purchase situation context: new purchase or reevaluation. (Q #12 and Q #20)

X_{06} = The nature of the principal business of the firm, manufacturing or otherwise, as reported by the respondent. (Q #32a)

X_{07} = The number of manufacturing and/or storage and distribution facilities maintained by the firm. (Q #34)

X_{08} = Percentage of motor carrier shipments that were shipped less than truckload. (Q #36)

X_{09} = The percentage of carrier selection decisions in case of new purchase situations where the trigger was product related. (Q #11)

X_{10} = The percentage of carrier selection decisions in case of reevaluation of purchase situations where the trigger was service characteristics related. (Q #19)

X_{11} = Perceived variety of service characteristics available. This variable was controlled for the nature of the purchase situation. The coding in each case was 'quite diverse,' 'somewhat diverse,' 'somewhat similar,' and 'quite similar.' (Q #15 and Q #23)

X_{12} = The availability of carriers. This variable was controlled for the nature of the purchase situation. (Q #14 and Q #22)

X_{13} = Number of sources of information available, controlled for the nature of the purchase situation. (Q #16 and Q #24)

X_{14} = Number of sources of information utilized, controlled for the nature of the purchase situation. (Q #16 and Q #24)

X_{15} = Source loyalty score. Obtained as an additive composite of the items in the source loyalty scale for each respondent. (Q #29)

HA1: The carrier selection decision is more likely to be internal than external to the firm as the percentage of total shipments of the firm that was carried on motor freight increases.

The hypothesis was supported if standardized β_{01} coefficient corresponding to X_{01} was significant and positive.

HA2: The carrier selection decision is more likely to be internal than external to the firm when the firm uses intermodal carriage.

The hypothesis was supported if standardized β_{02} coefficient corresponding to X_{02} was significant and positive.

HA3: The carrier selection decision is more likely to be internal than external to the firm when the firm uses "freight pre-paid" terms of sale more frequently.

The hypothesis was supported if standardized β_{03} coefficient corresponding to X_{03} was significant and positive.

HA4: The carrier selection decision is more likely to be internal than external to the firm when a higher percentage of the purchase situations faced by the firm are new purchase situations or reevaluation of purchase situations.

The hypothesis was supported if standardized β_{04} coefficient corresponding to X_{04} was significant and positive.

HA5: The carrier selection decision is more likely to be internal than external to the firm when the size of the buying center increases.

The hypothesis was supported if standardized β_{05} coefficient corresponding to X_{05} was significant and positive.

HA6: The carrier selection decision is more likely to be internal than external to the firm when the nature of the principal business of the firm is non-manufacturing.

The hypothesis was supported if standardized β_{06} coefficient corresponding to X_{06} was significant and positive.

HA7: The carrier selection decision is more likely to be internal than external to the firm when the number of manufacturing and/or storage and distribution facilities maintained by the firm increases.

The hypothesis was supported if standardized β_{07} coefficient corresponding to X_{07} was significant and positive.

HA8: The carrier selection decision is more likely to be internal than external to the firm as the percentage of motor carrier freight shipped less than truckload increases.

The hypothesis was supported if standardized β_{08} coefficient corresponding to X_{08} was significant and positive.

HA9: In the case of a new purchase situation, the carrier selection decision is more likely to be internal than external to the firm when the trigger for the carrier selection decisions are more often product related.

The hypothesis was supported if standardized β_{09} coefficient corresponding to X_{09} was significant and positive.

HA10: In the case of a reevaluation of purchase situation, the carrier selection decision is more likely to be internal than external to the firm when the trigger for the carrier selection decisions are more often service characteristics related.

The hypothesis was supported if standardized β_{10} coefficient corresponding to X_{10} was significant and positive.

HA11: The carrier selection decision is more likely to be internal than external to the firm when there is a greater perceived variety of service characteristics among the carriers available.

The hypothesis was supported if standardized β_{11} coefficient corresponding to X_{11} was significant and positive.

HA12: The carrier selection decision is more likely to be internal than external to the firm as the number of carriers available increases.

The hypothesis was supported if standardized β_{12} coefficient corresponding to X_{12} was significant and positive.

HA13: The carrier selection decision is more likely to be internal than external to the firm when more sources of information are available.

The hypothesis was supported if standardized β_{13} coefficient corresponding to X_{13} was significant and positive.

HA14: The carrier selection decision is more likely to be internal than external to the firm when more sources of information are utilized.

The hypothesis was supported if standardized β_{14} coefficient corresponding to X_{14} was significant and positive.

HA15: The carrier selection decision is more likely to be internal than external to the firm when there is a higher level of source loyalty toward the existing carrier or carriers.

The hypothesis was supported if standardized β_{15} coefficient corresponding to X_{15} was significant and positive.

HYPOTHESES SET B

HB1: If alternative choices exist, there will be a positive relationship between the degree of source loyalty toward the existing carrier or carriers and the frequency of routine

transportation purchasing (i.e. the greater the degree of source loyalty, the more frequently will motor carrier freight purchasing be considered a routine decision).

The alternate hypothesis above was accepted or rejected based on the outcome of the following correlation analysis study. The hypothesis was supported if there was a significant positive correlation of the frequency of Routinized Purchase Situation occurrence (Q #8) with the score on the source loyalty scale (Q #29), given that alternative carriers are available for selection.

$$r_{X_{16}X_{18}} > 0$$

where,

X_{16} = Frequency of routinized purchase situation

X_{18} = Source Loyalty score

$r_{X_{16}X_{18}}$ = Coefficient of Correlation

HB2: If there is a reevaluation of a transportation purchasing situation, there will be a positive relationship between the degree of source loyalty towards the existing carrier and the frequency of retention of the existing carrier.

The alternate hypothesis above was accepted or rejected based on the outcome of the following correlation analysis study. The hypothesis was supported if there was a significant positive correlation of frequency of retention of existing carrier in a Reevaluation of Purchase Situation occurrence (Q #10) with the score on the source loyalty scale (Q #29).

$$r_{X_{17}X_{18}} > 0$$

where,

X_{17} = Frequency of retention of existing carrier, given reevaluation of purchase situation

X_{18} = source loyalty score

$r_{X_{16}X_{18}}$ = Coefficient of Correlation

HYPOTHESES SET C

HC1: The criteria for selection of a carrier from the choice set will differ when purchasing firms differ in their organizational characteristics. Specifically, these characteristics are: the percentage of the total shipments of the firm carried on motor carriers, percentage of motor carrier freight shipped less than truckload, usage of intermodal carriage, terms of sale predominantly used, predominant purchase situation context of transportation faced, size of buying center, nature of firm's business, size of the firm, and the number of manufacturing and/or storage and distribution facilities maintained by the firm.

The alternate hypothesis above was accepted or rejected based on the outcome of the following canonical correlation analysis study. The hypothesis was supported if there was a significant correlation that existed between the set of variables, namely,

the percentage of the total shipments of the firm carried on motor carriers (Q #2), percentage of motor carrier freight shipped less than truckload (Q #36), usage of intermodal carriage (Q #7), terms of sale predominantly used (Q #3), predominant purchase situation context of transportation faced (Q #8), size of buying center (Q #12 and Q #20), nature of firm's business (Q #32a), size of the firm (Q #33 and Q #39), and the number of manufacturing and/or storage and distribution facilities maintained by the firm (Q #34), and the set of criteria that determine carrier evaluation and choice (Q #17 and Q #25), there being a control for the purchase situation variable.

HC2: Criteria for selection of a carrier from the choice set will differ when the firms face different environmental variables. Specifically, these variables are: the trigger to the carrier selection decision, the perceived variety of service characteristics that are available, availability of carriers, sources of information available, sources of information utilized, distance of the average motor carrier shipment, and proximity of facilities to motor carrier hubs.

The alternate hypothesis above was accepted or rejected based on the outcome of the following canonical correlation analysis study. The hypothesis was supported if there was a significant correlation that existed between the set of variables, namely,

the trigger to the carrier selection decision (Q #11), the perceived variety of service characteristics that are available (Q #15 and Q #23), availability of carriers (Q #14 and Q #22), sources of information available (Q #16 and Q #24), sources

of information utilized (Q #16 and Q #24), distance of the average motor carrier shipment (Q #37b), and proximity of facilities to motor carrier hubs (Q #38), and the set of criteria that determine carrier evaluation and choice (Q #17 and Q #25), there being a control for the purchase situation variable.

HC3: Criteria for selection of a carrier from the choice set will differ with the extent of the firm's source loyalty to the existing carrier or carriers.

The alternate hypothesis above was accepted or rejected based on the outcome of the following canonical correlation analysis study. The hypothesis was supported if there was a significant correlation that existed between the set of items in the source loyalty scale, and the set of criteria that determine carrier evaluation and choice (Q #17 and Q #25), there being a control for the purchase situation variable.

EXPLORATORY QUESTIONS

Exploratory Question 1: What is the relationship between the sales volume of a firm (Q #39) and the internality or externality of the transportation purchasing decision (Q #4).

Exploratory Question 2: What is the relationship between the level of employment of the firm (Q #34) and the internality or externality of the transportation purchasing decision (Q #4).

Exploratory Question 3: What is the relationship between the distance of the average motor carrier shipment (Q #37b) and the internality or externality of the transportation purchasing decision (Q #4).

Exploratory Question 4: What is the relationship between the average distance of the firm's facilities from transportation hubs (Q #38) and the internality or externality of the transportation purchasing decision (Q #4).

SUMMARY

In this chapter, the specific hypotheses that are to be tested in this study have been developed. A methodology for testing the hypothesis has been presented. Details of the questionnaire construction, sampling design and pre-testing of the questionnaire have been described. The statistical tests for the hypotheses have also been presented. The description of the data, and analysis of the results are presented in Chapter 4. The conclusions and discussion of the findings are presented in Chapter 5.

CHAPTER 4

RESULTS AND ANALYSES

OVERVIEW

This chapter presents the analytical results, and findings of the study. First, the response rate for the survey is presented, and the issue of non-response bias is discussed. Second, an assessment of the source loyalty scale used in the study is presented. Third, the results of the tests for Hypothesis Set A, Hypothesis Set B and Hypothesis Set C are presented. The findings regarding the exploratory questions are presented in the next section. Finally, some unanticipated findings that were found to be of interest in post-hoc analyses are presented. A summary of the data is presented in Appendix - E.

RESPONSE RATE FOR CARRIER SELECTION STUDY

The first wave of the survey was mailed on March 30, 1990. A reminder postcard was mailed on April 10, and a second wave of the survey with a letter of reminder was mailed on April 20. The total number of questionnaires mailed in the first wave was 1434. From the initial mailing, a total of 178 pieces were returned by the postal department for being undeliverable as addressed. These were identified by the outgoing date-stamp. Most of these were taken off the mailing for the second wave (i.e., the ones that came back before April 20). As of May 21, a total of 154 usable responses were received. The figure does not include 74 responses that were incomplete. Some were not filled out as the respondent did not qualify to be in the study, while others declined to respond, or returned incomplete surveys. The May 21 cut-off was chosen as the required sample size had already been achieved. Subsequent responses will be used later, but are excluded for the purpose of this study. The overall response rate was therefore $((154+74)/(1434-178)) \times 100 = 18.153 \%$. The completion rate computed for responses that were useable for the study was $\{154 / (1434 - 178)\} \times 100 = 12.3 \%$. While this figure is not very high, it must be considered that the instrument was long (8 pages) and fairly detailed. Also, the time frame for the cut-off of responses for inclusion in the study was fairly tight. However, a justification for the cut-off is also that the rate of responses had fallen to less than 5 in the week preceding May 21. A further delay would not have been an attractive trade-off in terms of increasing the sample size further. The analysis for response rate determination is presented in Table 12.

Table 12. Response Rate Determination

Number of Questionnaires Mailed	1434	
Less undelivered	-178	
Effective number of Questionnaires Mailed		1256
Useable responses	154	
Incomplete Questionnaires Returned	74	
Total Number of Responses		228
Effective Response Rate	$(228*100)/1256$	18.15%

COMPARISON OF RESPONSES FROM FIRST AND SECOND MAILINGS

The responses were coded as to the day they were received after completion by the respondents. All responses received up to and including April 24 were coded as the first wave, and subsequent responses were coded as the second wave. As of May 21, 83 responses (useable ones) were received in the second wave and 71 responses were received and coded from the first wave of mailing. A comparison of the two waves of responses was made on the following variables:

Proportion of shipments on Motor Carriers

Proportion of shipments made freight pre-paid

Proportion of shipments where carrier selection was left to shipper

Whether intermodal shipments were made

Number of carriers available for new purchase situation

Number of members in the buying center for new purchase decision

Evaluation of service characteristics of available carriers for new purchase situation

Number of carriers available for reevaluation purchase situation

Number of members in the buying center for reevaluation purchase decision

Evaluation of service characteristics of available carriers for reevaluation purchase situation

Nature of Business (Manufacturing or Non-manufacturing)

Freight volume in tons and in dollars

Average distance of motor carrier shipments.

Score on the source loyalty scale

The SPSSX REPORT procedure was used to breakdown and compare the two waves of responses for the variables listed above. The results are presented in Table 13 and Table 14. There were no significant differences for the variables at the 5% level, so it was concluded that there was no difference among the responses received before and after the second mailing. In other words, respondents who needed more than two stimuli (more than the first mailing and the reminder post card) do not appear to differ in their responses in the variables discussed.

EVALUATION OF NON-RESPONSE BIAS

In this study, the response rate achieved was under 20%. As such, the final sample may not accurately reflect the original sample chosen by a random sampling process. Thus the effect of bias due to non-response was investigated. It was important, therefore, to see if the respondents were systematically different from those in the population that chose not to respond. For mail surveys, bias due to

Table 13. Comparison of Data from the Two Mailings

Variable	t-Statistic	p-Value
Proportion of shipment on motor carriers	0.70	0.487
Proportion of shipments made freight pre-paid	-1.04	0.302
Proportion of shipments where carrier selection was left to shipper	-0.83	0.409
Whether intermodal shipments were made	0.08	0.938
Number of carriers available for new purchase situation	-0.94	0.347
Evaluation of service characteristics of available carriers for new purchase situation	-0.2	0.840
Number of sources of information utilized for new purchase situation	0.61	0.545
Number of members in buying center for new purchase situation	-0.67	0.507

Table 14. Comparison of Data from the Two Mailings

Variable	t-Statistic	p-Value
Nature of business		
manufacturing or non-manufacturing	-0.51	0.609
Annual freight volume in dollars	0.09	0.927
Annual freight volume in tons	0.88	0.384
Annual sales volume	-1.00	0.318
Average distance for motor		
carrier shipments	1.59	0.113
Proportion of new and reevaluation		
purchase situations combined	0.99	0.325
Score on source loyalty scale	-0.60	0.956
Number of carriers available for		
reevaluation purchase situation	0.23	0.818
Evaluation of service		
characteristics of		
available carriers for		
reevaluation purchase situation	-1.03	0.306
Number of sources of		
information utilized		
for reevaluation purchase situation	0.56	0.577
Number of members in buying center		
for reevaluation purchase situation	0.03	0.973

non-response can be studied by comparing those who respond immediately, and those who respond after follow-up steps are taken (Fowler, 1984). To this end, the findings in the previous section suggest that there was no major problem. However, another approach to determine non-response bias was also utilized.

A random sample from the revised mailing list (the addresses that were undeliverable were removed) was selected, and a telephone survey was conducted to uncover demographic and classification information of non-respondents. As there was no way of identifying who the non-respondents were, the first question in the phone interview asked if they had received and responded to the survey. If they had received the questionnaire, but had not responded yet, they were asked for information on six questions. Thirty-two individuals were sampled (approximately 2.5% of the original sample, less the undeliverable), and twenty-three of them said they had not yet mailed the responses. The results of the phone survey were compared with the combined data for the respondents from both the first and the second wave. The SPSSX REPORT procedure was used to conduct the comparison, then the T-TEST procedure was used to check for significance of differences. The results are presented in Table 15. There were no significant differences at the 5% level except for the variable "sales volume." It appears therefore, that the findings of the study may not be applicable to the businesses that have a relatively smaller sales volume. However, the findings must also be qualified to the extent that other differences may still exist along dimensions that were not covered in the phone survey, as well as the fact that less than 2.5% of the actual non-respondents were surveyed. However, as no significant non-response bias was uncovered from the investigations, except as noted above for sales volume, a strong case for absence of such bias was presented, and analysis of data for the purpose of testing of the hypotheses was carried out.

Table 15. Comparison of Data from Respondents and Non-respondents

Variable	t-Statistic	p-Value
Proportion of shipment		
on motor carriers	-1.75	0.091
Proportion of shipments		
made freight pre-paid	0.33	0.745
Proportion of shipments where carrier		
selection was left to shipper	-0.46	0.652
Nature of business		
manufacturing or non-manufacturing	0.02	0.988
Annual sales volume	-5.68	0.000

ASSESSMENT OF RELIABILITY OF SOURCE LOYALTY SCALE

The source loyalty scale was reexamined with the final data set, and it was found that the reliability estimates were lower than they were found to be during the pretest. The reliability estimate α dropped from 0.85 to 0.774 for the full 25 item scale. However, by eliminating a number of the items, the reliability measure was improved ($\alpha = 0.795$). The details are presented in Table 16. The computations were done using the RELIABILITY procedure on SPSSX. The items retained in the final source loyalty scale are shown in Figure 15.

TEST OF HYPOTHESES

The hypotheses developed earlier in Chapter 3 were tested with the data obtained from the carrier selection survey. In the remaining part of this chapter, the results of the specific tests of the hypotheses are described, and recorded. The implications of the results are discussed in Chapter 5, together with the limitations of this study and directions for future research. In the following section, the test results for each of the three sets of hypotheses are presented in order.

HYPOTHESIS SET A

A multiple regression model was used as a global test of the hypotheses in this set. Two separate regressions were run, one for each purchase scenario. The findings are reported below.

Table 16. Reliability Estimate of Source Loyalty Scale

20-May-90 CARRIER SELECTION STUDY
 02 08.01 VIRGINIA TECH COMPUTER CENTER IBM 3090-200 VM/XA

RELIABILITY ANALYSIS - SCALE

ITEM-TOTAL STATISTICS

	SCALE MEAN IF ITEM DELETED	SCALE VARIANCE IF ITEM DELETED	CORRECTED ITEM- TOTAL CORRELATION	SQUARED MULTIPLE CORRELATION	ALPHA IF ITEM DELETED
MFSLIT1	33.5130	57.0400	.4581	.5075	.7720
MFSLIT2	33.3377	56.3689	.5257	.4737	.7601
MFSLIT3	32.7727	55.7505	.4484	.2808	.7729
MFSLIT5	33.4675	57.7000	.4311	.3702	.7751
MFSLIT7	32.1558	57.7141	.3225	.2497	.7839
MFSLIT8	33.3831	54.2510	.6220	.5697	.7592
MFSLIT9	33.6494	58.2815	.4918	.4922	.7728
MFSLIT11	32.8377	56.7251	.4118	.2106	.7760
MFSLIT12	32.9870	57.0325	.3561	.1862	.7811
MFSLIT14	32.4351	54.9271	.4455	.3180	.7732
MFSLIT16	32.4481	56.8764	.3754	.3125	.7793
MFSLIT19	32.4935	60.1993	.2605	.2009	.7870
MFSLIT21	33.0000	58.1046	.3601	.2143	.7801
MFSLIT23	31.9221	59.4710	.2451	.2228	.7896
MFSLIT25	32.3247	59.7762	.2515	.2467	.7883

RELIABILITY COEFFICIENTS 15 ITEMS
 ALPHA = .7892 STANDARDIZED ITEM ALPHA = .7945

- A much superior alternative must be available before we would consider replacing this carrier.
- We would go out of our way to recommend this carrier to our colleagues in other companies.
- We would not be concerned about carrying low safety-stock when dealing with this carrier.
- We like to use carriers like these regularly because they make shipping a lot easier.
- We would continue to use this carrier even if the user department desired another carrier.
- We would feel reluctant to drop this carrier as a source of motor freight.
- We are satisfied with our relationship with this carrier.
- We would want to establish long term relationship with this carrier even if they did not offer the lowest price among available carriers.
- If there were an unacceptable number of customer complaints about this carrier, we would work with them to solve their problems.
- We would feel more comfortable establishing a sole-source relationship with this carrier than other available carriers.
- We are prepared to make considerable investments (time, personnel, money) in order to establish a long-term relationship with this carrier.
- Our company would continue to use this carrier even if their prices fluctuate somewhat.
- We would welcome extensive contacts with this carrier's personnel in order to establish a close working relationship.
- We would use this carrier more frequently than normal to help it, if it were experiencing financial difficulties.
- We would like to decrease business with other carriers we currently use and increase this carrier's volume of business.

Figure 15. Items Included in Revised Source Loyalty Scale

New Purchase Situation

For the new purchase situation, the regression model was specified as follows:

$$\begin{aligned} IE = & C + B_{01} \times X_{01} + B_{02} \times X_{02} + B_{03} \times X_{03} + B_{04} \times X_{04} \\ & + B_{05} \times X_{05} + B_{06} \times X_{06} + B_{07} \times X_{07} + B_{08} \times X_{08} \\ & + B_{09} \times X_{09} + B_{11} \times X_{11} + B_{12} \times X_{12} + B_{13} \times X_{13} + B_{14} \times X_{14} \\ & + B_{15} \times X_{15} \end{aligned}$$

Where,

IE = Internality/Externality of the decision. The percentage of time the respondent reports that the carrier specification was left to the firm. (COMSPEC)

X₀₁ = The percentage of the total shipments that was carried on motor carriers. (MCSHIP)

X₀₂ = The use of intermodal carriage. (INTMODAL)

X₀₃ = The percentage of times the terms of sale in which the company engages was "freight pre-paid." (FPRE)

X₀₄ = The percentage of time the situation context faced by the firm was either a new purchase situation or a reevaluation of purchase situation. (NPRVPSIT)

X₀₅ = The size of the buying center new purchase situations. (NPBUYNUM)

X₀₆ = The nature of the principal business of the firm, manufacturing or otherwise, as reported by the respondent. (NATBUS)

X_{07} = The number of manufacturing and/or storage and distribution facilities maintained by the firm. (NUMLOC)

X_{08} = Percentage of motor carrier shipments that were shipped less than truckload. (PCTLTL)

X_{09} = The percentage of carrier selection decisions in case of new purchase situations where the trigger was product related. (NPSNP)

X_{11} = Perceived variety of service characteristics among the carriers available in case of a new purchase. (NPSVEVAL)

X_{12} = The availability of alternative carriers in case of a new purchase situation. (NPCARPTL)

X_{13} = Number of sources of information available in case of a new purchase situation. (NPISA)

X_{14} = Number of sources of information utilized by shipper in decision making, for a new purchase situation. (NPISU)

X_{15} = Source loyalty score. (SLSCORE)

The multiple regression model with $R\text{-square} = 0.6182$ was significant, the associated $p\text{-value}$ being 0.0001. The adjusted $R\text{-square}$ was 0.5765. The details of the analysis of variance for the regression are presented in Table 17. However, when the correlations of the estimates were examined, a correlation was noted between NPISA

and NPISU (-0.5495). Also, there appeared to be correlations between the intercept and SLSCORE (-0.7260) and NPSVEVAL (-0.4635). Examination of the collinearity diagnostics revealed that the lowest eigenvalue was 0.031964 and the eigenvalue ratio $\lambda \text{ max} / \lambda \text{ min}$ was approximately 363 which was less than 1000, the level that suggests significant problems. Variance inflation associated with the parameter estimates was small and indicated that the collinearity problem was not severe. The details of the collinearity diagnostics are presented in Table 18.

Since the focus of the research is on estimating and testing of the β s, the correlations of the intercept with the two regressor variables were not meaningful. To check whether those correlations were masking any other severe collinearity among the regressor variables, the collinearity diagnostics were generated once again with the COLLINOINT option in SAS, suppressing the intercept term in computing the collinearity diagnostics. The results showed no eigenvalue less than .329236, and all the variance inflation factors were under 2.0 (Table 19), thus confirming that collinearity was not a problem. The residuals were examined to locate outliers. The critical value for R-Student at the 5% level, when examining 142 residuals with 15 model parameters was 3.615 approximately¹⁰. No observation had a R-Student \geq 3.615. So outliers were not a problem.

Reevaluation of Purchase Situation

For the reevaluation of purchase situation, the regression model was specified as follows:

$$\begin{aligned}
 IE = & C + B_{01} \times X_{01} + B_{02} \times X_{02} + B_{03} \times X_{03} + B_{04} \times X_{04} \\
 & + B_{05} \times X_{05} + B_{06} \times X_{06} + B_{07} \times X_{07} + B_{08} \times X_{08} \\
 & + B_{10} \times X_{10} + B_{11} \times X_{11} + B_{12} \times X_{12} + B_{13} \times X_{13} + B_{14} \times X_{14}
 \end{aligned}$$

¹⁰ See Myers (1986), Table for R-Student, pp. 353.

Table 17. Analysis of Variance:Regression Model for New Purchase

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB> F
MODEL	14	6.9442	0.4960	14.805	0.0001
ERROR	128	4.2885	0.0335		
TOTAL	142	11.2326			
<hr/>					
	ROOT MSE	0.1830	R-SQUARE	0.6182	
	DEP MEAN	0.7608	ADJ R-SQUARE	0.5765	
	C.V.	24.0599			

Table 18. Collinearity Diagnostics: New Purchase Regression Model

TEST FOR HYPOTHESES SET A FOR NEW PURCHASE SITUATION								12
								1:59 SUNDAY, MAY 20, 1990
VARIABLE	DF	VARIABLE LABEL						
INTERCEP	1	INTERCEPT						
FPRE	1	PROPORTION SHIPPED FREIGHT PREPAID						
INTMODAL	1	INTERNODAL SHIPMENTS MADE						
MATBUS	1	NATURE OF BUSINESS						
MCSNIP	1	PROPORTION OF TOTAL SHIPMENT ON MOTOR CA						
NUMLOC	1	NUMBER OF STORAGE DISTRIBUTION LOCATIONS						
MPRVPSIT	1	COMBINED PERCENTAGE OF NEW AND REEVAL PU						
SLSCORE	1	SCORE ON SOURCE LOYALTY SCALE						
MPSMP	1	NEW PURCH. SIT. DUE TO NEW PRODUCT						
MPBUYNUM	1	NUMBER OF MEMBERS IN BUYING CTR. FOR NEW						
MPCARPTL	1	MP CARRIERS CONSIDERED FOR SELECTION						
MPSVEVAL	1	MP EVAL. OF SERVICE CHARACTERISTICS OF A						
MPISA	1	MP SOURCES OF INFO AVAILABLE						
MPISU	1	MP SOURCES OF INFO UTILIZED						
PCTILT	1	PROPORTION OF MOTOR CARRIER FREIGHT SHIP						

COLLINEARITY DIAGNOSTICS							
NUMBER	EIGENVALUE	CONDITION NUMBER	VAR PROP INTERCEP	VAR PROP FPRE	VAR PROP INTMODAL	VAR PROP MATBUS	VAR PROP MCSNIP
1	10.868981	1.000000	0.0001	0.0015	0.0013	0.0016	0.0009
2	0.945809	3.389945	0.0000	0.0003	0.0013	0.0029	0.0004
3	0.596154	4.269876	0.0004	0.0035	0.0110	0.0014	0.0108
4	0.527634	4.538665	0.0000	0.0194	0.0039	0.0416	0.0000
5	0.510409	4.614614	0.0000	0.0116	0.0556	0.1577	0.0002
6	0.335867	5.688672	0.0000	0.0734	0.0008	0.0506	0.0183
7	0.253682	6.545607	0.0001	0.0944	0.0509	0.0035	0.0343
8	0.244033	6.965284	0.0006	0.1042	0.0742	0.5359	0.0414
9	0.201902	7.337090	0.0005	0.4339	0.0561	0.0021	0.1583
10	0.169029	8.018874	0.0000	0.0877	0.4558	0.0169	0.0380
11	0.140172	8.805700	0.0004	0.1578	0.1718	0.1057	0.0633
12	0.123873	9.367115	0.0022	0.0090	0.0323	0.0111	0.2401
13	0.063575	13.075275	0.0000	0.0024	0.0348	0.0037	0.0535
14	0.031964	18.440096	0.0469	0.0001	0.0330	0.0594	0.3173
15	0.0069173	39.639346	0.9486	0.0009	0.0171	0.0057	0.0232

NUMBER	VAR PROP NUMLOC	VAR PROP MPRVPSIT	VAR PROP SLSCORE	VAR PROP MPSMP	VAR PROP MPBUYNUM	VAR PROP MPCARPTL	VAR PROP MPSVEVAL
1	0.0009	0.0017	0.0001	0.0020	0.0011	0.0019	0.0005
2	0.05810	0.0108	0.0001	0.0170	0.0023	0.0050	0.0004
3	0.0024	0.0391	0.0009	0.0042	0.0002	0.3224	0.0043
4	0.0575	0.0781	0.0000	0.4728	0.0037	0.0617	0.0007
5	0.0434	0.1405	0.0000	0.1411	0.0018	0.0162	0.0047
6	0.0061	0.2315	0.0000	0.0817	0.0002	0.2352	0.0009
7	0.0791	0.0329	0.0006	0.0983	0.0083	0.1416	0.0032
8	0.0930	0.1559	0.0012	0.0012	0.0155	0.0066	0.0063
9	0.0187	0.0037	0.0014	0.0005	0.1507	0.0510	0.0077
10	0.0021	0.1368	0.0011	0.0697	0.1230	0.0154	0.0050
11	0.0297	0.0482	0.0007	0.0168	0.5237	0.0791	0.0075
12	0.0075	0.0033	0.0027	0.0484	0.0001	0.0235	0.2986
13	0.0195	0.0135	0.0004	0.0013	0.0006	0.0220	0.0105
14	0.0589	0.0600	0.2475	0.0328	0.0885	0.0135	0.5297
15	0.0003	0.0440	0.7434	0.0123	0.0802	0.0050	0.1200

NUMBER	VAR PROP MPISA	VAR PROP MPISU	VAR PROP PCTILT
1	0.0007	0.0008	0.0016
2	0.0000	0.0004	0.0152
3	0.0019	0.0001	0.1206
4	0.0001	0.0006	0.0105
5	0.0040	0.0075	0.0048
6	0.0089	0.0108	0.1854
7	0.0792	0.0686	0.1802
8	0.0066	0.0057	0.1038
9	0.0045	0.0070	0.0233
10	0.0138	0.0652	0.1777
11	0.0243	0.0088	0.0970
12	0.0116	0.1186	0.0328
13	0.8322	0.6685	0.0023
14	0.0083	0.0342	0.0106
15	0.0038	0.0032	0.0343

Table 19. COLLINOINT Diagnostics: New Purchase Regression Model

TEST FOR HYPOTHESES SET A FOR NEW PURCHASE SITUATION 12
15:12 SUNDAY, MAY 20, 1990

VARIABLE	DF	VARIABLE LABEL
INTERCEP	1	INTERCEPT
FPRE	1	PROPORTION SHIPPED FREIGHT PREPAID
INTMODAL	1	INTERMODAL SHIPMENTS MADE
MATBUS	1	NATURE OF BUSINESS
MCSHIP	1	PROPORTION OF TOTAL SHIPMENT ON MOTOR CA
NUMLOC	1	NUMBER OF STORAGE DISTRIBUTION LOCATIONS
MPRVPSIT	1	COMBINED PERCENTAGE OF NEW AND REEVAL PU
SLSCORE	1	SCORE ON SOURCE LOYALTY SCALE
MPSMP	1	NEW PURCH. SIT. DUE TO NEW PRODUCT
MPBUYNUM	1	NUMBER OF MEMBERS IM BUYING CTR. FOR NEW
MPCARPTL	1	MP CARRIERS CONSIDERED FOR SELECTION
MPSVEVAL	1	MP EVAL. OF SERVICE CHARACTERISTICS OF A
MPISA	1	MP SOURCES OF INFO AVAILABLE
MPISU	1	MP SOURCES OF INFO UTILIZED
PCTLTL	1	PROPORTION OF MOTOR CARRIER FREIGHT SHIP

COLLINEARITY DIAGNOSTICS

NUMBER	EIGENVALUE	CONDITION NUMBER	VAR PROP FPRE	VAR PROP INTMODAL	VAR PROP MATBUS	VAR PROP MCSHIP	VAR PROP NUMLOC
1	2.512588	1.000000	0.0174	0.0320	0.0084	0.0054	0.0155
2	1.780756	1.187841	0.0408	0.0562	0.0967	0.0241	0.0000
3	1.469927	1.307413	0.0434	0.0002	0.0425	0.0014	0.0922
4	1.279921	1.401100	0.0168	0.0002	0.0053	0.0550	0.0162
5	1.091289	1.517367	0.0347	0.0226	0.0014	0.0411	0.1286
6	1.061368	1.538607	0.0295	0.0277	0.0120	0.4118	0.0809
7	0.962213	1.615939	0.1160	0.0105	0.0008	0.0010	0.0423
8	0.774015	1.801714	0.1790	0.0910	0.0221	0.0780	0.0427
9	0.693865	1.902931	0.0003	0.0112	0.0381	0.0050	0.0693
10	0.603459	2.040501	0.0879	0.0010	0.4959	0.0033	0.0408
11	0.537881	2.161312	0.3969	0.0552	0.0244	0.0163	0.0015
12	0.502761	2.235526	0.0211	0.5975	0.1575	0.0460	0.1106
13	0.400721	2.504030	0.0074	0.0427	0.0861	0.2940	0.2947
14	0.329236	2.762531	0.0086	0.0520	0.0088	0.0174	0.0647

TEST FOR HYPOTHESES SET A FOR NEW PURCHASE SITUATION 14
15:12 SUNDAY, MAY 20, 1990

NUMBER	VAR PROP MPRVPSIT	VAR PROP SLSCORE	VAR PROP MPSMP	VAR PROP MPBUYNUM	VAR PROP MPCARPTL	VAR PROP MPSVEVAL	VAR PROP MPISA
1	0.0111	0.0020	0.0211	0.0345	0.0356	0.0060	0.0388
2	0.0388	0.0551	0.0050	0.0048	0.0002	0.0506	0.0175
3	0.0265	0.0009	0.0903	0.0589	0.0876	0.0491	0.0129
4	0.1382	0.1603	0.0183	0.0040	0.0091	0.0153	0.0336
5	0.0206	0.0118	0.0644	0.0012	0.0000	0.1925	0.0156
6	0.0272	0.0703	0.0215	0.0033	0.0000	0.0126	0.0002
7	0.0214	0.0607	0.0375	0.1305	0.0050	0.0029	0.0108
8	0.0848	0.1270	0.0509	0.0983	0.1699	0.0402	0.0038
9	0.0077	0.0239	0.4573	0.1456	0.0025	0.2452	0.0011
10	0.0668	0.1413	0.1450	0.0003	0.2505	0.0102	0.0081
11	0.0941	0.2054	0.0046	0.3108	0.0746	0.0934	0.0118
12	0.0069	0.0046	0.0298	0.0079	0.3360	0.0344	0.0280
13	0.4518	0.1296	0.0504	0.1992	0.0016	0.2365	0.0267
14	0.0040	0.0069	0.0039	0.0008	0.0273	0.0112	0.7911

NUMBER	VAR PROP MPISU	VAR PROP PCTLTL
1	0.0312	0.0153
2	0.0224	0.0018
3	0.0004	0.0143
4	0.0690	0.0333
5	0.0318	0.1512
6	0.0395	0.0095
7	0.0004	0.4120
8	0.0001	0.0062
9	0.0000	0.1568
10	0.0106	0.0032
11	0.0790	0.0454
12	0.0061	0.0528
13	0.0077	0.0922
14	0.7018	0.0061

$$+ B_{15} \times X_{15}$$

Where,

IE = Internality/Externality of the decision. The percentage of time the respondent reports that the carrier specification was left to the firm. (COMSPEC)

X₀₁ = The percentage of the total shipments that was carried on motor carriers. (MCSHIP)

X₀₂ = The use of intermodal carriage. (INTMODAL)

X₀₃ = The percentage of times the terms of sale in which the company engages was "freight pre-paid." (FPRE)

X₀₄ = The percentage of time the situation context faced by the firm was either a new purchase situation or a reevaluation of purchase situation. (NPRVPSIT)

X₀₅ = The size of the buying center new purchase situations. (RVBUYNUM)

X₀₆ = The nature of the principal business of the firm, manufacturing or otherwise, as reported by the respondent. (NATBUS)

X₀₇ = The number of manufacturing and/or storage and distribution facilities maintained by the firm. (NUMLOC)

X_{08} = Percentage of motor carrier shipments that were shipped less than truckload. (PCTLTL)

X_{10} = The percentage of carrier selection decisions in case of reevaluation of purchase situations where the trigger was service characteristics related. (SRVTRIG)

X_{11} = Perceived variety of service characteristics among the carriers available in case of a new purchase. (RVSVEVAL)

X_{12} = The availability of alternative carriers in case of a new purchase situation. (RVCARPTL)

X_{13} = Number of sources of information available in case of a new purchase situation. (RVISA)

X_{14} = Number of sources of information utilized by shipper in decision making, for a new purchase situation. (RVISU)

X_{15} = Source loyalty score. (SLSCORE)

The multiple regression model with R-square = 0.6289 was significant, the associated p-value being 0.0001. The adjusted R-square was 0.5883. The details of the analysis of variance for the regression are presented in Table 20. However, when the correlations of the estimates were examined, a correlation was noted between RVISA and RVISU (-0.6177). Also, there appeared to be correlations between the intercept and SLSCORE (-0.7250) and RVSVEVAL (-0.4812). Examination of the collinearity

diagnostics revealed that the lowest eigenvalue was 0.006822 and the eigenvalue ratio ($\lambda \text{ max}$) / ($\lambda \text{ min}$) was approximately 1587 which was more than 1000, the level that suggests potential problems. Variance inflation associated with the parameter estimates were small however, and indicated that the collinearity problem was not severe. The details of the collinearity diagnostics are presented in Table 21. Once again, as in the case of the new purchase situation, it appears that there is a dependency among the intercept and one or more of the regressor variables.

Since the focus of the research is on estimating and testing of the β s, the correlations of the intercept with the two regressor variables were not meaningful. To check whether those correlations were masking any other severe collinearity among the regressor variables, the collinearity diagnostics were generated once again with the COLLINOINT option in SAS, suppressing the intercept term. The results showed no eigenvalue less than .254458, and all the variance inflation factors were under 2.3 (Table 22). Collinearity therefore was not a problem. The residuals were examined to locate outliers. The critical value for R-Student at the 5% level, when examining 142 residuals with 15 model parameters was 3.615 approximately¹¹. No observation had a R-Student \geq 3.615. So outliers again were not a problem.

Results of Test of Individual Hypotheses

The results of the the tests of the individual hypotheses in set A based on the significance and sign of the corresponding β s are now presented.: The results of the regression equations for the two scenarios together with the parameter estimates and the corresponding p-values are summarized in Table 23 and Table 24.

¹¹ See Myers (1986), Table for R-Student, pp. 353.

Table 20. Analysis of Variance:Regression Model for Reevaluation Purchase

SOURCE	DF	SUM OF SQUARES	MEAN SQUARE	F VALUE	PROB> F
MODEL	14	7.0645	0.5046	15.496	0.0001
ERROR	128	4.1681	0.0326		
TOTAL	142	11.2326			
		ROOT MSE	0.1805	R-SQUARE	0.6289
		DEP MEAN	0.7608	ADJ R-SQUARE	0.5883
		C.V.	23.7198		

Table 21. Collinearity Diagnostics: Reevaluation Purchase Regression Model

VARIABLE		DF	VARIABLE LABEL
INTERCEP	1		INTERCEPT
FPRE	1		PROPORTION SHIPPED FREIGHT PREPAID
INTMODAL	1		INTERNODAL SHIPMENTS MADE
MATBUS	1		NATURE OF BUSINESS
MCSHIP	1		PROPORTION OF TOTAL SHIPMENT ON MOTOR CA
MUMLOC	1		NUMBER OF STORAGE DISTRIBUTION LOCATIONS
MPRVPSIT	1		COMBINED PERCENTAGE OF NEW AND REEVAL PU
SLSCORE	1		SCORE ON SOURCE LOYALTY SCALE
SRVTRIG	1		SERVICE RELATED TRIGGER FOR SELECTION DE
RVBUYNUM	1		NUMBER OF MEMBERS IN BUYING CTR. FOR RE-
RVCARPTL	1		RV CARRIERS CONSIDERED FOR SELECTION
RVSVEVAL	1		RV EVAL. OF SERVICE CHARACTERISTICS OF A
RVISA	1		RV SOURCES OF INFO AVAILABLE
RVISU	1		RV SOURCES OF INFO UTILIZED
PCTLTL	1		PROPORTION OF MOTOR CARRIER FREIGHT SHIP

COLLINEARITY DIAGNOSTICS							
NUMBER	EIGENVALUE	CONDITION NUMBER	VAR PROP INTERCEP	VAR PROP FPRE	VAR PROP INTMODAL	VAR PROP MATBUS	VAR PROP MCSHIP
1	11.106135	1.000000	0.0001	0.0014	0.0013	0.0016	0.0009
2	0.918072	3.478109	0.0000	0.0000	0.0019	0.0012	0.0000
3	0.612490	4.258257	0.0003	0.0017	0.0042	0.0015	0.0117
4	0.500391	4.711149	0.0000	0.0250	0.0749	0.2153	0.0006
5	0.416771	5.162173	0.0000	0.0165	0.0197	0.0319	0.0042
6	0.297936	6.105485	0.0000	0.0195	0.0005	0.0097	0.0345
7	0.239000	6.816831	0.0000	0.3094	0.0232	0.1287	0.0156
8	0.227799	6.982410	0.0013	0.1397	0.2722	0.2636	0.0532
9	0.171142	8.055697	0.0002	0.3918	0.1550	0.2580	0.0839
10	0.167431	8.144475	0.0001	0.0383	0.1797	0.0224	0.1161
11	0.132109	9.168845	0.0008	0.0157	0.0006	0.0176	0.3004
12	0.109086	10.090129	0.0007	0.0348	0.1426	0.0086	0.0455
13	0.063043	13.272846	0.0065	0.0028	0.0764	0.0070	0.0005
14	0.031772	18.696516	0.0416	0.0025	0.0329	0.0093	0.3094
15	0.0068219	40.348645	0.9484	0.0007	0.0150	0.0236	0.0235

NUMBER	VAR PROP MUMLOC	VAR PROP MPRVPSIT	VAR PROP SLSCORE	VAR PROP SRVTRIG	VAR PROP RVBUYNUM	VAR PROP RVCARPTL	VAR PROP RVSVEVAL
1	0.0009	0.0017	0.0001	0.0010	0.0010	0.0018	0.0005
2	0.7030	0.0126	0.0000	0.0002	0.0007	0.0030	0.0000
3	0.0000	0.0163	0.0008	0.0009	0.0044	0.4217	0.0043
4	0.0142	0.1960	0.0000	0.0094	0.0014	0.0025	0.0007
5	0.0006	0.3135	0.0000	0.0158	0.0014	0.1547	0.0004
6	0.0823	0.0459	0.0001	0.0437	0.0022	0.1998	0.0000
7	0.0273	0.1100	0.0002	0.1094	0.0392	0.0036	0.0000
8	0.0581	0.0529	0.0022	0.0127	0.0009	0.0082	0.0197
9	0.0115	0.0124	0.0009	0.0281	0.1085	0.0534	0.0005
10	0.0114	0.0077	0.0006	0.0150	0.3552	0.0806	0.0283
11	0.0014	0.0186	0.0008	0.1016	0.0424	0.0475	0.2197
12	0.0005	0.0990	0.0007	0.4949	0.2816	0.0049	0.0962
13	0.0698	0.0212	0.0068	0.1466	0.0077	0.0004	0.0004
14	0.0014	0.0393	0.2472	0.0168	0.0991	0.0096	0.4854
15	0.0178	0.0529	0.7396	0.0038	0.0544	0.0083	0.1439

NUMBER	VAR PROP RVISA	VAR PROP RVISU	VAR PROP PCTLTL
1	0.0007	0.0007	0.0015
2	0.0000	0.0006	0.0101
3	0.0025	0.0006	0.0860
4	0.0032	0.0050	0.0016
5	0.0059	0.0074	0.1617
6	0.0760	0.0461	0.2028
7	0.0188	0.0214	0.1020
8	0.0028	0.0005	0.0707
9	0.0245	0.0130	0.0802
10	0.0046	0.0257	0.1413
11	0.0363	0.0568	0.0043
12	0.0132	0.0833	0.0078
13	0.6105	0.6764	0.0025
14	0.1413	0.0298	0.0606
15	0.0597	0.0327	0.0669

Table 22. COLLNOINT Diagnostics: Reevaluation Purchase Regression Model

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ARIABLE	DF	VARIABLE LABEL
INTERCEP	1	INTERCEPT
PRE	1	PROPORTION SHIPPED FREIGHT PREPAID
MTMODAL	1	INTERMODAL SHIPMENTS MADE
ATBUS	1	NATURE OF BUSINESS
CSHIP	1	PROPORTION OF TOTAL SHIPMENT ON MOTOR CA
UMLOC	1	NUMBER OF STORAGE DISTRIBUTION LOCATIONS
PRVPSIT	1	COMBINED PERCENTAGE OF NEW AND REEVAL PU
LSCORE	1	SCORE ON SOURCE LOYALTY SCALE
RVTRIG	1	SERVICE RELATED TRIGGER FOR SELECTION DE
VBUMUM	1	NUMBER OF MEMBERS IN BUYING CTR - FOR RE-
VCARPTL	1	RV CARRIERS CONSIDERED FOR SELECTION
VSVEVAL	1	RV EVAL. OF SERVICE CHARACTERISTICS OF A
VISA	1	RV SOURCES OF INFO AVAILABLE
VISU	1	RV SOURCES OF INFO UTILIZED
CTLTL	1	PROPORTION OF MOTOR CARRIER FREIGHT SHIP

COLLINEARITY DIAGNOSTICS

BER	EIGENVALUE	CONDITION NUMBER	VAR PROP FPRE	VAR PROP INTMODAL	VAR PROP MATBUS	VAR PROP MCSHIP	VAR PROP NUMLOC
1	2.515106	1.000000	0.0227	0.0148	0.0084	0.0071	0.0041
2	1.676512	1.224827	0.0646	0.1036	0.1237	0.0208	0.0010
3	1.476149	1.305308	0.0047	0.0004	0.0017	0.0065	0.0517
4	1.315119	1.382915	0.0023	0.0378	0.0089	0.0200	0.1273
5	1.136668	1.487515	0.0176	0.0183	0.0470	0.3144	0.1289
6	1.013150	1.575583	0.0967	0.0481	0.0293	0.0036	0.0724
7	0.923804	1.650016	0.0184	0.0016	0.0131	0.2120	0.0000
8	0.892510	1.678694	0.1503	0.0006	0.0000	0.0007	0.1087
9	0.705398	1.888257	0.0018	0.0013	0.1545	0.0461	0.0583
10	0.606773	2.035940	0.2729	0.0011	0.0312	0.0010	0.0920
11	0.516084	2.207587	0.2216	0.0198	0.4035	0.1650	0.0199
12	0.495916	2.252029	0.0405	0.7403	0.1195	0.0565	0.0918
13	0.472352	2.307519	0.0859	0.0024	0.0450	0.0753	0.1352
14	0.254458	3.143908	0.0000	0.0099	0.0141	0.0710	0.1087

TEST FOR HYPOTHESES SET A FOR REEVALUATION PURCHASE 35
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MBER	VAR PROP MPRVPSIT	VAR PROP SLSCORE	VAR PROP SRVTRIG	VAR PROP RVBUYNUM	VAR PROP VRCARPTL	VAR PROP RVSVEVAL	VAR PROP RVISA
1	0.0077	0.0003	0.0222	0.0379	0.0458	0.0047	0.0382
2	0.0184	0.0390	0.0240	0.0000	0.0001	0.0024	0.0156
3	0.1438	0.1200	0.0453	0.0443	0.0247	0.0129	0.0107
4	0.0061	0.0510	0.0253	0.0205	0.0016	0.1471	0.0008
5	0.0137	0.0076	0.0590	0.0136	0.0102	0.0216	0.0115
6	0.1114	0.0433	0.0228	0.0006	0.0133	0.3450	0.0004
7	0.0578	0.0000	0.1639	0.1146	0.0013	0.0028	0.0411
8	0.0156	0.1718	0.0059	0.0146	0.0439	0.0246	0.0115
9	0.0728	0.0693	0.0017	0.0107	0.5836	0.0692	0.0099
10	0.0080	0.0485	0.0303	0.4101	0.0075	0.0997	0.0613
11	0.0764	0.2773	0.1901	0.0057	0.0294	0.0310	0.0021
12	0.0216	0.0072	0.2048	0.0001	0.0788	0.0360	0.0026
13	0.4302	0.1321	0.1110	0.2202	0.1599	0.0431	0.0041
14	0.0165	0.0326	0.0937	0.1070	0.0000	0.1599	0.7901

MBER	VAR PROP RVISU	VAR PROP FCTLTL
1	0.0343	0.0094
2	0.0150	0.0073
3	0.0320	0.0052
4	0.0011	0.1696
5	0.0000	0.0427
6	0.0020	0.0000
7	0.0975	0.0341
8	0.0000	0.3636
9	0.0000	0.0172
10	0.0232	0.1259
11	0.0114	0.0588
12	0.0021	0.1059
13	0.1127	0.0178
14	0.6686	0.0426

HA1: The carrier selection decision is more likely to be internal than external to the firm as the percentage of total shipments of the firm that was carried on motor freight increases.

The hypothesis was not supported in case of either of the scenarios. The standardized β_{MCSHIP} coefficient estimate corresponding to X_{01} was negative and not significant.

HA2: The carrier selection decision is more likely to be internal than external to the firm when the firm uses intermodal carriage.

The hypothesis was supported for both scenarios. The standardized $\beta_{INTMODAL}$ coefficient corresponding to X_{02} was positive and significant for both new purchase and reevaluation of purchase situations.

HA3: The carrier selection decision is more likely to be internal than external to the firm when the firm uses "freight pre-paid" terms of sale more frequently.

The hypothesis was supported for both scenarios. The standardized β_{FPRE} coefficient corresponding to X_{03} was significant and positive for both new purchase and reevaluation of purchase situations.

HA4: The carrier selection decision is more likely to be internal than external to the firm when a higher percentage of the purchase situations faced by the firm are new purchase situations or reevaluation of purchase situations.

The hypothesis was not supported for either of the scenarios. The standardized $\beta_{NPRVPSIT}$ coefficient corresponding to X_{04} was positive but not significant in either of the scenarios.

HA5: The carrier selection decision is more likely to be internal than external to the firm when the size of the buying center increases.

The hypothesis was not supported for either of the scenarios. The standardized $\beta_{NPBUYNUM}$ coefficient, and the $\beta_{RVBUYNUM}$ coefficient corresponding to X_{05} were positive and negative in that order, but were not significant in their respective scenarios.

HA6: The carrier selection decision is more likely to be internal than external to the firm when the nature of the principal business of the firm is non-manufacturing.

The hypothesis was supported for both scenarios. The standardized β_{NATBUS} coefficient corresponding to X_{06} was significant and positive for both new purchase and reevaluation of purchase situations.

HA7: The carrier selection decision is more likely to be internal than external to the firm when the number of manufacturing and/or storage and distribution facilities maintained by the firm increases.

The hypothesis was not supported for either of the scenarios. The standardized β_{NUMLOC} coefficient corresponding to X_{07} was negative and not significant in either of the scenarios.

HA8: The carrier selection decision is more likely to be internal than external to the firm as the percentage of motor carrier freight shipped less than truckload increases.

The hypothesis was not supported for either of the scenarios. The standardized β_{PCTLTL} coefficient corresponding to X_{08} was positive but not significant in either of the scenarios.

HA9: In the case of a new purchase situation, the carrier selection decision is more likely to be internal than external to the firm when the trigger for the carrier selection decisions are more often product related.

The hypothesis was not supported. The standardized β_{NPSNP} coefficient corresponding to X_{09} was negative and not significant.

HA10: In the case of a reevaluation of purchase situation, the carrier selection decision is more likely to be internal than external to the firm when the trigger for the carrier selection decisions are more often service characteristics related.

The hypothesis was not supported. The standardized $\beta_{SRVTRIG}$ coefficient corresponding to X_{10} was positive but not significant.

HA11: The carrier selection decision is more likely to be internal than external to the firm when there is a greater perceived variety of service characteristics among the carriers available.

The hypothesis was not supported for either of the scenarios. The standardized $\beta_{NPSVEVAL}$ coefficient, and the $\beta_{RVSVEVAL}$ coefficient corresponding to X_{11} were positive and negative in that order, and not significant in their respective scenarios.

HA12: The carrier selection decision is more likely to be internal than external to the firm as the number of carriers available increases.

The hypothesis was not supported for either of the scenarios. The standardized $\beta_{NPCARPTL}$ coefficient, and the $\beta_{RVCARPTL}$ coefficient corresponding to X_{12} were negative not significant in respective scenarios.

HA13: The carrier selection decision is more likely to be internal than external to the firm when more sources of information are available.

The hypothesis was not supported for either of the scenarios. The standardized β_{NPISA} coefficient, and the β_{RVISA} coefficient corresponding to X_{13} were negative and not significant in respective scenarios.

HA14: The carrier selection decision is more likely to be internal than external to the firm when more sources of information are utilized.

The hypothesis was supported for both the scenarios. The standardized β_{NPISU} coefficient, and the β_{RVISU} coefficient corresponding to X_{14} were significant and positive in respective scenarios.

HA15: The carrier selection decision is more likely to be internal than external to the firm when there is a higher level of source loyalty toward the existing carrier or carriers.

The hypothesis was not supported for either of the scenarios. The standardized $\beta_{SLSCORE}$ coefficient corresponding to X_{13} was positive but not significant in either of the scenarios.

Table 23. Estimates of Parameters: New Purchase Regression Model

Variable	Std. Parameter Estimate	T for H0: Parameter = 0	P-value
New Purchase Situation			
Proportion Shipped "freight pre-paid"	0.4023	6.607	0.0001
Use of Intermodal Carriage	0.3854	5.853	0.0001
Nature of Business	0.3075	4.877	0.0001
Proportion Shipped on Motor Carriers	-0.0471	-0.787	0.4327
Number of Locations	-0.0117	-0.187	0.8517
Proportion of Purchase Situations New or Reevaluation	0.0486	0.762	0.4473
Source Loyalty Score	0.0340	0.564	0.5737
Product Related Trigger for New Purchase Situation	-0.0167	-0.278	0.7814
Buying Center Size	0.0129	0.203	0.8391
No. of Carriers Available	-0.0200	-0.315	0.7531
Perceived Variety of Service Characteristics	0.0791	1.293	0.1984
No. of Sources of Information Available	-0.0699	-0.921	0.3588
No. of Sources of Information Utilized	0.1630	2.254	0.0259
Proportion of Shipments sent LTL	0.0923	1.588	0.1148

Table 24. Estimates of Parameters: Reevaluation Purchase Regression Model

Variable	Std. Parameter Estimate	T for H0: Parameter = 0	P-value
Reevaluation of Purchase Situation			
Proportion Shipped "freight pre-paid"	0.4049	6.669	0.0001
Use of Intermodal Carriage	0.3633	5.706	0.0001
Nature of Business	0.2881	4.659	0.0001
Proportion Shipped on Motor Carriers	-0.0627	-1.070	0.2865
Number of Locations	-0.0210	-0.353	0.7246
Proportion of Purchase Situations New or Reevaluation	0.0530	0.869	0.3866
Source Loyalty Score	0.0292	0.488	0.6263
Service Related Trigger for Reevaluation Situation	0.0002	0.002	0.9980
Buying Center Size	-0.0161	-0.252	0.8014
No. of Carriers Available	-0.0159	-0.258	0.7968
Perceived Variety of Service Characteristics	-0.0061	-0.104	0.9174
No. of Sources of Information Available	-0.0953	-1.188	0.2371
No. of Sources of Information Utilized	0.2368	3.099	0.0024
Proportion of Shipments sent LTL	0.0912	1.572	0.1184

HYPOTHESIS SET B

The results of the correlation analysis are summarized in Table 25.

HB1: If alternative choices exist, there will be a positive relationship between the degree of source loyalty toward the existing carrier or carriers and the frequency of routine transportation purchasing (i.e. the greater the degree of source loyalty, the more frequently will motor carrier freight purchasing be considered a routine decision).

The hypothesis above was supported. From the data:

$$r_{X_{16}X_{18}} = 0.27127, \text{ and the associated p-value} = 0.0007.$$

where,

$$X_{16} = \text{Frequency of routinized purchase situation (RPSIT)}$$

$$X_{18} = \text{Source Loyalty score (SLSCORE)}$$

$$r_{X_{16}X_{18}} = \text{Coefficient of Correlation}$$

HB2: If there is a reevaluation of a transportation purchasing situation, there will be a positive relationship between the degree of source loyalty towards the existing carrier and the frequency of retention of the existing carrier.

The hypothesis above was not supported. From the data:

$$r_{X_{17}X_{18}} = 0.07857, \text{ and the associated p-value} = 0.3544.$$

where,

X_{17} = Frequency of retention of existing carrier, given reevaluation of purchase situation (RVPPPOS)

X_{18} = source loyalty score (SLSCORE)

$r_{X_{16}X_{18}}$ = Coefficient of Correlation

HYPOTHESIS SET C

Canonical correlation analysis using the PROC CANCORR procedure in SAS was used to test this set of hypotheses. Separate analysis were conducted for the two scenarios (i.e., New purchase situation and reevaluation of purchase situation).

HC1: The criteria for selection of a carrier from the choice set will differ when purchasing firms differ in their organizational characteristics. Specifically, these characteristics are: the percentage of the total shipments of the firm carried on motor carriers, percentage of motor carrier freight shipped less than truckload, usage of intermodal carriage, terms of sale predominantly used, predominant purchase situation context of transportation faced, size of buying center, nature of firm's business, size of the firm, and the number of manufacturing and/or storage and distribution facilities maintained by the firm.

This hypothesis (HC1) was supported for the new purchase situation. The probability level for the null hypotheses that all the canonical correlations are 0 in the

Table 25. Results for Tests of Hypothesis Set B

<i>Relationship of Source Loyalty with Buyclass Situation and Relationship of Source Loyalty with Selection Decision</i>			
Variable	Number of Observations	Mean	Standard Deviation
Proportion of routine purchase situations (RPSIT)	154	0.6840	0.2867
Proportion of reevaluation of purchase situations resulting in retention of existing carrier (RVPOS)	141	0.7125	0.2766
Source loyalty score (SLSCORE)	154	55.0714	7.8233
<i>Pearson Correlation Coefficients</i>			
		RPSIT	RVPOS
	SLSCORE	0.2713	0.0786
	p-Value	0.0007	0.3544

population is 0.0001. The multivariate statistic Wilks' Λ was significant at 0.0001. The first two canonical correlations were significant. The first canonical correlation was 0.7436, and was substantially larger than any of the between set correlations, the highest of which was 0.4198. The highest correlation within the carrier selection criteria set was 0.5910. The highest correlation among the organizational characteristic variables was 0.3544.

The canonical redundancy analysis shows that the cumulative proportion of variance explained by the first two pairs of canonical variables was 0.0472 and .1146. Details of the analysis are presented in Table 26 and Table 27.

This hypothesis (HC1) was supported for the reevaluation of purchase situation. The probability level for the null hypotheses that all the canonical correlations are 0 in the population is 0.0001. The multivariate statistic Wilks' Λ was significant at 0.0001. The first three canonical correlations were significant. The first canonical correlation was 0.7428, and was substantially larger than any of the between set correlations, the highest of which was 0.3501. The highest correlation within the carrier selection criteria set was 0.7475 however. The highest correlation among the organizational characteristic variables was 0.3544.

The canonical redundancy analysis shows that the cumulative proportion of variance explained by the first three pairs of canonical variables was 0.0808 and .1559. Details of the analysis are presented in Table 28 and Table 29.

HC2: Criteria for selection of a carrier from the choice set will differ when the firms face different environmental variables. Specifically, these variables are: the trigger to the carrier selection decision, the perceived variety of service characteristics that are

Table 26. CANCELLATION Analysis Results: HC1-New Purchase

TESTS OF H0: THE CANONICAL CORRELATION IN THE CURRENT ROW AND ALL THAT FOLLOW ARE ZERO.

Canonical Pair	Adjusted Canonical Correlation	Squared Canonical Correlation	Approx F	Prob > F
1	0.6671	0.5529	1.6454	0.0001
2	0.5161	0.4016	1.3065	0.0089
3	0.4205	0.3130	1.1097	0.1971

MULTIVARIATE TEST STATISTICS AND F APPROXIMATIONS

Statistic	Value	F	Prob > F
Wilks' Lambda	0.0706	1.645	0.0001
Pillai's Trace	2.1367	1.557	0.0001
Hotelling-Lawley Trace	3.4217	1.739	0.0001

$$\hat{\eta}_{\text{mult}}^2 = (\text{Pillai's Trace} / S) = 2.1367/9 = 0.237$$

Table 27. CANCERR Results: HC1-New Purchase

REDUNDANCY ANALYSIS				
Standardized Variance of the "Selection Criteria" Explained by the Canonical Variables				
Their Own Canonical Variables			The Opposite Canonical Variables	
Proportion	Cumulative Proportion	Canonical R-Square	Proportion	Cumulative Proportion
1 0.1299	0.1299	0.5529	0.0718	0.0718
2 0.1064	0.2364	0.4016	0.0428	0.1146
Standardized Variance of the "Organizational Variables" Explained by the Canonical Variables				
Their Own Canonical Variables			The Opposite Canonical Variables	
Proportion	Cumulative Proportion	Canonical R-Square	Proportion	Cumulative Proportion
1 0.0502	0.0502	0.5529	0.0278	0.0278
2 0.0484	0.0986	0.4016	0.0194	0.0472

Table 28. CANCERR Analysis Results: HC1-Reevaluation of Purchase

TESTS OF H0: THE CANONICAL CORRELATION IN THE CURRENT ROW AND ALL THAT FOLLOW ARE ZERO.				
Canonical Pair	Adjusted Canonical Correlation	Squared Canonical Correlation	Approx F	Prob > F
1	0.6620	0.5517	1.8918	0.0001
2	0.5439	0.4285	1.5811	0.0001
3	0.4071	0.3328	1.3826	0.0004
MULTIVARIATE TEST STATISTICS AND F APPROXIMATIONS				
Statistic	Value	F	Prob > F	
Wilk's Lambda	0.0506	1.892	0.0001	
Pillai's Trace	2.3909	1.809	0.0001	
Hotelling-Lawley Trace	3.8670	1.966	0.0001	
$\hat{\eta}_{mult}^2 = (\text{Pillai's Trace}/S) = 2.391/9 = 0.263$				

Table 29. CANCELL Results: HC1-Reevaluation Purchase

REDUNDANCY ANALYSIS				
Standardized Variance of the "Selection Criteria" Explained by the Canonical Variables				
Their Own Canonical Variables			The Opposite Canonical Variables	
Proportion	Cumulative Proportion	Canonical R-Square	Proportion	Cumulative Proportion
1 0.1336	0.1336	0.5517	0.0737	0.0737
2 0.1101	0.2437	0.4285	0.0472	0.1209
Standardized Variance of the "Organizational Variables" Explained by the Canonical Variables				
Their Own Canonical Variables			The Opposite Canonical Variables	
Proportion	Cumulative Proportion	Canonical R-Square	Proportion	Cumulative Proportion
1 0.0726	0.0726	0.5517	0.0401	0.0401
2 0.0671	0.1397	0.4285	0.0288	0.0689

available, availability of carriers, sources of information available, sources of information utilized, distance of the average motor carrier shipment, and proximity of facilities to motor carrier hubs.

This hypothesis (HC2) was supported for the new purchase situation. The probability level for the null hypotheses that all the canonical correlations are 0 in the population is 0.0043. The multivariate statistic Wilks' Λ was significant at 0.0043. The first canonical correlation was significant. The first canonical correlation was 0.7244, and was substantially larger than any of the between set correlations, the highest of which was -0.2719. The highest correlation within the carrier selection criteria set was 0.5734. The highest correlation among the environmental variables was 0.3141.

The canonical redundancy analysis shows that the cumulative proportion of variance explained by the first pair of canonical variables was 0.0218 and .0788. Details of the analysis are presented in Table 30 and Table 31.

This hypothesis (HC2) was supported for the reevaluation of purchase situation. The probability level for the null hypotheses that all the canonical correlations are 0 in the population is 0.0041. The multivariate statistic Wilks' Λ was significant at 0.0041. The first canonical correlation was significant. The first canonical correlation was 0.6682, and was substantially larger than any of the between set correlations, the highest of which was 0.3581. The highest correlation within the carrier selection criteria set was 0.7545 however. The highest correlation among the environmental variables was 0.2458.

Table 30. CANCELLATION Analysis Results: HC2-New Purchase

TESTS OF H0: THE CANONICAL CORRELATION IN THE CURRENT ROW AND ALL THAT FOLLOW ARE ZERO.				
Canonical Pair	Adjusted Canonical Correlation	Squared Canonical Correlation	Approx F	Prob > F
1	0.6199	0.5247	1.4185	0.0043
2	0.5164	0.4095	1.1240	0.2129
MULTIVARIATE TEST STATISTICS AND F APPROXIMATIONS				
Statistic		Value	F	Prob > F
Wilk's Lambda	0.1166		1.419	0.0043
Pillai's Trace	1.7062		1.365	0.0091
Hotelling-Lawley Trace		2.8059	1.471	0.0019
$\hat{\eta}_{mult}^2 = (\text{Pillai's Trace}/S) = 1.7062/6 = 0.285$				

Table 31. CANCORR Results: HC2-New Purchase

REDUNDANCY ANALYSIS				
Standardized Variance of the "Selection Criteria"				
Explained by the Canonical Variables				
Their Own Canonical Variables			The Opposite Canonical Variables	
Proportion	Cumulative Proportion	Canonical R-Square	Proportion	Cumulative Proportion
1 0.1501	0.1501	0.5247	0.0788	0.0788
Standardized Variance of the "Environmental Variables"				
Explained by the Canonical Variables				
Their Own Canonical Variables			The Opposite Canonical Variables	
Proportion	Cumulative Proportion	Canonical R-Square	Proportion	Cumulative Proportion
1 0.0416	0.0416	0.5247	0.0218	0.0218

The canonical redundancy analysis shows that the cumulative proportion of variance explained by the first pair of canonical variables was 0.0472 and .0879. Details of the analysis are presented in Table 32 and Table 33.

HC3: Criteria for selection of a carrier from the choice set will differ with the extent of the firm's source loyalty to the existing carrier or carriers.

This hypothesis was not supported for either of the scenarios. The details of the analysis are presented in Table 34 and Table 35.

EXPLORATORY QUESTIONS

The results of the investigation of the exploratory questions are presented in Table 36 and Table 37.

Exploratory Question 1: What is the relationship between the sales volume of a firm and the internality or externality of the transportation purchasing decision.

There was a significant positive relationship, the associated p-value being 0.0109.

Exploratory Question 2: What is the relationship between the level of employment of the firm and the internality or externality of the transportation purchasing decision.

There was a positive relationship, but it was not significant.

Table 32. CANCERR Analysis Results: HC2-Reevaluation of Purchase

TESTS OF H0: THE CANONICAL CORRELATION IN THE CURRENT ROW AND ALL THAT FOLLOW ARE ZERO.				
Canonical Pair	Adjusted Canonical Correlation	Squared Canonical Correlation	Approx F	Prob > F
1	0.4867	0.4466	1.4212	0.0041
2	0.4657	0.4089	1.2695	0.0533
MULTIVARIATE TEST STATISTICS AND F APPROXIMATIONS				
Statistic	Value	F	Prob > F	
Wilks' Lambda	0.1162	1.421	0.0041	
Pillai's Trace	1.7486	1.413	0.0041	
Hotelling-Lawley Trace	2.7119	1.421	0.0041	
$\hat{\eta}_{\text{mult}}^2 = (\text{Pillai's Trace}/S) = 1.7486/6 = 0.288$				

Table 33. CANCERR Results: HC2-Reevaluation of Purchase

REDUNDANCY ANALYSIS				
Standardized Variance of the "Selection Criteria" Explained by the Canonical Variables				
Their Own Canonical Variables			The Opposite Canonical Variables	
Proportion	Cumulative Proportion	Canonical R-Square	Proportion	Cumulative Proportion
1 0.1969	0.1969	0.4466	0.0879	
2 0.1334	0.3303	0.4089	0.0546	0.1425
Standardized Variance of the "Environmental Variables" Explained by the Canonical Variables				
Their Own Canonical Variables			The Opposite Canonical Variables	
Proportion	Cumulative Proportion	Canonical R-Square	Proportion	Cumulative Proportion
1 0.1057	0.1057	0.4466	0.0472	0.0472
2 0.0350	0.1407	0.4089	0.0143	0.0615

Table 34. CANCELL Analysis Results: HC3-New Purchase

TESTS OF H0: THE CANONICAL CORRELATION IN THE CURRENT ROW AND ALL THAT FOLLOW ARE ZERO.

Canonical Pair	Adjusted Canonical Correlation	Squared Canonical Correlation	Approx F	Prob > F
1	0.1226	0.1036	0.6531	0.8822

MULTIVARIATE TEST STATISTICS AND F APPROXIMATIONS

Statistic	Value	F	Prob > F
Wilk's Lambda	0.8964	0.653	0.8822
Pillai's Trace	0.1036	0.653	0.8822
Hotelling-Lawley Trace	0.1156	0.653	0.8822

$\hat{\eta}_{mult}^2 = (\text{Pillai's Trace}/S) = 0.1036/1 = 0.1036$

Table 35. CANCELL Analysis Results: HC3-Reevaluation of Purchase

TESTS OF H0: THE CANONICAL CORRELATION IN THE CURRENT ROW AND ALL THAT FOLLOW ARE ZERO.				
Canonical Pair	Adjusted Canonical Correlation	Squared Canonical Correlation	Approx F	Prob > F
1	0.2878	0.1808	1.2471	0.2178
MULTIVARIATE TEST STATISTICS AND F APPROXIMATIONS				
Statistic	Value	F	Prob > F	
Wilk's Lambda	0.8193	1.247	0.2178	
Pillai's Trace	0.1808	1.247	0.2178	
Hotelling-Lawley Trace	0.2206	1.247	0.2178	
$\hat{\eta}_{mult}^2 = (\text{Pillai's Trace}/S) = 0.1808/1 = 0.1808$				

Exploratory Question 3: What is the relationship between the distance of the average motor carrier shipment and the internality or externality of the transportation purchasing decision.

There was a negative relationship, but it was not significant.

Exploratory Question 4: What is the relationship between the average distance of the firm's facilities from transportation hubs and the internality or externality of the transportation purchasing decision.

There was a negative relationship, but it was not significant.

SUMMARY

In this chapter, the results of the specific hypotheses tested in this study have been presented. Four of the fifteen hypotheses in Hypothesis Set A were supported. Specifically, proportion of shipments shipped freight pre-paid, use of intermodal carriage, nature of business and number of sources of information utilized in the carrier selection process were found to be positively related to internal carrier selection decision making. Proportion of total freight shipped on motor carriers, proportion of shipments that were less than truckload, and proportion of carrier selection decisions that were new purchases or reevaluation of purchases were found to be positively related to internal carrier selection decision making, as was the score on the source

Table 36. Analysis for Exploratory Questions 1 & 2

<i>Relationship of Internality of Carrier Selection Decision with Annual Sales Volume of Shipper Firm and with Level of Employment</i>			
Variable	Number of Observations	Mean	Standard Deviation
Annual Sales Volume (SALES)	146	3.7055	1.4535
Number of Employees (EMPL)	149	2869	8076
Proportion of carrier Selection decision internal (COMSPEC)	154	0.7561	0.2836
<i>Pearson Correlation Coefficients</i>			
		SALES	EMPL
	COMSPEC	0.2101	0.0933
	p-Value	0.011	0.258

Table 37. Analysis for Exploratory Questions 3 & 4

<i>Relationship of Internality of Carrier Selection Decision with Average Distance of Motor Carrier Shipment and with Average Distance of Facility from Transportation Hub</i>			
Variable	Number of Observations	Mean	Standard Deviation
Average Distance of Motor Carrier Shipment (AVDIST)	146	685.4	450.2
Average Distance of Facility from Transportation Hub (AVHUBDST)	108	49.6	101.99
Proportion of carrier Selection decision internal (COMSPEC)	154	0.7561	0.2836
<i>Pearson Correlation Coefficients</i>			
		AVDIST	AVHUBDST
	COMSPEC	-0.134	-0.136
	p-Value	0.107	0.162

loyalty scale. These relationships were not found statistically significant at the 5% level. One of the two hypotheses in Hypothesis Set B was supported. A positive relationship was found between frequency of routine purchase situation and source loyalty toward existing carriers. Two of the three hypotheses in Hypotheses Set C were supported. Specifically, organizational characteristics and environmental variables were found to be significantly related to the criteria used for carrier selection. The results of the investigation of the exploratory questions were also presented. One of the four relationships was found to be significant. There was also a positive relationship of sales volume to the internality of the transportation purchasing decision. The discussion of the findings, conclusions, limitations and implications for future research are presented in Chapter 5.

CHAPTER 5

CONCLUSIONS

This chapter discusses the analytical findings reported in Chapter 5, addresses the conclusions and provides directions for future research that can be drawn from this study. A brief overview of the study is presented, followed by a summary of the major findings. Implications for theory and practice of marketing are then presented. Finally, the limitations of the study are discussed, and directions for future research are proposed.

OVERVIEW OF THE RESEARCH

The purpose of this study was to examine motor carrier transportation purchasing as an organizational buying phenomenon. A model of motor carrier transportation purchasing was developed and empirically tested. Specifically, the

model investigated the role of various organizational and environmental variables and source loyalty on the locus of the carrier selection decision: whether it was internal or external to the shipper organization. The effect of the variables above on the development of the carrier selection criteria was also investigated. The relationship of source loyalty to the buyclass of motor carrier transportation purchasing was also examined as well as its impact on the actual selection decision.

A mail survey of traffic executives was conducted for the empirical part of this study. The survey gathered information about the motor carrier selection decision process, selection criteria, and information on organizational and environmental variables. A scale to measure source loyalty¹² of shippers toward carrier companies was also refined and used. A total of 228 responses were received for a response rate of 18.5%.

The next section will discuss the findings for the individual hypotheses that were proposed for empirical testing.

DISCUSSION OF THE RESULTS

HYPOTHESIS SET A

There were a total of 15 hypotheses in Hypothesis Set A regarding the effect of organizational and environmental variables and source loyalty on the locus of the carrier selection decision. The results of the significance test on the β s are summarized in Table 38 and Table 39.

¹² Morris, Avila and Burns (1989)

The hypothesis HA2 that carrier selection decisions are more likely to be internal than external when the firm uses intermodal carriage, was supported for both the new purchase situation and the reevaluation of purchase situation. This has important implications for the carrier companies. On one hand, the carrier companies will find the usage of intermodal carriage an important segmenting tool when evaluating their potential customers. On the other hand, as shippers making more carrier selection decisions internally are more likely to be using intermodal carriage, carrier companies may find it useful to include such capability among their service characteristics.

The hypothesis HA3 that the carrier selection decision was more likely to be internal than external when the firm used a higher proportion of "freight pre-paid" terms of sale was supported. It is likely that the firms that use "freight pre-paid" terms of sale see the value added by the transportation function as integral to the overall "product" and as such are likely to try and retain control over the carrier selection decision. While this dimension of a shipper firm is a useful segmentation characteristic, it also would indicate that carrier firms are more likely to be successful in being selected if they are willing to customize their service so as to blend more with the shippers' objectives.

The hypothesis HA6 that the carrier selection decision was more likely to be internal when the nature of the principal business of the firm was non-manufacturing was supported. This finding could have two different implications for carrier companies. Viewing the nature of business as a segmenting dimension, carrier companies may position themselves as vendors for the motor carriage service for non-manufacturing companies in the market. In a secondary fashion, the results would indicate the existence of a potential market where the carrier companies can go beyond the specific carrier selection situation and may project themselves as the total solution to the transportation problem for the manufacturer shipper. This would involve taking

over the entire transportation function for companies that are not sophisticated in transportation planning themselves, or find it not efficient to engage in.

The hypothesis HA14 that the carrier selection decision was more likely to be internal as more sources of information were utilized by shippers was supported. This hypothesis would imply that carrier companies, when planning their promotion, should use multiple media to reach out to heavy buyers of motor carrier freight. The next step in this direction would be to determine what are the specific media that are utilized, and their relative effectiveness with shippers.

The hypothesis HA4 that carrier selection decisions are more likely to be internal than external when a higher proportion of the purchase decisions are for new purchases or for reevaluation of purchases, was not supported. However, the direction of the results was the same as that hypothesized. To further examine the results, the variables were each coded high and low according to whether the respective proportions were $\geq .50$ or $< .50$. Then two-way contingency tables were created for COMSPEC * NPSIT and COMSPEC * RVPSIT. Chi-square tests of independence were not significant in either case, but again the case for a positive relationship between COMSPEC and RVPSIT appears to be stronger than does that for the relationship between COMSPEC and NPSIT. It would thus appear that there is a small effect for the relationship between COMSPEC and RVPSIT, which is being further confounded by the inclusion of NPSIT ($NPRVPSIT = NPSIT + RVPSIT$). If such is the case, it can be interpreted, that new purchase situations need not necessarily involve internal carrier selection decision, and may just as well be passed over to external entities. However, for reevaluation of purchase situations, shippers are more likely to have better understanding of the needs and like more control over the decision, favoring an internal one.

The hypothesis HA8 that the carrier selection decision was more likely to be internal as the percentage of motor carrier freight shipped less-than-truckload increased was not supported, but the direction of the relationship was the same as hypothesized. The a priori justification of the hypothesis was that the shippers who frequently ship LTL do so to maintain a high level of customer service. Because of the higher rates involved, it would seem appropriate that shippers would seek to retain control over the carrier selection decision. As the results were not significant it could be that the relationship is weaker than at first thought. It is possible that in some cases, LTL shipments were shipped freight-collect, or the consignee arranged for pick-up. Another possible explanation may be that LTL shipments are handled as a routine purchase, and designated carriers are automatically used. This would be a plausible explanation for the non-significance of the findings, the effect being too small to have been picked up by the sample size used.

The hypothesis HA15 that carrier selection decision was more likely to be internal than external when there was a higher level of source loyalty towards existing carriers was not supported, but the results were in the direction hypothesized. When the distribution of the SLSCORE variable was examined, it was found that the distribution was bi-modal, with the majority of the values being clustered around the values of 55 and 60. Thus absence of sufficient variability may have prevented significant relationship between COMSPEC and SLSCORE. However, to further examine the results, the variable SLSCORE was recoded as high or low depending on whether the value was ≥ 58 or < 58 . The chi-square test of independence for the two-way table between COMSPEC and the recoded SLSCORE was found significant, ($p=0.004$). This would tend to support the argument that the relationship can be better identified when the scale for source loyalty yields a wider range of scores. It may have been more appropriate, in hindsight, to have used the source loyalty scale in the context of

a carrier that represented the most representative of those used by the shipper. While this may have yielded more variability, shipper identification of a typical carrier may be the next problem that would have to be solved. Assuming that these arguments hold, and there is a relationship, carriers would find it beneficial to develop shipper source loyalty, as that would result in more selection decisions being made by the shipper, and chances of the carrier which has the loyalty being selected would be higher.

The hypothesis HA1 that carrier selection decisions are more likely to be internal as the percentage of the total shipments of the firm that utilized motor freight increases was not supported. The sign of the parameter estimate was the opposite of that hypothesized. It was observed though that the parameter estimate itself was very small in both the scenarios, being of the order of 0.001, with a relatively high standard error of estimation, and that was a very likely reason for the reversal of the sign from what was hypothesized. The results were further examined after recoding the variables as high and low, and the chi-square test of independence for the two-way table was not found significant. It would thus appear that the relationship is extremely weak if it does exist, and may not be of practical importance. However there is also a possibility that a better test may be possible if the absolute measures rather than proportions be used as the size of the organization may unequally weight the proportions. To find support for this argument, two-way tables were created for COMSPEC and VOLTON (volume of motor carrier shipments in tons) and VOLDOL (volume of motor carrier shipments in dollars), and chi-square tests of independence were significant in both cases at the 5% level. While no firm conclusions should be drawn as there were many missing values reported for both VOLTON and VOLDOL, a case can be made for testing the reformulated hypothesis in the future, using absolute figures rather than proportions. There is again theoretical justification that

greater volume would increase knowledge and experience on making the carrier selection decision, leading to a higher proportion of the selection decisions being internal. If the relationship can be shown to be significant, it will be a useful segmenting dimension to be used by carrier companies.

The hypothesis HA5 that the carrier selection decision was more likely to be internal when the size of the buying center increased, was not supported. The results were in the hypothesized direction for the new purchase scenario, but the sign was reversed in the case of reevaluation purchase. As was argued for HA1, the reversal of sign itself may not be of relevance, reflecting instability of the parameter estimate more than anything else. The results suggest that there is no relationship of the locus of the carrier selection decision with the size of the buying center. There is however a possibility that the variable "size of the buying center" may have been measured less than accurately. As the level of the respondent differs in the hierarchy of the organization, the perception of buying center membership may change. As there was no cross validation of the reported membership of the buying center, the data could not be examined further. However there is no reason to deviate from the theoretical argument that larger buying centers will have more expertise among them, and as such be more likely to seek control over the carrier selection decision. Any subsequent study will need to ensure that there is agreement among the respondents as to what the concept of a buying center is in the case of carrier selection, and determine that there is adequate variability, so that the hypothesis can be properly tested.

The hypothesis HA7 that the carrier selection decision was more likely to be internal as the number of manufacturing and storage locations maintained by the firm increased, was not supported, and the direction of the relationship was reversed for both the new purchase situation and the reevaluation of purchase situation. The distribution of the variable NUMLOC was very skewed to the low end, and the range

was inordinately large. This is a plausible explanation for not finding the relationship significant. In support, it can be said that when the variable was collapsed into high and low categories, around the median value, the chi-square test of independence for the two-way table for COMSPEC*NUMLOC was significant. There is justification therefore for retesting the hypothesis in a future study with the problem of the distribution fixed. The skewness of the distribution may have resulted from size of the organizations or from specific product-market characteristics.

The hypothesis HA9 that carrier selection decisions were more likely to be internal than external when a higher proportion of the new purchase decisions are triggered by product related considerations was not supported, and the direction was also reversed for the relationship. The hypothesis HA10 that the carrier selection decision was more likely to be internal than external when a higher proportion of the reevaluation of purchase decisions were triggered by service related considerations was not supported, but the relationship was in the direction hypothesized. For both hypotheses HA9 and HA10, the results indicate that there is no relationship between COMSPEC and the trigger for the carrier selection decision in either the new purchase scenario or the reevaluation of purchase scenario. It would appear that locus of the carrier selection decision is independent of the trigger for the carrier selection decision. But there is the possibility that the lack of increased variability in the measure of the variables may be masking the extent of the relationship. For now, the results of this study would suggest that it would not be worthwhile for carrier companies to investigate the antecedents of the carrier selection decision they participate in.

The hypothesis HA11 that the carrier selection decision was more likely to be internal than external when there was a greater perceived variety of service characteristics amongst the available carriers was not supported. While the direction of the relationship was as hypothesized for new purchase situations, the relationship

was negative in the case of reevaluation of purchase situations. The results strongly suggest the absence of any relationship between the locus of the carrier selection decision and the perceived variety of service characteristics among the available carriers. On the surface this may appear to bolster the argument that motor carrier freight is an undifferentiated product. However the reason for non-significance may be that what matters is not the perceived variety of service characteristics, but the presence or absence of specific service characteristics among the available carriers. It may also be that the belief that carriers may be amenable on negotiation, to provide customized service is what is relevant. Unfortunately the present study did not gather the information necessary to test these propositions, and as such the hypothesis remains to be tested in its reformulated version in a subsequent study.

The hypothesis HA12 that the carrier selection decision was more likely to be internal than external as the number of carriers available for potential selection was not supported. The direction of the relationship was found to be the opposite of what was hypothesized for both new purchase and reevaluation of purchase situations. The results would suggest that there is no relationship between the locus of the carrier selection decision and the actual number of available carriers. It may be that the availability of carriers with specific characteristics, and not just the sheer number may be related to the locus of the carrier selection decision. This hypothesis, though not supported as it stands, may be worthwhile to retest after reformulation, as it may then have implications for possible market development strategies on the part of carrier companies.

The hypothesis HA13 that the carrier selection decision was more likely to be internal than external when more sources of information about the carriers are available was not supported, and the direction of the relationship was also reversed from what was hypothesized. The most likely explanation for the lack of significance

is that both the variables NPISA and RVISA were strongly correlated with the variables NPISU and RVISU respectively, and failed to achieve significance in the regression equation in the presence of the latter variables. The chi-square tests of independence for the two-way tables COMSPEC*NPISA and COMSPEC*RVISA were both significant at the 5% level. The implication of this finding (based on the two-way tables, even as the original hypothesis was not supported due to collinearity problems) would be for carrier companies to aggressively promote themselves in view of the potential expansion of demand in the market such increased availability of information would tend to create.

It was found on examination, that the variables included in the regressions explained approximately 58% of the variation in the dependent variable COMSPEC. However, almost all of the explained variation came from the four variables that were found to be statistically significant. A plausible post-hoc explanation as to the situation is that locus of the carrier selection process has a very strong relationship with the product characteristics that are typical to the shipper. Even though the question regarding SIC code of the products being shipped posed no problem during the pretest, in the actual study that information was missing or not useable for almost all the responses, and as such was not made a part of the analysis. It is also suggested that further investigation of the individual characteristics of the participants in the carrier selection decision may provide explanation of more of the variance in the locus of the carrier selection decision.

HYPOTHESIS SET B

In the second set of hypotheses, hypothesis HB1 that there was a positive relationship between source loyalty toward existing carrier or carriers and the

Table 38. Summary of Hypotheses Tests: Hypothesis Set A

Variable	Significant	Hypothesized Direction
New Purchase Situation		
Proportion Shipped "freight pre-paid"	Yes	Yes
Use of Intermodal Carriage	Yes	Yes
Nature of Business	Yes	Yes
Proportion Shipped on Motor Carriers	No	No
Number of Locations	No	No
Proportion of Purchase Situations New or Reevaluation	No	Yes
Source Loyalty Score	No	Yes
Product Related Trigger for New Purchase Situation	No	No
Buying Center Size	No	Yes
No. of Carriers Available	No	No
Perceived Variety of Service Characteristics	No	Yes
No. of Sources of Information Available	No	No
No. of Sources of Information Utilized	Yes	Yes
Proportion of Shipments sent LTL	No	Yes

Table 39. Summary of Hypotheses Tests: Hypothesis Set A

Variable	Significant	Hypothesized Direction
Reevaluation of Purchase Situation		
Proportion Shipped "freight pre-paid"	Yes	Yes
Use of Intermodal Carriage	Yes	Yes
Nature of Business	Yes	Yes
Proportion Shipped on Motor Carriers	No	No
Number of Locations	No	No
Proportion of Purchase Situations New or Reevaluation	No	Yes
Source Loyalty Score	No	Yes
Service Related Trigger for Reevaluation Situation	No	Yes
Buying Center Size	No	No
No. of Carriers Available	No	No
Perceived Variety of Service Characteristics	No	No
No. of Sources of Information Available	No	No
No. of Sources of Information Utilized	Yes	Yes
Proportion of Shipments sent LTL	No	Yes

frequency of routine transportation purchasing, was supported. This finding has important implications for carrier companies. It suggests that it is in the interest of carrier companies to cultivate source loyalty on the part of their shippers. With source loyal relationships, carrier selection is likely to be a routine purchase decision without going through an evaluation process that involves expending additional resources to compete with other carriers, as well as there being the possibility of losing out to another competing carrier. It also suggests that the carrier companies have the need to understand the nature of source loyalty in the context of freight purchasing, so as to be able to facilitate the development of source loyal relationships with shipper companies.

However, the hypothesis HB2 that there was a positive relationship between source loyalty and the retention of existing carriers in case of a reevaluation of purchase was not supported although the results were in the hypothesized direction. There could be three possible reasons at least, that can be offered as a post-hoc explanation. On examination, it was seen that the distribution of the source loyalty scores was skewed toward the high end. The distribution was bi-modal and most of the observations were clustered around the values of 55 and 60. As such, the full range of variation of the measure was not adequately captured, and may have resulted in the relationship not being statistically significant. Another reason for not finding the relationship significant may be that the power of the test was not high enough, given the strength of the relationship (actually under 10%). A third explanation may be that when a reevaluation of purchase situation occurs, it is in spite of a source loyal relationship. The reason behind triggering of the reevaluation of purchase decision may be strong enough to overcome the tendency to keep the carrier selection decision at the routine purchase level, and once that happens, the effects of source loyalty weakens considerably when it comes to the carrier selection decision which results.

However to come to a firm conclusion, a future study must address the first two methodological issues before venturing to test the third proposition. In case support is found for it, it would mean that carriers should not expect past relationships to help them routinely survive reevaluation of purchase situations unscathed. It would be indicated in that case, that carriers direct their resources to competing fully with other potential carriers in case the shipper reevaluates the carrier selection decision. A summary of the results of the tests of hypotheses in set B are presented in Table 40.

HYPOTHESIS SET C

In the third set of hypotheses, both HC1 and HC2 that stated there was relationship between the carrier selection criteria and organizational characteristics and environmental variables respectively were supported. However, hypothesis HC3 that there was a relation between the carrier selection criteria and source loyalty towards existing carriers was not.

Interpretation of the canonical correlations is predicated on three criteria: a) the level of statistical significance of the function, b) the magnitude of the canonical correlation and c) the redundancy measure for the percentage of variance accounted for from the two data sets. The level of significance is set at 5%. No bounds are set as to the magnitude of the canonical correlation as such, but it must be remembered that the correlations refer to the variance explained in the canonical variates, and not in the original variables. The Stewart-Love index of redundancy measures the amount of variance in one set that can be explained by the variance in the other set.

For HC1 in the case of new purchase situation, the result suggests that the first pair of canonical variates shows a relationship between the importance of the two criteria (cost of truckload service and cost of less-than truckload service), with the

Table 40. Summary of Hypotheses Tests: Hypothesis Set B

Relationship of Source Loyalty with the Variable	Significant	Hypothesized Direction
Frequency of Routine Transportation Purchasing	Yes	Yes
Frequency of Retention of Existing Carrier in the event of Reevaluation of Purchase	No	Yes

organizational variable proportion of shipments that are made less than truckload. The second pair of canonical variates suggests that there is less emphasis on the importance of the criteria for on time service when the predominant term of shipment used is "freight collect." In case of a reevaluation of purchase situation, the information from the first pair of canonical variates is identical to that in case of new purchase, but the correlation between the second pair would suggest that the criteria of reputation for reliability is less emphasized when a higher proportion of shipments are made under "freight collect" terms. However, the findings have to be interpreted with the consideration that a very small portion of the variance in the set of criteria was explained by the variance in the set of organizational characteristics variables (only 11% and 12% approximately in case of new purchase situation and reevaluation of purchase situation respectively).

The canonical correlation was found significant for HC2 in both scenarios. The significant pair of canonical variates in the case of a new purchase situation suggest a positive relationship between the importance of frequency of service and the proportion of purchase situations triggered by product related considerations. In case of reevaluation of purchase situation, relationships between availability of carriers and importance of the criteria of number of destinations served, and that of "evaluation of service characteristics of existing carriers" with the criteria of number of destinations served are indicated. Once again though, it must be noted that only about 8% and 14% of the variance in the set of criteria were explained by the variance in the set of environmental variables.

The hypothesis HC3 was not supported in either of the scenarios. While there is still a priori justification that source loyalty toward the existing carrier or carriers will tend to affect the evaluative criteria used, the basis of such effect may be to make the criteria favor the existing carrier or carriers. As this will be a random effect, being

a function of the strengths of specific carriers that the particular shipper has been doing business with, there would be a very slim chance of finding a significant systematic effect. A summary of the results of the tests of hypotheses in set C are presented in Table 41.

Given that the canonical correlations for HC1 and HC2 were statistically significant, the variance within the criteria themselves was much greater than that which could be explained by the variance in the organizational characteristics or the environmental variables or source loyalty score. A possible reason for this is the lack of control in the present study of product-market related variance as well as the variance due to individual characteristics of the participants in the buying decision. Though statistically valid statements about relationship of criteria for carrier selection with the various independent variables cannot be made, the results provide an opportunity to examine the data so as to uncover possible relationships whose statistical significance can be tested under controlled conditions in future studies. To this end a series of two-way tables were set up to examine the relationships of carrier evaluation criteria with organizational characteristics, environmental variables and source loyalty score. While the criteria for reporting (theoretical interest and significance of chi-square tests of independence) may be less than adequate, they are considered sufficient for the purpose of generating possible relationships for testing in future research.

The new purchase scenario will be examined first. The data show that for the sample used in this study, following relationships appeared to exist.

The importance of the criteria "carrier reputation for reliability" appeared to differ based on the "proportion of shipments made on freight pre-paid terms, proportion of total shipments made on motor carriers, and on whether the shipper uses intermodal carriage."

Table 41. Summary of Hypotheses Tests: Hypothesis Set C

Relationship of Carrier Selection Criteria With	Purchase Situation	Significant
Organizational Variables	New Purchase	Yes
Organizational Variables	Reevaluation of Purchase	Yes
Environmental Variables	New Purchase	Yes
Environmental Variables	Reevaluation of Purchase	Yes
Source Loyalty Score	New Purchase	Yes
Source Loyalty Score	Reevaluation of Purchase	Yes

The importance of the criteria "carrier financial security" appeared to differ based on the "proportion of shipments made on freight pre-paid terms, whether shipments involved intermodal carriage, nature of shippers' principal business, number of information sources utilized and annual sales volume of the shipper."

The importance of the criteria "cost of TL service" appeared to differ based on "the number of sources of information utilized, the proportion of LTL motor carrier shipments made, source loyalty score and annual sales volume of the firm."

The importance of the criteria "cost of LTL service" appeared to differ based on "whether the shipper utilizes intermodal carriage, number of locations the shipper needs service for, nature of shippers' business, proportion of shipments made LTL, and annual sales volume of the firm."

The importance of the criteria "on time service" appeared to differ based on "the proportion of shipments using motor carriage and number of sources of information utilized."

The importance of the criteria "frequency of service" appeared to differ based on "the proportion of LTL shipments that are made."

For the reevaluation of purchase scenario, the following relationships appear to exist.

The importance of the criteria "on time service" appeared to differ based on "the proportion of shipments made under freight pre-paid terms, the source loyalty score, proportion of LTL shipments, and shippers' annual sales volume."

The importance of the criteria "carrier information support" appeared to differ based on "use of intermodal carriage, proportion of shipments made under freight pre-paid terms, number of sources of information utilized, and proportion of LTL shipments."

The importance of the criteria "cost of LTL service" appeared to differ based on "the nature of shippers' business, proportion of shipments made on motor carriers, proportion of LTL shipments, and shippers' annual sales volume."

The importance of the criteria "cost of TL service" appeared to differ based on "the proportion of shipments made under freight pre-paid terms, source loyalty score, and shippers' annual sales volume."

Once again, the relationships outlined above are not meant as statistically valid generalizations, but are presented as observations based on the data that suggest propositions that may be tested in future studies.

EXPLORATORY QUESTIONS

Four exploratory questions were investigated. Sales volume for shippers was found to be positively related to the internality of carrier selection decisions. This would suggest that larger firms were more likely to retain control over the carrier selection decision, and would be better potential prospects for carrier firms to do business with, when compared to smaller firms.

Average distance for motor carrier shipments and average distance of location from a transportation hub appeared to be negatively related to the internal carrier selection decisions, but the relationships were not statistically significant. When the data was examined further, it appeared that the negative sign was an indication of the wide variation in the range. When the data was collapsed to high and low values around the median, while still not statistically significant, the sign was positive. The relationship of the size of employment to internal carrier selection decision was positive, but not significant. The study suggests therefore, that the relationship of the locus of the carrier selection decision with the size of the shipper firm work force, the

average distance of motor carrier shipment and the distance from carrier hubs is not significant so as to make these variables useful segmenting dimensions for carrier marketing strategies.

IMPLICATIONS OF THE RESEARCH

In this section, the implications of the research findings on theoretical, methodological and substantive issues will be examined. The contribution to theory building in the area of transportation purchasing will be examined, followed by a discussion of the methodology used and its appropriateness. Finally the implications of the results for practitioners will be addressed.

THEORETICAL IMPLICATIONS

The present study has theoretical implications for transportation purchasing behavior being studied as an organizational buying behavior phenomenon. Specifically, the findings regarding the relationships of organizational characteristics and environmental variables and source loyalty toward existing vendor with purchasing behavior will have implications for the knowledge base in organizational buying behavior literature.

Motor-carrier freight purchasing has been examined under the Sheth (1973) model of industrial buying behavior. The present research investigated the effects of organization specific factors, and environmental factors (situational variables and information sources in the Sheth model) on the carrier selection decision. The results show that there is a relationship between the locus of the purchasing decision and the

organizational and environmental variables. Firms are more likely under certain conditions to purchase freight internally than to leave the decision to the consignee. Specifically, the nature of the firms' business, the terms of shipment predominantly utilized, use of intermodal carriage and the extent of information search were found to be significantly related to the carrier selection decision making as posited in the industrial buyer behavior model (Sheth, 1973). The findings also provide empirical support to the conceptualization of the general model of transportation choice (Krapfel and Mentzer, 1982), in that the organizational characteristics and sources of information that were used were shown to be related to the carrier selection decision.

There was a significant relationship of the organizational characteristics and environmental variables with the criteria for carrier selection, which is in support of both the Sheth model and the general model of transportation choice proposed by Krapfel and Mentzer. However, only a very small (though statistically significant) portion of the variance in the criteria was thus explained. It is felt that inclusion of product specific factors and industry specific factors as explanatory variables in the model will provide a better fit for the model. An important contribution is that subsequent to finding support for hypotheses HC1 and HC2, the study yielded a series of propositions regarding the relationship of carrier selection criteria with various organizational and environmental variables and source loyalty that will serve as a source for generating hypotheses for future studies.

Another contribution of this research is the investigation of the effect of source loyalty on the carrier selection decision process. While the relationship of source loyalty with the locus of the carrier selection decision process was not found significant, the results were in the hypothesized direction. Also there was a significant positive relationship of the source loyalty measure with the routine purchase buyclass variable. The relationship of source loyalty to the frequency of retention of existing

carrier was not found significant, although the results were in the hypothesized direction. A reason for not finding these relationships significant may have been that there was not a sufficient amount of variability in the measure of source loyalty. It appears from the results overall, that the range of the source loyalty measure needs to be increased. To that end, the further refinement of the scale used, by adding new items, will prove helpful.

METHODOLOGICAL IMPLICATIONS

The research employed a mail survey technique for data collection. While the total design method (Walker, Kirschmann and Conant 1987) was used to develop and implement the data collection, the response rate was not as high as was expected. The modified source loyalty scale was pre-tested and refined for use in this study.

The issue of statistical conclusion validity (the ability of statistical tests to detect the postulated relationships) was addressed in this research. The exploratory nature of the study precluded a priori knowledge of variance estimates, medium effect sizes were assumed and power level was set at 80% to compute sample sizes based on the standard power tables (Cohen 1977).

The multiple regression analysis used allowed simultaneous testing of the relationship of the locus of the carrier selection decision with a variety of independent variables. The problems related to collinearity were not fatal. Only one pair of variables with a fairly strong dependence was observed, but it did not damage other coefficients. There were no severe outliers or high leverage observations. The one problem that was evident was that there was insufficient variability on some of the predictor variables. This might have prevented significant findings for some of the relationships.

Canonical correlation analysis was successfully used in this research. The ability of the canonical correlation analysis to explore relationships among sets of variables was demonstrated, particularly when there was almost no a priori knowledge as to how the variables were related from one set to the other. The canonical correlation analysis also served an important role in demonstrating the fact that the independent variables in the study: organizational variables, environmental variables and source loyalty, explained a relatively small amount of variance in the set of evaluative criteria for carrier selection. This drew attention toward the need for future research incorporating other sources of variance such as individual factors of the buying center participants, and product-market characteristics that may account for a significant incremental amount of variance.

Finally, the canonical analysis while not being very useful in terms of predictive ability because of the small amounts of variance explained, did provide directions as to ways in which the evaluative criteria were linked to the independent variables. It allowed a composite measure of relationships that would otherwise have involved an unmanageably large number of bivariate correlations.

SUBSTANTIVE IMPLICATIONS

The findings of this research have implications for marketing practitioners. The research provides carrier companies with the tools to segment their market, and in turn allow them to achieve better fit with their customer needs.

Specifically, organizations whose principal business is other than manufacturing, who use intermodal carriage, and use freight pre-paid terms of shipment more often are more likely to make carrier selection decisions internally. Therefore carrier companies should target such organizations for their business. Companies that decide

on carrier selection internally were also found to be using more information sources regarding availability and characteristics of carriers. This would imply that carriers need to disseminate information about their availability and services through diverse sources.

The research also underscored the importance of source loyalty in carrier shipper relationships. The findings show that when shippers have high source loyalty towards existing carriers there is a high frequency of routine transportation purchasing. Therefore it would appear that investment of effort by carrier companies in developing source loyal relationships with carriers will pay off in repeat business more often than not. The research also lays out the dimensions of source loyalty for a better understanding in the context of transportation purchasing.

Finally, the research has also established that criteria for selection used by shippers differ when their organizational characteristics differ and also when they face different environmental variables. While there is need for further research to uncover more details about how the criteria actually differ, an important first step has been taken to establish the existence of such differences. This kind of information will provide tremendous opportunities to carrier companies to customize their products to identified target customers.

LIMITATIONS OF THE STUDY

A major limitation of this study has to do with the problem of non-response. The response rate of approximately 18% precludes any claims of the actual sample being representative of the population. Even though the efforts at investigating non-response seem to suggest that other than on "sales volume," the respondents and non-respondents appear to be similar, there is no guarantee that such was actually the

case. In fact the data showed that one of the reasons why some of the hypothesized relationships failed to achieve significance was because of lack of variation in the ranges of some of the dependent variables. In hindsight, a factorial design where respondents would be chosen so as to have the appropriate range of values for the independent variables would have improved the chances of uncovering significant relationships.

A second major limitation of the study has to do with the specification of the model for the carrier selection decision. It was decided at the outset, to investigate the effects of organizational and environmental variables on the carrier selection decision, as well as the effect of source loyalty. The study found that while these factors had significant relationships with the locus of the carrier selection decision as well as development of criteria for carrier selection, they explained only a relatively small portion of the variance. It would appear that product specific factors and individual factors of members of the buying center account for a relatively large portion of the variance, which this model fails to capitalize on.

A third limitation of the study is that the source loyalty scale needs to be refined further. Whereas coefficient α is 0.79, there is scope for further improvement. Also the scale should be able to distinguish better between high and low source loyalty. This limitation may have prevented findings of significance in some of the hypotheses involving source loyalty.

A fourth limitation of the study has been that, as is the case with mail survey research, there was no control ultimately over who responded to the survey. The level of the respondent in the organization appears to have varied widely in the study, ranging from traffic supervisor to the vice president of transportation. This has probably contributed to noise in the data in terms of the figures reported. The level of the individual responding probably has affected the aggregation of the information

reported. While the intention was to have the highest ranking individual in the organization who dealt with the carrier selection decision to respond, such was not always the case as the actual responses showed.

DIRECTIONS FOR FUTURE RESEARCH

This study can be considered the first step in a series of studies to investigate transportation purchasing as an industrial service purchasing function. While the effects of organizational and environmental variables and source loyalty have been examined in this study, more research designed specifically to overcome the limitations that have been outlined earlier is warranted before firm conclusions can be reached.

Because of the lack of variability that was observed for certain independent variables, it may be better to use in the future quasi-experimental designs that ensure such variability, rather than use a random sample drawn from the population.

Also, as the variance explained by the organizational and environmental variables and source loyalty in this research was relatively small, inclusion of product specific variables as well as market specific variables in the model in future research may result in better specification of the model.

Investigation of transportation purchasing in settings other than motor carriers will add to the generalizability of the findings, and add to the explanatory capabilities of the model.

Finally the intangible nature of the freight transportation product calls for a comparison of the transportation service purchasing behavior with other organizational service purchasing situations for identifying similarities and dissimilarities that can ultimately lead to improved performance of the function.

SUMMARY

This research has successfully examined motor carrier freight purchasing as an organizational buying phenomenon using the Sheth (1973) model which is the dominant paradigm in the area. Organizational variables such as terms of shipment, nature of the firms business, and usage of intermodal carriage were found to have significant relationship to the locus of the carrier selection decision. Among environmental variables the sources of information about carriers that were utilized had a significant relationship to the locus of the carrier selection decision. Source loyalty toward existing carriers was found to be positively related to the frequency of purchase situations that were classified as routine purchase. In addition it was found that carrier selection criteria employed by shipper firms differed as the firms differed on in terms of organizational characteristics and environmental variables they faced.

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Appendix A. Cover Letter



THE R. B. PAMPLIN COLLEGE OF BUSINESS

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061-0236

May 29, 1990

Dear Transportation Executive:

Motor carriers are the mainstay of freight transportation for the domestic U.S. market. At the beginning of the 1990's, the industry has become more adept at working under the conditions that exist with deregulation. At the present time there is a strong need for the evaluation of the carrier selection process of shippers who predominantly use motor carriers. The purpose is to understand the needs of the shipper better, and also to provide the motor carrier industry with information on shipper needs and the process of carrier selection so they can provide enhanced service to their customers.

For this study to be successful, it is extremely important that I have input from your company. It is also important to the research that this survey be completed by the individual in your organization who is responsible for the motor carrier freight purchasing decision. I would appreciate this survey questionnaire being forwarded to that appropriate individual for completion. If you are the most appropriate person, I would appreciate your completing the questionnaire and returning it in the enclosed envelope at your earliest convenience.

The confidentiality of your responses will be maintained and results reported only at the aggregate level. If you would like a copy of the findings and managerial implications of this research, please include a business card from your organization (do not attach it to the questionnaire).

Thank you very much for taking time out of your busy schedule to participate in the survey. I believe that the results will have worthwhile managerial implications.

Sincerely,

John T. Mentzer, Ph.D.
Professor of Marketing

Encl: Carrier Selection Survey

Appendix B. Reminder Post-card



THE R. B. PAMPLIN COLLEGE OF BUSINESS
VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061-0209

Dear Traffic Executive:

Recently, I sent you a questionnaire asking for your cooperation in a study of the motor carrier freight purchasing decision. If you have already returned the questionnaire, thank you for your valuable contribution.

If you have not had a chance to do so yet, may I ask you to please have the appropriate person complete and return the questionnaire? Your prompt participation is vital to the success of the research project.

Sincerely,

Dr. John T. Mentzer, Ph.D.
Professor of Marketing

Appendix C. Cover Letter for Second Wave of Mailing



THE R. B. PAMPLIN COLLEGE OF BUSINESS

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Blacksburg, Virginia 24061-0236

April 20, 1990

Dear Transportation Executive:

Approximately two weeks ago, I sent you a survey questionnaire, and requested that you take a few minutes to complete and return it. To refresh your memory, the survey was part of a research study that investigates shipper needs which impact on the firm's motor carrier selection decision. I cannot over-emphasize how vital your cooperation is to the successful completion of this research. I understand that asking for your cooperation in this research project may pose some inconvenience, but I would urge you to weigh that against the potential that the research will uncover significant information that will aid your day-to-day business operation.

I have enclosed another questionnaire to be completed by the *individual in your organization who is responsible for the motor carrier freight purchasing decision*. If you have already completed and returned the questionnaire, it is not necessary to duplicate your effort, and I thank you for your cooperation. If you have not yet completed and returned a questionnaire, would you take a few minutes from your busy schedule to assist me in this valuable research effort? Your cooperation in this regard is greatly appreciated.

Sincerely,

John T. Mentzer, Ph.D.
Professor of Marketing

Encl: Carrier Selection Surveys

Appendix D. Questionnaire

CARRIER SELECTION SURVEY

This survey pertains to outbound shipments within North America, using common carriage, including LTL, but excluding package freight services such as UPS, RPS, Federal Express etc.

Part I

- 1. Approximately how many motor carrier shipments did your company purchase in the past twelve months?
2. What portion of the number of your outbound shipments over the past twelve months used motor carriers?
3. For the shipments utilizing motor carriage over the past twelve months, what proportion had the following terms of sale?
4. For the same shipments as in Question 2, for what proportion was the carrier specified by each of the following sources?

- 5. Over the last twelve months, were your shipping requirements met solely by contract carriage?
6. Over the past twelve months, were your shipping requirements met solely by private carriage?
7. Over the past twelve months, did your motor carrier shipments involve any intermodal carriage?

Part II

Three situation categories are described here. Please take a couple of minutes to familiarize yourself with the scenarios, as there will be questions relative to them in the next sections.

Situation 1

You had to purchase motor carrier freight to ship a new product, to ship from a new plant, to ship to a new destination, or a combination of the above. This is a New Purchase Situation.

Situation 2

You had to purchase motor carrier freight for an existing product and felt the need to reevaluate the carrier selection for whatever reason, and asked for additional information which could alter the carrier selection decision. This is a Reevaluation of Purchase Situation.

Situation 3

You had to purchase motor carrier freight, and chose the one used the previous time the need arose, without any reevaluation whatever. This is a Routine Purchase Situation.

8. In the past twelve months, what proportion of your motor carrier shipments fall into the different situation categories described above? (The total needs to be 100%)
 New Purchase Situation _____% Reevaluation of Purchase Situation _____%
 Routine Purchase Situation _____%
9. Were any of these changes ever considered when a "Reevaluation of Purchase Situation" came up?
 Mode Change: Yes / No ___ If yes, what proportion of the time? _____%
 Change to dedicated contract carriage: : Yes / No ___ If yes, what proportion of the time? _____%
 Change to private carriage: : Yes / No ___ If yes, what proportion of the time? _____%
10. For the times a "Reevaluation of Purchase Situation" occurred, what proportion of those times was a carrier other than the one used the previous time actually chosen? _____%

While answering the questions in Section A, please refer to the last time that you faced a "New Purchase Situation" in the last twelve months.

Section A

11. Which one or more of these factors caused the situation? Please check all that apply.

New Product _____ New Destination _____
 New Plant or Origin _____

12. Which company personnel took part in the carrier selection process (job titles)? Assess the influence each of them had on the decision by checking the appropriate levels below.

Job Title	Department	Major Influence	Some Influence	Little Influence
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

13. In your estimate, how long did the carrier selection process take? _____ Days
14. How many carriers were initially considered for possible selection? _____
15. Check the phrase that most closely describes your evaluation of the variety of service characteristics offered by the available carriers. The services offered by the carriers were:
 ___ quite diverse ___ somewhat diverse
 ___ somewhat similar ___ quite similar
16. What were the sources of information on carriers that were available to you? Which did you utilize? Circle all that apply (A=Available, U=Utilized).
 A U Federal government and its agencies
 A U State government and its agencies
 A U Other governmental and quasi-governmental agencies
 A U Carrier sales representatives
 A U Carrier promotional material
 A U Publicity material
 A U Trade Association Material
 A U Private agencies, such as freight forwarders
 A U Internal company records for past experience
 A U Word of mouth
 Others, please specify _____

17. On a scale of 1 to 5 (1=very important, 2=somewhat important, 3=neither important nor unimportant, 4=somewhat unimportant and 5=not relevant) rate the importance of the following criteria for carrier selection, the last time you faced a "New Purchase Situation." Circle the appropriate response.

	Very Important			Not Relevant	
	1	2	3	4	5
Frequency of service	1	2	3	4	5
Directness of service	1	2	3	4	5
Large number of destinations served	1	2	3	4	5
Average transit time	1	2	3	4	5
Pick-up and delivery service	1	2	3	4	5
Backhaul availability	1	2	3	4	5
On time service	1	2	3	4	5
Shipment tracing capability	1	2	3	4	5
Material handling capability	1	2	3	4	5
Range of available equipment	1	2	3	4	5
Intermodal capability	1	2	3	4	5
Cost of TL service	1	2	3	4	5
Cost of LTL service	1	2	3	4	5
Loss and damage record	1	2	3	4	5
Response time on claims	1	2	3	4	5
Reputation for reliability	1	2	3	4	5
Carrier financial security	1	2	3	4	5
Carrier commitment to shipper	1	2	3	4	5
Response to emergency shipments	1	2	3	4	5
Flexibility of service	1	2	3	4	5
Carrier salesperson support	1	2	3	4	5
Information support	1	2	3	4	5
Proximity of carrier office	1	2	3	4	5
Other _____	1	2	3	4	5

18. Please rate the carrier that was chosen in the last "New Purchase Situation" on each of the criteria below. (1=poor, 2=less than average 3=average, 4=above average and 5=excellent). Circle the appropriate response.

	Poor			Excellent	
	1	2	3	4	5
Frequency of service	1	2	3	4	5
Directness of service	1	2	3	4	5
Large number of destinations served	1	2	3	4	5
Average transit time	1	2	3	4	5
Pick-up and delivery service	1	2	3	4	5
Backhaul availability	1	2	3	4	5
On time service	1	2	3	4	5
Shipment tracing capability	1	2	3	4	5
Material handling capability	1	2	3	4	5
Range of available equipment	1	2	3	4	5
Intermodal capability	1	2	3	4	5
Cost of TL service	1	2	3	4	5
Cost of LTL service	1	2	3	4	5
Loss and damage record	1	2	3	4	5
Response time on claims	1	2	3	4	5
Reputation for reliability	1	2	3	4	5
Carrier financial security	1	2	3	4	5
Carrier commitment to shipper	1	2	3	4	5
Response to emergency shipments	1	2	3	4	5
Flexibility of service	1	2	3	4	5
Carrier salesperson support	1	2	3	4	5
Information support	1	2	3	4	5
Proximity of carrier office	1	2	3	4	5
Other _____	1	2	3	4	5

While answering the questions in Section B, please refer to the last time that you faced a "Reevaluation of Purchase Situation" in the last twelve months, when you had to select a carrier.

Section B

19. Which one or more of these factors do you think caused the situation? Please check all that apply.

- Dissatisfaction with existing carrier's service features
- Dissatisfaction with existing carrier's quality of service
- Dissatisfaction with existing carrier's price
- Existing carrier discontinued some or all service features
- Availability of new carrier with better price
- Availability of new carrier with more appropriate service features

20. Which company personnel took part in the carrier selection process (job titles)? Assess the influence each of them had on the decision by checking the appropriate levels below.

Job Title	Department	Major Influence	Some Influence	Little Influence
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

21. In your estimate, how long did the carrier selection process take? _____ Days

22. How many carriers were initially considered for possible selection? _____

23. Check the statement that most closely describes your evaluation of the variety of service characteristics offered by the available carriers. The services offered by the carriers were:
 quite diverse somewhat diverse
 somewhat similar quite similar

24. What were the sources of information on carriers that were available to you? Which did you utilize? Circle all that apply.

- U Federal government and its agencies
- U State government and its agencies
- U Other governmental and quasi-governmental agencies
- U Carrier sales representatives
- U Carrier promotional material
- U Publicity material
- U Trade Association Material
- U Private agencies, such as freight forwarders
- U Internal company records for past experience
- U Word of mouth
- Others, please specify _____

25. On a scale of 1 to 5 (1=very important, 2=somewhat important, 3=neither important nor unimportant, 4=somewhat unimportant and 5=not important) rate the importance of the following criteria for carrier selection, the last time you faced a "Reevaluation of Purchase Situation." Circle the appropriate response.

	Very Important			Not Relevant	
	1	2	3	4	5
Frequency of service	1	2	3	4	5
Directness of service	1	2	3	4	5
Large number of destinations served	1	2	3	4	5
Average transit time	1	2	3	4	5
Pick-up and delivery service	1	2	3	4	5
Backhaul availability	1	2	3	4	5
On time service	1	2	3	4	5
Shipment tracing capability	1	2	3	4	5
Material handling capability	1	2	3	4	5
Range of available equipment	1	2	3	4	5
Intermodal capability	1	2	3	4	5
Cost of TL service	1	2	3	4	5
Cost of LTL service	1	2	3	4	5
Loss and damage record	1	2	3	4	5
Response time on claims	1	2	3	4	5
Reputation for reliability	1	2	3	4	5
Carrier financial security	1	2	3	4	5
Carrier commitment to shipper	1	2	3	4	5
Response to emergency shipments	1	2	3	4	5
Flexibility of service	1	2	3	4	5
Carrier salesperson support	1	2	3	4	5
Information support	1	2	3	4	5
Proximity of carrier office	1	2	3	4	5
Other _____	1	2	3	4	5

26. Please rate the carrier that was chosen in the last "Reevaluation of Purchase Situation" on each of the criteria below. (1=poor, 2=less than average 3=average, 4=above average and 5=excellent). Circle the appropriate response.

	Poor			Excellent	
	1	2	3	4	5
Frequency of service	1	2	3	4	5
Directness of service	1	2	3	4	5
Large number of destinations served	1	2	3	4	5
Average transit time	1	2	3	4	5
Pick-up and delivery service	1	2	3	4	5
Backhaul availability	1	2	3	4	5
On time service	1	2	3	4	5
Shipment tracing capability	1	2	3	4	5
Material handling capability	1	2	3	4	5
Range of available equipment	1	2	3	4	5
Intermodal capability	1	2	3	4	5
Cost of TL service	1	2	3	4	5
Cost of LTL service	1	2	3	4	5
Loss and damage record	1	2	3	4	5
Response time on claims	1	2	3	4	5
Reputation for reliability	1	2	3	4	5
Carrier financial security	1	2	3	4	5
Carrier commitment to shipper	1	2	3	4	5
Response to emergency shipments	1	2	3	4	5
Flexibility of service	1	2	3	4	5
Carrier salesperson support	1	2	3	4	5
Information support	1	2	3	4	5
Proximity of carrier office	1	2	3	4	5
Other _____	1	2	3	4	5

PART III

27. How many carriers did your firm do business with in the last twelve months? _____

Please respond to the items in Section A with reference to the carrier that was most frequently used by your firm in the last twelve months

Section A

28. How long have you used this carrier? _____ Years/months

29. On a scale of 1 to 5 (1=strongly agree, 2=somewhat agree, 3=neither agree nor disagree, 4=somewhat disagree and 5=strongly disagree) indicate your evaluation of this carrier. Circle the appropriate response.

	Strongly Agree			Strongly Disagree	
	1	2	3	4	5
A much superior alternative must be available before we would consider replacing this carrier.	1	2	3	4	5
We would go out of our way to recommend this carrier to our colleagues in other companies.	1	2	3	4	5
We would not be concerned about carrying low safety-stock when dealing with this carrier.	1	2	3	4	5
If another carrier offered us lower price, we would switch carriers.	1	2	3	4	5
We like to use carriers like these regularly because they make shipping a lot easier.	1	2	3	4	5
We will search for alternative carriers if this carrier develops goals which conflict with ours.	1	2	3	4	5
We would continue to use this carrier even if the user department desired another carrier.	1	2	3	4	5
We would feel reluctant to drop this carrier as a source of motor freight.	1	2	3	4	5
We are satisfied with our relationship with this carrier.	1	2	3	4	5
Our company will be searching for and evaluating new carriers for motor freight.	1	2	3	4	5
We would want to establish long term relationship with this carrier even if they did not offer the lowest price among available carriers.	1	2	3	4	5
If there were an unacceptable number of customer complaints about this carrier, we would work with them to solve their problems.	1	2	3	4	5
We will search for alternative carriers if this carrier is not able to perform to our level of expectation.	1	2	3	4	5
We would feel more comfortable establishing a sole-source relationship with this carrier than other available carriers.	1	2	3	4	5
Our company would tend to be very aggressive in pushing for a better price or a better deal from this carrier.	1	2	3	4	5
We are prepared to make considerable investments (time, personnel, money) in order to establish a long-term relationship with this carrier.	1	2	3	4	5
We will maintain our relationship with this carrier only if they could help us achieve a price advantage over our competitor.	1	2	3	4	5
A long term relationship with this carrier is highly unlikely.	1	2	3	4	5
Our company would continue to use this carrier even if their prices fluctuate somewhat.	1	2	3	4	5
We would continue to use this carrier only at the insistence of the user department.	1	2	3	4	5
We would welcome extensive contacts with this carrier's personnel in order to establish a close working relationship.	1	2	3	4	5
Our relationship with this carrier will terminate if an atmosphere of conflict rather than cooperation develops.	1	2	3	4	5
We would use this carrier more frequently than normal to help it, if it were experiencing financial difficulties.	1	2	3	4	5
We will search for alternative carriers if communication problems with this carrier are not handled promptly.	1	2	3	4	5

	Strongly Agree					Strongly Disagree
	1	2	3	4	5	

We would like to decrease business with other carriers we currently use and increase this carrier's volume of business.

Please respond to the items in Section B with reference to the carrier in the group of carriers your firm regularly uses, that was least frequently used in the last twelve months

Section B

30. How long have you used this carrier? _____ Years/months

31. On a scale of 1 to 5 (1=strongly agree, 2=somewhat agree, 3=neither agree nor disagree, 4=somewhat disagree and 5=strongly disagree) indicate your evaluation of this carrier. Circle the appropriate response.

	Strongly Agree					Strongly Disagree
	1	2	3	4	5	
A such superior alternative must be available before we would consider replacing this carrier.	1	2	3	4	5	
We would go out of our way to recommend this carrier to our colleagues in other companies.	1	2	3	4	5	
We would not be concerned about carrying low safety-stock when dealing with this carrier.	1	2	3	4	5	
If another carrier offered us lower price, we would switch carriers.	1	2	3	4	5	
We like to use carriers like these regularly because they make shipping a lot easier.	1	2	3	4	5	
We will search for alternative carriers if this carrier develops goals which conflict with ours.	1	2	3	4	5	
We would continue to use this carrier even if the user department desired another carrier.	1	2	3	4	5	
We would feel reluctant to drop this carrier as a source of motor freight.	1	2	3	4	5	
We are satisfied with our relationship with this carrier.	1	2	3	4	5	
Our company will be searching for and evaluating new carriers for motor freight.	1	2	3	4	5	
We would want to establish long term relationship with this carrier even if they did not offer the lowest price among available carriers.	1	2	3	4	5	
If there were an unacceptable number of customer complaints about this carrier, we would work with them to solve their problems.	1	2	3	4	5	
We will search for alternative carriers if this carrier is not able to perform to our level of expectation.	1	2	3	4	5	
We would feel more comfortable establishing a sole-source relationship with this carrier than other available carriers.	1	2	3	4	5	
Our company would tend to be very aggressive in pushing for a better price or a better deal from this carrier.	1	2	3	4	5	
We are prepared to make considerable investments (time, personnel, money) in order to establish a long-term relationship with this carrier.	1	2	3	4	5	
We will maintain our relationship with this carrier only if they could help us achieve a price advantage over our competitor.	1	2	3	4	5	
A long term relationship with this carrier is highly unlikely.	1	2	3	4	5	
Our company would continue to use this carrier even if their prices fluctuate somewhat.	1	2	3	4	5	

	Strongly Agree					Strongly Disagree				
We would continue to use this carrier only at the insistence of the user department.	1	2	3	4	5	1	2	3	4	5
We would welcome extensive contacts with this carrier's personnel in order to establish a close working relationship.	1	2	3	4	5	1	2	3	4	5
Our relationship with this carrier will terminate if an atmosphere of conflict rather than cooperation develops.	1	2	3	4	5	1	2	3	4	5
We would use this carrier more frequently than normal to help it, if it were experiencing financial difficulties.	1	2	3	4	5	1	2	3	4	5
We will search for alternative carriers if communication problems with this carrier are not handled promptly.	1	2	3	4	5	1	2	3	4	5
We would like to decrease business with other carriers we currently use and increase this carrier's volume of business.	1	2	3	4	5	1	2	3	4	5

PART IV

Please provide some classification information for your firm in this section

32a. What business is your firm in? Please be as specific as possible.

32b. SIC codes of primary products _____

33. Number of employees _____

34. Number of manufacturing or storage/distribution locations _____

35. Average annual motor carrier freight purchased: _____ Tons @ _____

36. Of total motor carrier tonnage, percentage of Less Than Truckload (LTL) shipment is _____ %

37a. What is your longest distance for a regular shipment on a motor carrier? _____ Miles

37b. What is the average distance for a shipment? _____ Miles

38. What are the distances of various manufacturing and/or storage/distribution locations of your organization from their nearest respective motor carrier transportation hub city?

Location #1	_____ Miles	Location #2	_____ Miles
Location #3	_____ Miles	Location #4	_____ Miles
Location #5	_____ Miles	Location #6	_____ Miles

39. Approximate annual Sales Volume: (check as appropriate)

_____ Under \$5 Million	_____ \$5 - \$25 Million
_____ Over \$25 Million but under \$50 Million	_____ Over \$50 Million but under \$100 Million
_____ Over \$100 Million	

40. In which state is your corporate headquarters located? _____

Appendix E. Summary of Data

VARIABLE	MEAN	STD DEV	MINIMUM	MAXIMUM	VALID N	LABEL
COUNTRY	1.045	.209	1.00	2.00	154	COUNTRY OF ORIGIN
ARRVDAY	1.526	.501	1.00	2.00	154	DAY OF ARRIVAL
PRESIT	2.779	.527	1.00	3.00	154	PREDOMINANT PURCHASE SITUATION FACED
NUMSHIP	26789.545	64968.051	.00	570000.0	154	NUMBER OF MOTOR CARRIER SHIPMENTS IN PAS
MCSHIP	.702	.304	.01	1.00	154	PROPORTION OF TOTAL SHIPMENT ON MOTOR CA
FPRE	.595	.376	.00	1.00	154	PROPORTION SHIPPED FREIGHT PREPAID
TERMS	2.266	1.138	1.00	4.00	154	PREDOMINANT TERMS OF SALE
CONSPEC	.756	.284	.00	1.00	154	PROPORTION WHERE CARRIER SPECIFICATION L
INTMODAL	.682	.467	.00	1.00	154	INTERMODAL SHIPMENTS MADE
PCTINDL	.058	.111	.00	1.00	154	PROPORTION OF SHIPMENTS INVOLVING INTERM
NPSIT	.106	.139	.00	1.00	154	PROPORTION OF SHIPMENTS INVOLVING NEM PU
RVPSIT	.192	.231	.00	1.00	154	PROPORTION OF SHIPMENTS INVOLVING REEVAL
RPSIT	.684	.287	.00	1.00	154	PROPORTION OF SHIPMENTS INVOLVING ROUTIN
RVVPOS	.712	.277	.00	1.00	141	PROPORTION OF TIME REEVAL RESULTED IN NE
NPSNP	.474	.501	.00	1.00	154	NEM PURCH. SIT. DUE TO NEM PRODUCT
NPBUYNUM	2.058	1.037	.00	6.00	154	NUMBER OF MEMBERS IN BUYING CTR. FOR NEM
NPCARPTL	6.701	7.536	1.00	43.00	154	NP CARRIERS CONSIDERED FOR SELECTION
NPSVEVAL	3.071	.964	1.00	4.00	154	NP EVAL. OF SERVICE CHARACTERISTICS OF A
NPISA	5.084	2.471	1.00	10.00	154	NP SOURCES OF INFO AVAILABLE
NPISU	3.675	1.771	1.00	9.00	154	NP SOURCES OF INFO UTILIZED
NPCR1	1.617	.951	1.00	5.00	154	NP FREQUENCY OF SERVICE
NPCR2	1.481	.857	1.00	5.00	154	NP DIRECTNESS OF SERVICE
NPCR3	2.058	1.178	1.00	5.00	154	NP LARGE NUMBER OF DESTINATIONS SERVED

VARIABLE	MEAN	STD DEV	MINIMUM	MAXIMUM	VALID N	LABEL
NPCR4	1.468	.668	1.00	3.00	154	NP AVERAGE TRANSIT TIME
NPCR5	1.409	.789	1.00	5.00	154	NP PICK-UP AND DELIVERY SERVICE
NPCR6	3.883	1.293	1.00	5.00	154	NP BACKHAUL AVAILABILITY
NPCR7	1.286	.580	1.00	3.00	154	NP ON TIME SERVICE
NPCR8	1.870	1.027	1.00	5.00	154	NP SHIPMENT TRACING CAPABILITY
NPCR9	2.422	1.292	1.00	5.00	154	NP MATERIAL HANDLING CAPABILITY
NPCR10	2.656	1.340	1.00	5.00	154	NP RANGE OF AVAILABLE EQUIPMENT
NPCR11	3.740	1.287	1.00	5.00	154	NP INTERMODAL CAPABILITY
NPCR12	2.078	1.484	1.00	5.00	154	NP COST OF TL SERVICE
NPCR13	1.844	1.319	1.00	5.00	154	NP COST OF LTL SERVICE
NPCR14	2.000	1.048	1.00	5.00	154	NP LOSS AND DAMAGE RECORD
NPCR15	2.182	1.111	1.00	5.00	154	NP RESPONSE TIME ON CLAIMS
NPCR16	1.526	.734	1.00	3.00	154	NP REPUTATION FOR RELIABILITY
NPCR17	1.753	.938	1.00	5.00	154	NP CARRIER FINANCIAL SECURITY
NPCR18	1.364	.635	1.00	3.00	154	NP CARRIER COMMITMENT TO SHIPPER
NPCR19	1.500	.716	1.00	3.00	154	NP RESPONSE TO EMERGENCY SHIPMENTS
NPCR20	1.942	.873	1.00	5.00	154	NP FLEXIBILITY OF SERVICE
NPCR21	2.214	.977	1.00	5.00	154	NP CARRIER SALESPERSON SUPPORT
NPCR22	2.357	.968	1.00	5.00	154	NP INFORMATION SUPPORT
NPCR23	3.481	1.233	1.00	5.00	154	NP PROXIMITY OF CARRIER OFFICE
SRVTRIG	.799	.402	.00	1.00	154	SERVICE RELATED TRIGGER FOR SELECTION DE
RVBUYNUM	1.669	.841	1.00	4.00	154	NUMBER OF MEMBERS IN BUYING CTR. FOR RE-
RVCARPTL	6.442	7.543	2.00	40.00	154	RV CARRIERS CONSIDERED FOR SELECTION

VARIABLE	MEAN	STD DEV	MINIMUM	MAXIMUM	VALID N	LABEL
RVSEVAL	3.058	.978	1.00	4.00	154	RV EVAL. OF SERVICE CHARACTERISTICS OF A
RVISA	4.935	2.563	1.00	10.00	154	RV SOURCES OF INFO AVAILABLE
RVISU	3.545	1.768	1.00	9.00	154	RV SOURCES OF INFO UTILIZED
RVCR1	1.545	.856	1.00	5.00	154	RV FREQUENCY OF SERVICE
RVCR2	1.422	.748	1.00	5.00	154	RV DIRECTNESS OF SERVICE
RVCR3	1.896	1.036	1.00	5.00	154	RV LARGE NUMBER OF DESTINATIONS SERVED
RVCR4	1.422	.684	1.00	4.00	154	RV AVERAGE TRANSIT TIME
RVCR5	1.532	.916	1.00	5.00	154	RV PICK-UP AND DELIVERY SERVICE
RVCR6	3.584	1.422	1.00	5.00	154	RV BACKHAUL AVAILABILITY
RVCR7	1.429	.731	1.00	4.00	154	RV ON TIME SERVICE
RVCR8	2.000	.922	1.00	5.00	154	RV SHIPMENT TRACING CAPABILITY
RVCR9	2.558	1.138	1.00	5.00	154	RV MATERIAL HANDLING CAPABILITY
RVCR10	2.636	1.209	1.00	5.00	154	RV RANGE OF AVAILABLE EQUIPMENT
RVCR11	3.584	1.282	1.00	5.00	154	RV INTERMODAL CAPABILITY
RVCR12	2.123	1.406	1.00	5.00	154	RV COST OF TL SERVICE
RVCR13	1.805	1.178	1.00	5.00	154	RV COST OF LTL SERVICE
RVCR14	2.019	.946	1.00	5.00	154	RV LOSS AND DAMAGE RECORD
RVCR15	2.149	1.021	1.00	5.00	154	RV RESPONSE TIME ON CLAIMS
RVCR16	1.565	.740	1.00	3.00	154	RV REPUTATION FOR RELIABILITY
RVCR17	1.838	.867	1.00	5.00	154	RV CARRIER FINANCIAL SECURITY
RVCR18	1.474	.697	1.00	3.00	154	RV CARRIER COMMITMENT TO SHIPPER
RVCR19	1.591	.805	1.00	5.00	154	RV RESPONSE TO EMERGENCY SHIPMENTS
RVCR20	1.955	.873	1.00	5.00	154	RV FLEXIBILITY OF SERVICE

VARIABLE	MEAN	STD DEV	MINIMUM	MAXIMUM	VALID N	LABEL
RVCR21	2.195	1.103	1.00	5.00	154	RV CARRIER SALESPERSON SUPPORT
RVCR22	2.312	1.045	1.00	5.00	154	RV INFORMATION SUPPORT
RVCR23	3.442	1.237	1.00	5.00	154	RV PROXIMITY OF CARRIER OFFICE
CARUSED	45.195	68.091	3.00	400.00	154	NUMBER OF CARRIERS USED IN PAST YEAR
MFASSO	8.734	6.285	1.00	30.00	154	MF LENGTH OF ASSOCIATION WITH CARRIER
MFSLIT1	1.682	.988	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 1
MFSLIT2	1.857	.959	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 2
MFSLIT3	2.422	1.159	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 3
MFSLIT4	3.364	1.142	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 4
MFSLIT5	1.727	.945	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 5
MFSLIT6	1.708	.824	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 6
MFSLIT7	3.039	1.176	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 7
MFSLIT8	1.812	1.040	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 8
MFSLIT9	1.545	.793	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 9
MFSLIT10	2.506	1.211	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 10
MFSLIT11	2.357	1.112	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 11
MFSLIT12	2.208	1.192	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 12
MFSLIT13	1.422	.782	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 13
MFSLIT14	2.760	1.263	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 14
MFSLIT15	2.234	.995	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 15
MFSLIT16	2.747	1.169	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 16
MFSLIT17	2.916	1.114	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 17
MFSLIT18	3.844	1.103	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 18

VARIABLE	MEAN	STD DEV	MINIMUM	MAXIMUM	VALID N	LABEL
MFSLIT19	2.701	.937	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 19
MFSLIT20	3.955	.999	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 20
MFSLIT21	2.195	1.036	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 21
MFSLIT22	1.870	.995	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 22
MFSLIT23	3.273	1.104	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 23
MFSLIT24	2.104	.826	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 24
MFSLIT25	2.870	1.033	1.00	5.00	154	MF SOURCE LOYALTY SCALE ITEM 25
NATBUS	.610	.489	.00	1.00	154	NATURE OF BUSINESS
EMPL	2848.906	8076.822	4.00	50000.00	149	NUMBER OF EMPLOYEES
NUMLOC	18.697	49.991	1.00	350.00	152	NUMBER OF STORAGE DISTRIBUTION LOCATIONS
VOLTON	284048.674	798042.813	2.00	4685107	86	VOLUME OF ANNUAL FREIGHT PURCHASE IN TON
VOLDOL	16420.695	38070.209	1.00	195000.0	105	VOLUME OF ANNUAL FREIGHT PURCHASE IN DOL
LDIST	2220.477	855.553	135.00	4000.00	153	LONGEST DISTANCE OF MOTOR CARRIER SHIPME
AVDIST	685.390	450.147	30.00	2000.00	146	AVERAGE DISTANCE OF MOTOR CARRIER SHIPME
AVHUBDST	49.611	101.994	1.00	989.00	108	AVERAGE DISTANCE OF CARRIER HUB FROM LOC
SALES	3.705	1.453	1.00	5.00	146	ANNUAL SALES VOLUME
PCTLTL	.527	.376	.01	1.00	143	PROPORTION OF MOTOR CARRIER FREIGHT SHIP
NPRVPSIT	.299	.271	.00	1.00	154	COMBINED PCT. OF NEW AND REEVAL. PURCH.
SLSCORE	35.571	6.982	22.00	58.00	154	SCORE ON SOURCE LOYALTY SCALE

SATYA PRASAD CHATTOPADHYAY

7/15 Central Avenue
Durgapur 713204
INDIA

EDUCATION

Ph. D. in General Business (Marketing)-1990
Major: Marketing, Minor: Management Science
Virginia Polytechnic Institute and State University
Blacksburg, Virginia

Master of Business Administration-1981
Major: Marketing and Operations Management
Indian Institute of Management, Calcutta, India

Bachelor of Mechanical Engineering-1979
Major: Mechanical Engineering
Jadavpur University, Calcutta, India

TEACHING EXPERIENCE

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
Instructor of Marketing 9/1984-6/1986

WESTERN NEW ENGLAND COLLEGE
Instructor of Marketing 9/1986-6/1987
Department Chairman 9/1987-6/1989

BUSINESS EXPERIENCE

BRITISH PAINTS (INDIA) LTD., Calcutta, India
Assistant to Manager Marketing Services 4/1980-6/1980

RECKITT & COLMAN (INDIA) LTD., Calcutta, India
Management Trainee 5/1981-10/1981
Management Services Executive 11/1981-8/1983

PROFESSIONAL MEMBERSHIPS

American Marketing Association
Northeast Business and Economics Association
Academy of Marketing Science

AWARDS

National Council of Physical Distribution Management-Citizens
Scholarship Foundation Award, 1985
Awarded Tuition Waiver Fall 1986
Jawaharlal Nehru Memorial Scholarship, India, 1974
National Science Talent Search Scholarship, India, 1973
National Scholarship, Government of India, 1973

